QUEST
QUATERNARY SCIENTIFIC

University of Reading

EAST HAM INDUSTRIAL ESTATE, BECKTON LONDON BOROUGH OF NEWHAM

Geoarchaeological Deposit Model Report

NGR: TQ 42060 82020

Site Code: EHA17

Date: 7th June 2017

Written by: C.R. Batchelor

QUEST, School of Archaeology, Geography and Environmental Science, Whiteknights, University of Reading, RG6 6AB

Tel: 0118 378 7978 / 8941
Email: c.r.batchelor@reading.ac.uk
http://www.reading.ac.uk/quest

DOCUMENT HISTORY:

REVISION	DATE	PREPARED BY	SIGNED	APPROVED BY	SIGNED	REASON FOR ISSUE
v1	07/06/17	C.R. Batchelor		C.R. Batchelor		First edition

CONTENTS

1. NON-TECHNICAL SUMMARY

Geoarchaeological fieldwork and deposit modelling was instigated at the East Ham Industrial Estate site in order to: (1) map the height and thickness of the deposits; (2) assess their geoarchaeological, archaeological and palaeoenvironmental significance and potential, and (3) prepare recommendations for geoarchaeological assessment. In order to address these aims, four geoarchaeological boreholes were retained from the site. These were described under laboratory-based conditions and integrated with stratigraphic data from existing records to produce a deposit model of the major depositional units across the site.

The results of the deposit modelling indicate that the sediments present beneath the site are similar to those recorded elsewhere in the Lower Thames Valley. A sequence of Shepperton Gravel is overlain by a sequence of Holocene alluvial sediments, buried beneath modern Made Ground. The mapped topographic surface and thickness of the deposits are broadly consistent with those recorded at other sites lying at this point along the floodplain edge. However, at East Ham Industrial Estate, the Shepperton Gravel surface descends in both a northerly and southerly direction to depths of up to -5.5m OD. It is generally overlain by a thick horizon of Peat measuring up to 3-4m in thickness, potentially representing around 4000 years of accumulation over multiple cultural periods. The Peat is overlain by Upper Alluvium, capped by Made Ground.

Significant archaeological remains have been found within the floodplain deposits to the east of the site, and on the basis of the Peat surface height at East Ham Industrial Estate (-1 to -2m OD) the potential for remains is considered to exist. However, even in the absence of the archaeological remains, the sediments have the potential to contain a wealth of further information on the past landscape, through the assessment/analysis of palaeoecological remains. Additional boreholes are due to be put down and monitored on the site to ground-truth and improve the resolution of the existing deposit model. However, in addition to this, it is strongly recommended that a borehole in the area of EH-BH201A is repeated, due to the very poor recovery of material during the initial drilling exercise. This borehole is of particular interest because the opportunity to obtain such thick peat sequences overlying a deep gravel surface is rare in this area of the Lower Thames Valley, and may provide important palaeoenvironmental data. In particular, because of the lower elevation and greater peat thickness, it could represent accumulation from an earlier date and for a longer period than that of previous nearby sites. Following this, radiocarbon dating and an assessment of the palaeoecological remains should be carried out to establish whether their concentration, preservation and diversity is sufficient to achieve the overall aims of the project.

2. INTRODUCTION

2.1 Site context

This report summarises the findings arising out of the fieldwork and deposit modelling undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development of land at the East Ham Industrial Estate, Beckton, London Borough of Newham (site code: EHA17; NGR: TQ 42060 82020; Figures 1 & 2). Quaternary Scientific were commissioned by CgMs Consulting to undertake the geoarchaeological investigations. The area of investigation lies on the Lower Thames Valley floodplain, approximately 2.2km from the modern River Thames to the south. The edge of the floodplain is mapped by the British Geological Survey (www.bgs.ac.uk/opengeoscience) as being approximately 200m to the north of the A13 Newham Way, which marks the northern border of the site. The site is therefore located very close to the interface between the floodplain and dryland environment. It is also located midway between the River Lea and River Roding tributaries.

The British Geological Survey (1 : 50,000) shows the site underlain by London Clay bedrock overlain by Alluvium, described as comprising clay, silty, peaty, sandy. In fact, the alluvial deposits of the Lower Thames and its tributaries are almost everywhere underlain by Late Devensian Late Glacial Gravels (in the Thames valley, the Shepperton Gravel of Gibbard, 1985, 1994), and this gravel is widely recorded in boreholes in the vicinity of the site. Geotechnical site investigations have previously been undertaken at the site by RSA geotechnical investigations ltd (2001) and IDOM Merebrooks (2016). In total, five boreholes have been put down reaching beyond the Shepperton Gravel surface (RSA-BH1 to RSA-BH5); these are located in each corner and the centre of the site (Figure 2; Table 1). In addition, 23 window samples have been put down across the site (RSA-WS1 to RSA-WS11 & MWS-WS1601 to MWS1612); these also are well distributed across the site, though do not include the area of current buildings (Figure 2; Table 1). No spatial data exists for these investigations, though it will be possible to estimate them using GIS software & existing topographic surveys in due course.

Combined, the records indicate a sequence of Shepperton Gravel resting at between 5 and 6.2m bgl (below ground level). Between 1.7 & 2,8m of peat rests directly on the Shepperton Gravel surface. The peat surface rests at 3.0 to 3.6m bgl which in turn is overlain by sandy, silty, clayey alluvium, sometimes organic-rich or even peaty alluvium (referred to here as the Upper Alluvium) to between 1 and 2.4m bgl. The sequence is capped by Made Ground varying in thickness up to 2.4m. Initial interrogation of the existing data therefore suggests that the deposits across the site are relatively consistent in terms of levels and thickness (assuming a relatively even present day surface).

The BGS also holds records beyond the northern and southern borders of the site (Table 1). To the south, these records indicate similar levels / thicknesses: the Shepperton Gravel lies at approximately -5m OD (7-7.5m bgl). Up to 3m of peat rests directly above it, and is overlain by silty clayey, sometimes organic-rich alluvium (referred to here as the Upper Alluvium). Made Ground caps the sequence, varying up to 3.6m in thickness. In one record north of the site (TQ48SW283),

an even thicker sequence of peat deposits was recorded (4m), resting on clayey gravelly deposits, interpreted here as the Lower Alluvium; The Shepperton Gravel was not recorded. This record is considered unreliable as it is considerably different to the other records, which are relatively consistent.

More widely, historical borehole records appear to suggest that the surface of the Shepperton Gravel rests between -3 and -6m OD, south of the A13 Newham Way, rising towards <-1m OD in the area of the Royal Albert Way. Especially deep surfaces are recorded along Tollgate Road, reaching depths of up to -12m OD. This entire area therefore appears to form a deeper area of the floodplain, and may even represent a major former channel adjacent to the floodplain edge. Such channels are not uncommon, and have been recorded downstream in the Barking and Havering areas (Green et al., 2014; Young, 2017).

2.2 Geoarchaeological, palaeoenvironmental and archaeological significance

The existing records therefore indicate considerable variation in the height of the Shepperton Gravel, and the type, thickness and age of the subsequent Holocene deposits within the vicinity of the site. Such variations are significant as they represent different environmental conditions that would have existed in a given location. For example: (1) the varying surface of the Shepperton Gravel may represent the location of former channels and bars (as outlined above); (2) the presence of peat represents former terrestrial or semi-terrestrial land-surfaces, and (3) the Alluvium represent periods of channel activity / changing hydrological conditions. Despite the number of palaeoenvironmental studies and archaeological interventions that have taken place adjacent to the A13 Newham Way, the sub-surface architecture is not that well understood in this area of Beckton. Thus by studying the sub-surface stratigraphy across the site and wider area in greater detail, it will be possible to build our understanding of the former landscapes and environmental changes that took place across space and time.

Organic-rich sediments (in particular Peat) also have high potential to provide a detailed reconstruction of past environments on both the wetland and dryland. In particular, they provide the potential to increase knowledge and understanding of the interactions between hydrology, human activity, vegetation succession and climate. Significant vegetation changes include the Mesolithic/Neolithic decline of elm woodland, the Neolithic colonisation and decline of yew woodland; the Late Neolithic/Early Bronze Age growth of elm on Peat, and the general decline of wetland and dryland woodland during the Bronze Age. Such investigations have successfully been carried out through the assessment/analysis of palaeoecological remains (e.g. pollen, plant macrofossils & insects) and radiocarbon dating, at nearby sites such as Golfers's Driving Range (Batchelor, 2009; Batchelor et al., in prep), A13 Woolwich Manor Way, Prince Regent Lane & Freemasons Road (Stafford, 2012) and Berwick Road (Batchelor et al., 2015). These records have provided detailed palaeoenvironmental reconstructions from the late Mesolithic to Iron Age (ca. 7000-2500 cal BP).

Finally, areas of high gravel topography, soils and peat represent potential areas that might have been utilised or even occupied by prehistoric people, evidence of which may be preserved in the archaeological (e.g. features and structures) and palaeoenvironmental record (e.g. changes in vegetation composition). The East Ham Industrial Estate is considered to have good potential for significant archaeological remains due to the high number of prehistoric remains found in the nearby area. These include probable Mesolithic and Neolithic lithics at Prince Regent Lane and Freemasons Road (Stafford et al., 2012); *in situ* Neolithic pottery, lithics, charcoal and charred grain at A13 Woolwich Manor Way (Stafford et al., 2012), Golfers Driving Range (Carew, 2006) & A13 Woolwich Manor Way (Stafford et al., 2012) and Bronze Age trackway and platform structures located towards the surface of the peat at Beckton Nursery (Divers, 1995), Beckton 3D (Meddens, 1996).

2.3 Aims and objectives

Further records are required in order to enhance our understanding of the sub-surface stratigraphy at the East Ham Industrial Estate site, and to assess its palaeoenvironmental and archaeological potential. Five significant research aims relevant to the geoarchaeological investigations at the site are outlined here:

1. To clarify the nature of the sub-surface stratigraphy across the site
2. To clarify the nature, depth, extent and date of any Alluvium and organic/Peat deposits;
3. To investigate whether the sequences contain any artefact or ecofact evidence for prehistoric or historic human activity;
4. To investigate whether the sequences contain any evidence for natural and/or anthropogenic changes to the landscape (wetland and dryland);
5. To integrate the new geoarchaeological record with other recent work in the local area for publication (if appropriate, pending the results of the investigations).

In order to address these aims, the following objectives are proposed as part of the current Pre-Planning Application works:

1. To monitor four borehole and six test-pits on the southern part of the site during the course of Phase 1 geotechnical site investigation works in April 2017, collecting continuous samples from the boreholes (Figure 3).
2. To describe the new boreholes under laboratory-based conditions.
3. To use the stratigraphic data from new and existing records to produce a deposit model of the major depositional units across the site, and to characterise the depositional sequence in more detail.

In order to fulfil the remaining aims, the following objectives are proposed as part of later Mitigation works:

4. To monitor two further borehole and select test-pits on the northern part of the site during the course of Phase 2 geotechnical site investigation works at a future date (TBD), collecting continuous samples from the boreholes (Figure 3).
5. To describe the new boreholes under laboratory-based conditions.
6. To use the stratigraphic data from the Phase 2 investigations to update the existing deposit model of the major depositional units across the site.
7. To revisit the site during the course of any archaeological interventions and sample as necessary.
8. To carry out an environmental archaeological assessment of selected borehole/column/bulk samples incorporating: (1) range finder radiocarbon dating to determine the approximate chronology of any periods of peat formation recorded within the borehole samples; (2) an assessment of their faunal and floral content, and (3) recommendations for further environmental archaeological investigations (if necessary);
9. To carry out environmental archaeological analysis (if necessary) incorporating the recommendations made during the assessment;
10. To publish the results of the site investigations, depending on the significance of the findings.

Figure 1: Location of (1) East Ham Industrial Estate and selected nearby archaeological / geoarchaeological investigations: (2) Beckton Nursery (HE-BN94; Divers, 1995); (3) Beckton 3D (HE-ED93; Meddens, 1996); (4) Golfers Driving Range (GWB02; Carew et al., 2006; Batchelor 2009; Batchelor et al., in prep); (5) A13 Woolwich Manor Way (WMA02; Stafford et al., 2012); (6) Beckton Alps (HE-BA94; Truckle & Sabel, 1994); (7) A13 Prince Regent Lane / Freemasons Road (WMA02; Stafford et al., 2012); (8) Vandome Close (VAD07; Nicholls et al., **2013); (9) 75 Berwick Road (Batchelor et al., 2015); (10) Royal Docks Community School (PRG97; Holder, 1998); (11) Beckton Tollgate (HE-TG94; Tamblyn, 1994); (12) East Beckton District Centre (HE-KW95; Jarrett, 1996).**

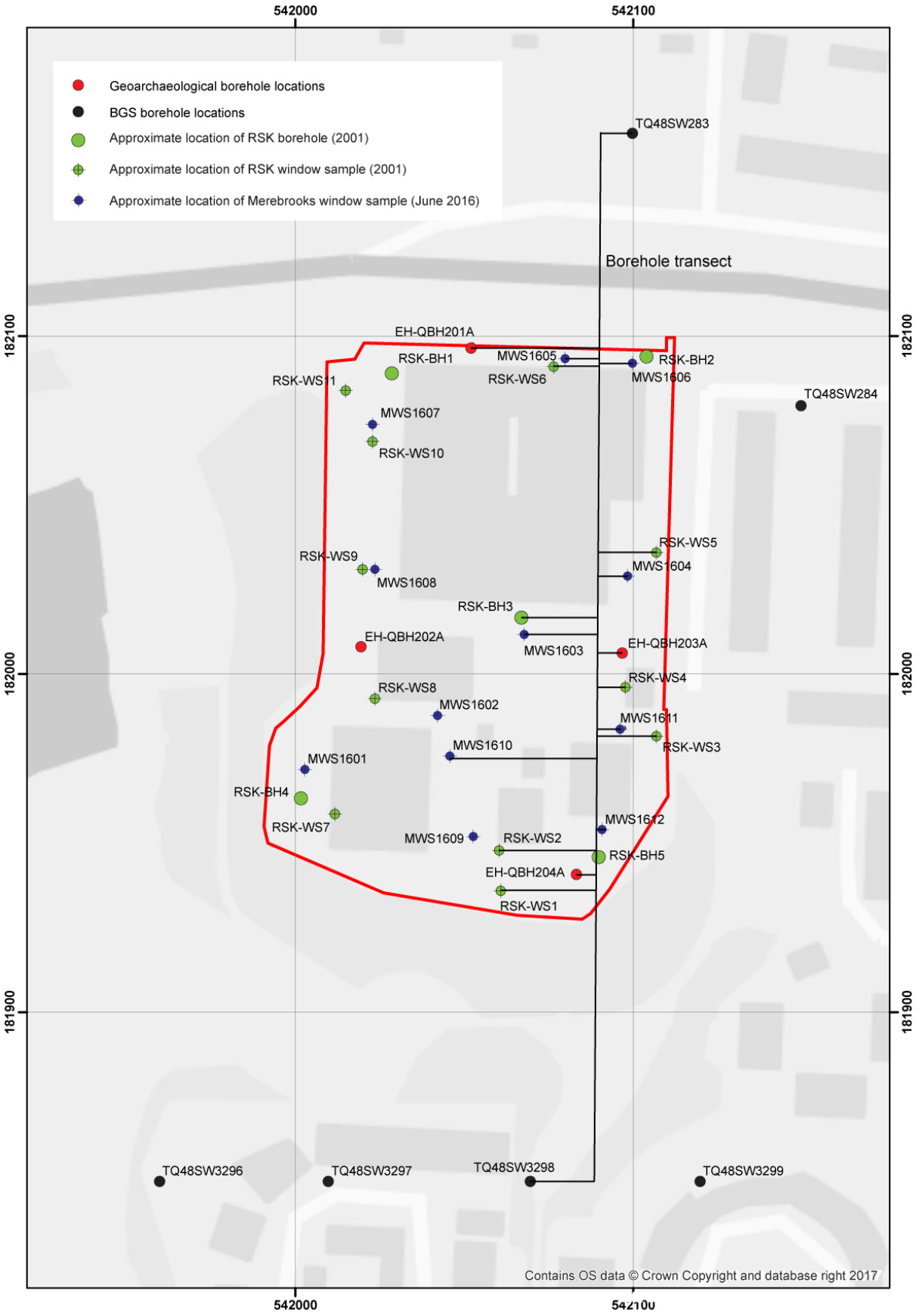

Figure 2: Location of the new, existing & proposed boreholes at East Ham Industrial Estate, Beckton, London Borough of Newham.

3. METHODS

3.1 Field investigations

A total of four new geoarchaeological boreholes (EH-QBH201A to EH-QBH204A) were put down by Merebrooks in April 2017 using a cable percussion rig, and monitored by Quaternary Scientific. This coring techniques provide a suitable method for the recovery of continuous, undisturbed core samples and provides sub-samples suitable for not only sedimentary and microfossil assessment and analysis, but also macrofossil analysis. Spatial co-ordinates for each borehole were obtained using a Leica Differential GPS (Table 1).

Table 1: Spatial co-ordinates for the geoarchaeological boreholes

Geoarchaeological borehole	Easting	Northing	Elevation
EH-QBH201A	542052.3	182097.41	1.50
EH-QBH202A	542019.88	182008.08	1.91
EH-QBH203A	542096.81	182006.17	1.95
EH-QBH204A	542083.27	181940.98	2.24

3.2 Lithostratigraphic description

Laboratory-based lithostratigraphic descriptions of the new borehole samples was carried out using standard procedures for recording unconsolidated sediment and peat, noting the physical properties (colour), composition (gravel, sand, clay, silt and organic matter) and inclusions (e.g. artefacts). 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; (3) recording the composition e.g. gravel, fine sand, silt and clay; (4) recording the degree of peat humification, and (5) recording the unit boundaries e.g. sharp or diffuse. The descriptions are displayed in Tables 2-5.

3.3 Deposit modelling

The deposit model for East Ham Industrial Estate was based on a review of 38 records including the four new geoarchaeological boreholes & 34 geotechnical interventions (Figure 2). Sedimentary units from the boreholes were classified into six groups: (1) Bedrock, (2) Gravel, (3) Lower Alluvium. (4) Peat, (5) Upper Alluvium and (6) Made Ground. The classified data for groups 1-6 were then input into a database within the RockWorks 16 geological utilities software, the output from which was displayed using ArcMAP 10. A north-west to south-east borehole transect is displayed in Figure 3. Models of surface height were generated for the Gravel, Lower Alluvium, Peat and Upper Alluvium using an Inverse Distance Weighted algorithm (Figures 3-5 & 7). Thickness of the Peat, total Holocene alluvium (incorporating the Lower Alluvium, Peat and Upper Alluvium) and Made Ground (Figures 4, 8 & 9) were also modelled (also using an Inverse Distance Weighted algorithm). A north-south borehole transect is displayed in Figure 10.

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. As a consequence of this the modelling procedure has been manually adjusted so that only those areas for which sufficient stratigraphic data is present will be modelled. In order to achieve this, a maximum distance cut-off filter equivalent to a 50m radius around each record is applied to all deposit models from the East Ham Industrial Estate site. In addition, it is important to recognise that multiple 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.

4. RESULTS, INTERPRETATION & DISCUSSION OF THE LITHOSTRATIGRAPHIC DESCRIPTIONS AND DEPOSIT MODELLING

The results of the deposit modelling are displayed in Figures 3 to 10. Figures 3 to 9 are surface elevation and thickness models for each of the main stratigraphic units across the site and immediately surrounding area; Figure 10 is a two-dimensional north-south transect across the site. The results of the deposit modelling indicate that the number and spread of the logs is sufficient to permit modelling with a high level of certainty across the site. However, it is also highlighted that sample recovery was often poor in all sequences, with no material being obtained from key depths in borehole EH-BH201A.

The full sequence of sediments recorded in the boreholes comprises:

Made Ground
Upper Alluvium – widely present
Peat – widely present
Lower Alluvium – occasionally present
Shepperton Gravel – widely present

4.1 Shepperton Gravel

The Shepperton Gravel was present in all boreholes that penetrated to the bottom of the Holocene sequence (Figures 3 & 10); this included the four new geoarchaeological boreholes (EH-BH201A – EH-BH204A), geotechnical boreholes RSK-BH1 to BH5 (not BH2) and all of the BGS boreholes (TQ48SW283-284 & 3296-3299). It was deposited during the Late Glacial (15,000 to 10,000 years before present) and comprises the sands and gravels of a high-energy braided river system which, while it was active would have been characterised by longitudinal gravel bars and intervening low-water channels in which finer-grained sediments might have been deposited. Such a relief pattern would have been present on the valley floor at the beginning of the Holocene when a lower-energy fluvial regime was being established.

The modelling exercise indicates that the surface of the Shepperton Gravel rests at between -3.0 and -3.5m OD towards the central and south-eastern areas of the site (EH-BH202A to EH-BH204A, RSK-BH3 and RSK-BH5), but falls from here in both a northerly and southerly direction. Towards the north and beyond the northern border of the site it reaches between -4.4 and -5.7m

OD (EH-BH201A, RSK-BH1, TQ48SW283 & 284). Similarly, in the south-western corner of the site, and beyond its southern border, the Gravel surface descends to between -4.5 and -5.20m OD (RSK-BH4 & TQ48SW3296-3299).

A wider deposit model similar to those from South Newham (Batchelor & Green, 2017), Greenwich Peninsula (e.g. Young, 2017a), the Lower Lea Valley (Corcoran et al., 2011), Barking (Green et al., 2014), Rainham (Young & Batchelor, 2017b), Battersea Power Station (Young, 2016) has not been developed for the Beckton area. However, inspection of the borehole records indicates considerable variation in the surface elevation of the Shepperton Gravel surface in the nearby area. The general, pattern appears to be a southerly rise in gravel surface height from between -3 and -5m OD towards -1.5m OD in the area of Royal Albert Dock. This is certainly the case to the east, where at Golfers Driving Range (Carew et al., 2009; Batchelor, 2009; Batchelor et al. in prep), Beckton 3D (Meddens, 1996) & Beckton Nursery (Divers, 1995), the Shepperton Gravel surface is recorded between at least -4 and -3.5m OD, but at East Ham Football Club (Scaife, 2001) & Royal Albert Dock (Batchelor, 2009), the Shepperton Gravel surface reaches ca. -1.5m OD. Surface elevations between -3 and -5m OD strongly suggest the location of a deep and large channel in this area of the Lower Thames Valley floodplain. Recording such channels along the margins of the floodplain is not unusual; similar observations were made during deposit modelling at Barking Riverside (Green et al., 2014) and more recently along the southern margins of Greenwich Peninsula (Young, 2017).

Of even greater interest is a small number of boreholes located along Tollgate Road, approximately 200m to the south of the East Ham Industrial Estate site. Here, the gravel surface reaches to between -7 and -11.2m OD, which is far deeper than any other sequence in this area of the Lower Thames Valley. The boreholes appear to be clustered in a small area, with no immediately apparent orientation indicating what may have formed them. Whilst not relavent to the East Ham Industrial Estate itself, this anomaly certainly warrants attention in any further investigation of the nearby area.

Finally, it is highlighted that an unusually square (potentially unnatural) piece of wood measuring 5 x 2.5 x 1cm was recorded projecting into the Gravel in EH-BH204 (Figure 11). The material overlying the gravel in this borehole was loose, suggesting collapse of the borehole; thus it is uncertain whether the wood is *in situ* or has been driven down by the drilling procedure.

4.2 Lower Alluvium

The Lower Alluvium was sporadically recorded (Figure 4), resting directly on the Shepperton Gravel. The deposits of the Lower Alluvium are described as a predominantly silty or clayey tending to become increasingly sandy downward in most sequences. The Lower Alluvium frequently contains detrital wood or plant remains, and in many cases is described as organic and with occasional Mollusca remains. The sediments of the Lower Alluvium are indicative of deposition during the Early to Mid-Holocene, when the main course of the Thames was probably confined to a single meandering channel. During this period, the surface of the Shepperton Gravel was progressively

buried beneath the sandy and silty flood deposits of the river. The richly-organic nature of the Lower Alluvium suggests that this was a period during which the valley floor was occupied by a network of actively shifting channels, with a drainage pattern on the floodplain that was still largely determined by the relief on the surface of the underlying Shepperton Gravel.

The Lower Alluvium was recorded in three sequences: EH-BH201A, EH202A & TQ48SW283. In each instance it is extremely thin, measuring less than 20cm. Elsewhere in the nearby area, the Lower Alluvium is similarly thin or absent (e.g. Golfers Driving Range; Carew et al., 2009; Batchelor, 2009; Batchelor et al., in prep).

4.3 Peat

Overlying the Gravel or Lower Alluvium in all boreholes across the site is a unit of peat. The Peat was often wet, with high concentrations of large wood remains. The peat is indicative of a transition towards semi-terrestrial (marshy) conditions, supporting the growth of sedge fen/reed swamp and/or woodland communities across the floodplain.

The surface of the Peat is relatively even, generally lying at between *ca.* -1 and -2m OD (Figure 5 & 10), and measures approximately 1.5m in thickness across the southern part of the site where the gravel surface is higher, and to between 3 and 4m thick towards the north and beyond the southern boundary of the site where the gravel surface is lowest (i.e. EH-BH201A, TQ48SW283 & 284, RSK-BH4 & TQ48SW3296-3299; Figure 6 & 10). A general guide is that 1m of Peat represents 1000 years accumulation in fen peatlands; thus a period of up to 4000 years could be represented on the current site. At the nearby Golfers Driving Range and Beckton Nursery sites, this spanned the late Mesolithic/early Neolithic to Bronze Age cultural periods. Peat initiation commenced at -5.45m OD in EH-BH201A however, compared to -3.64m OD at Golfers Driving Range. The lower elevation and thicker peat horizon at East Ham Industrial Estate, could therefore indicate that accumulation took place from an earlier date and for a longer period. Furthermore, it is the upper part of the Peat that has yielded prehistoric structures on nearby sites (see above/below).

4.4 Upper Alluvium

The Upper Alluvium rests on the Peat and was recorded in all records across the site. The sediments of the Upper Alluvium are indicative of deposition within low energy fluvial and/or semi-aquatic conditions during the Holocene. The high mineral content of the sediments may reflect increased sediment loads resulting from intensification of agricultural land use from the later prehistoric period onward, combined with the effects of rising sea level.

The deposits of the Upper Alluvium are described as predominantly silty or clayey which are very occasionally organic-rich. The surface of the Upper Alluvium is relatively even, generally lying at between -0.5 and 0.5m OD (Figures 7 & 10).

The Total Alluvium thickness (incorporating Lower Alluvium, Peat and Upper Alluvium) is displayed in Figure 8. The thickness of the Total Alluvium tends to reflect the topography of the Gravel

surface, with greater thicknesses recorded in areas of low Gravel topography and vice versa, as might be expected.

4.5 Made Ground

Between 1 and 2m of Made Ground caps the Holocene alluvial sequence across the majority of the site (Figure 9).

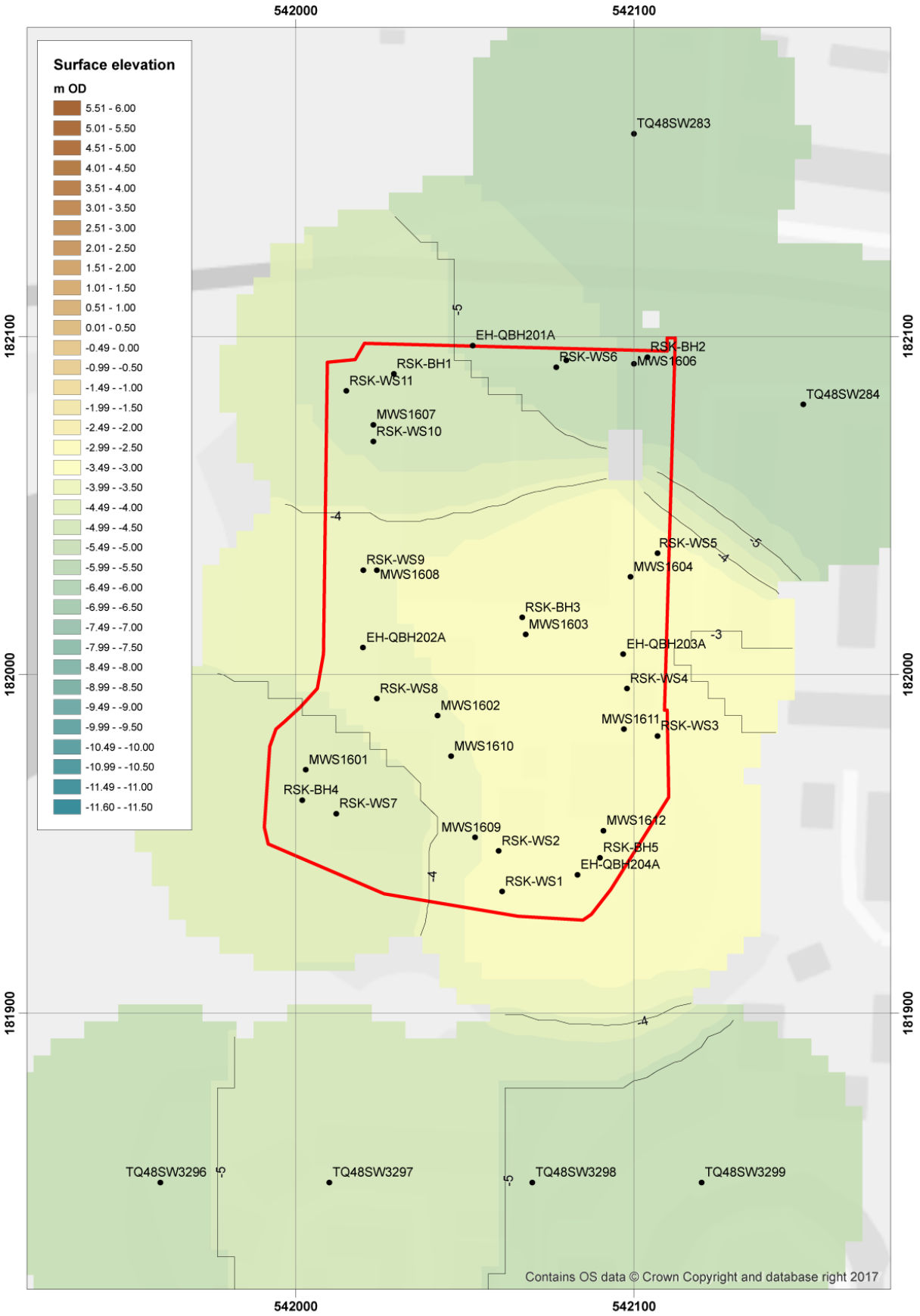

Figure 3: Top of the Gravel (m OD)

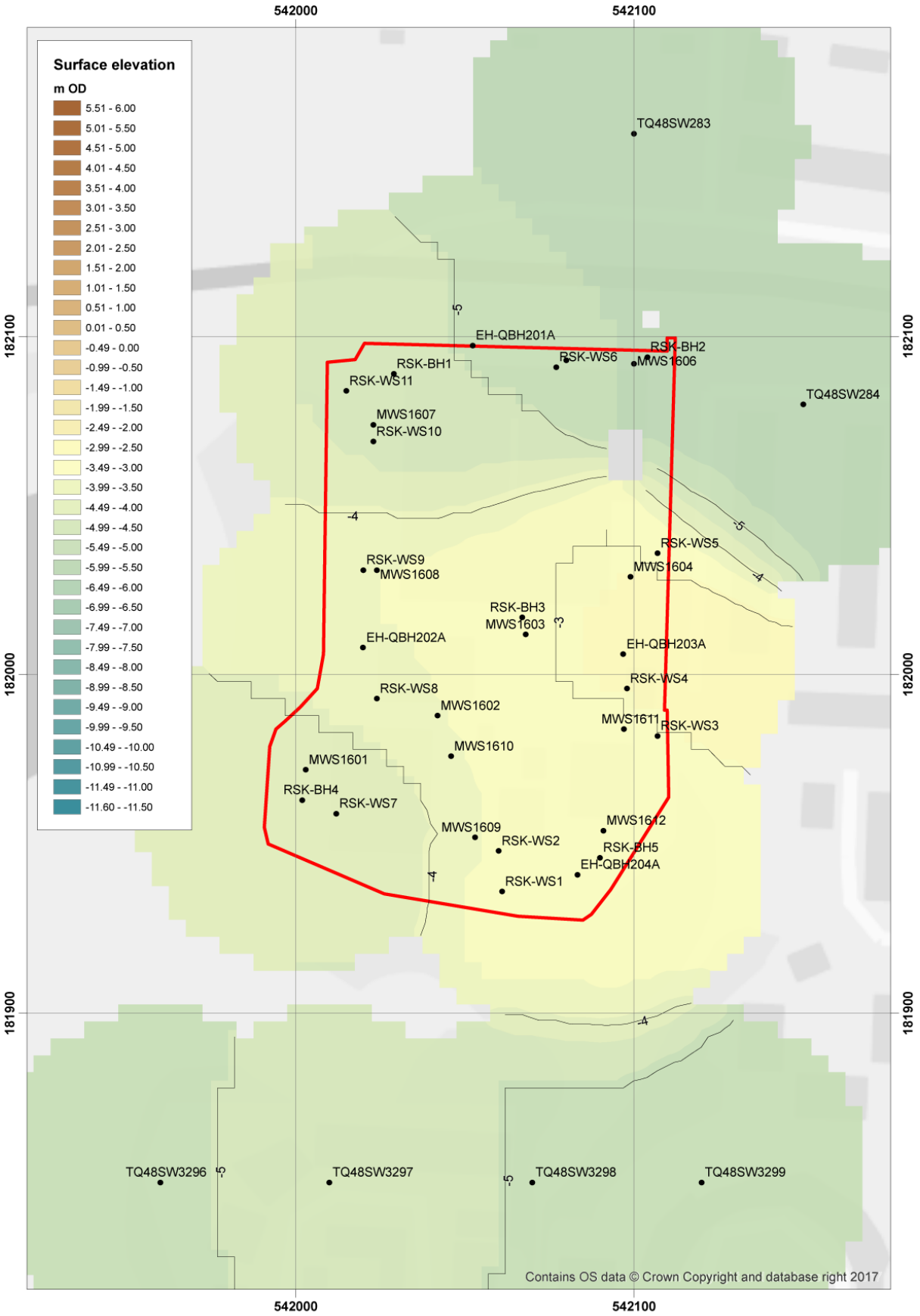

Figure 4: Top of the Lower Alluvium (m OD)

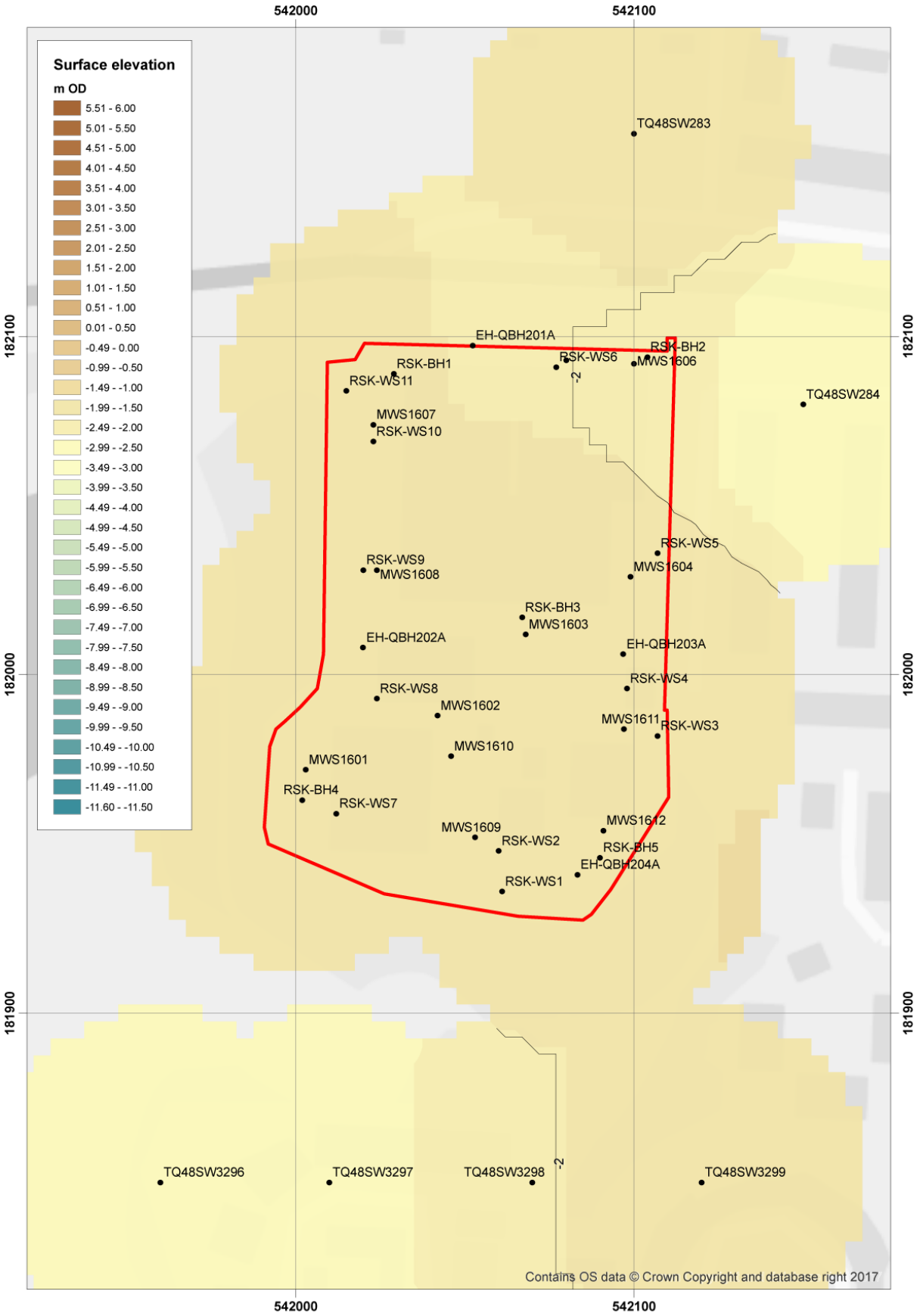

Figure 5: Top of the Peat (m OD)

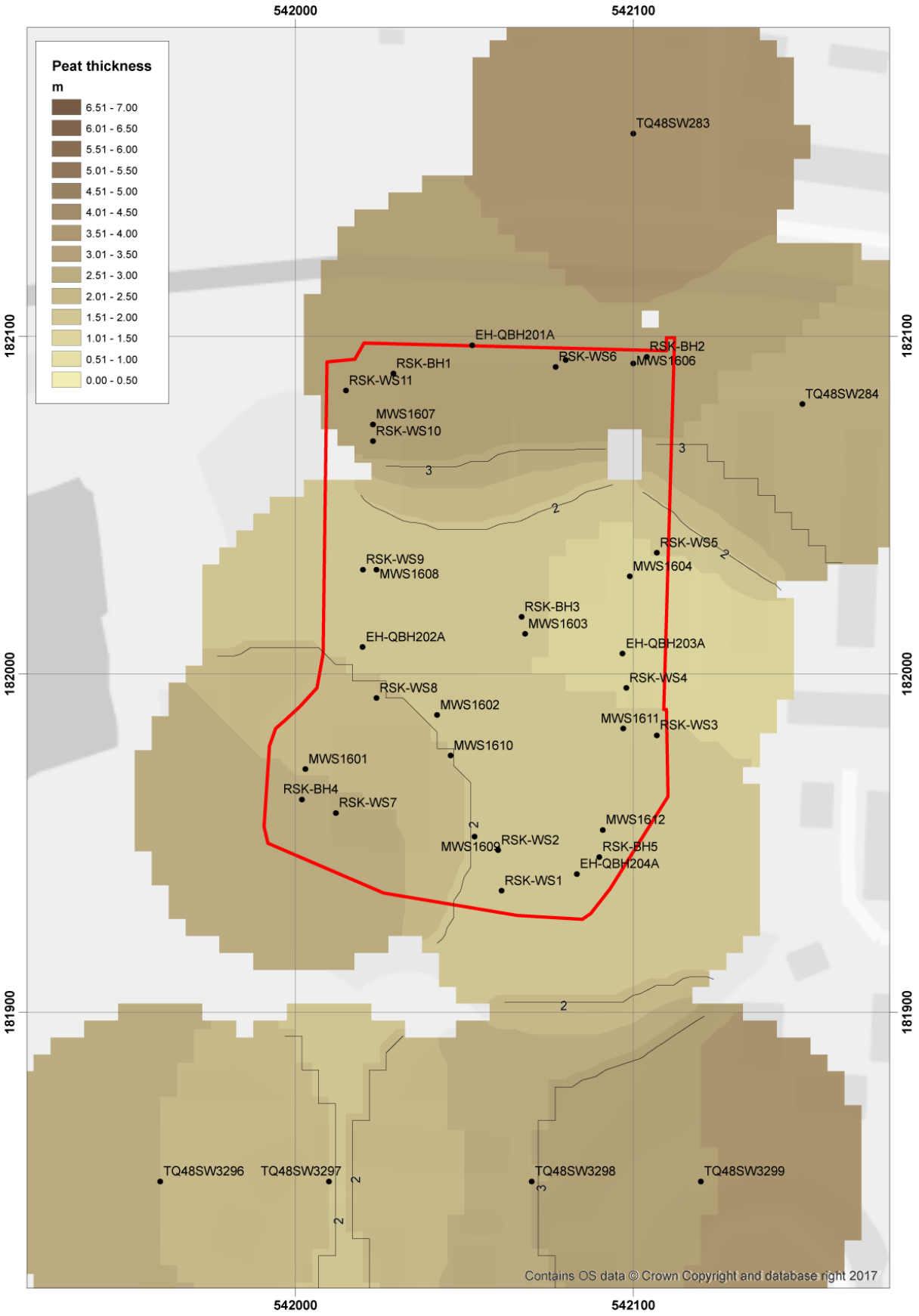

Figure 6: Thickness of the Peat (m)

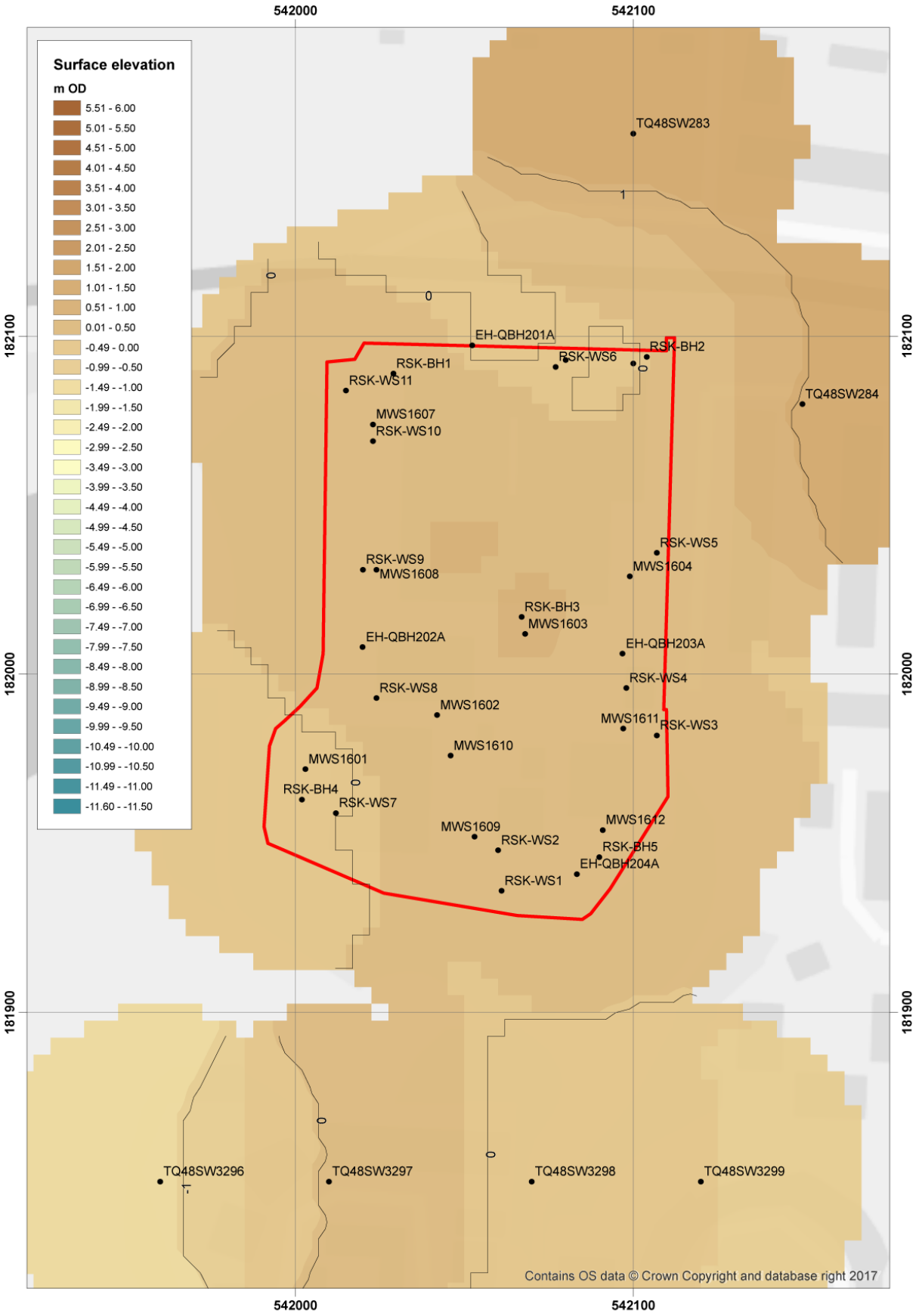

Figure 7: Top of the Upper Alluvium (m OD)

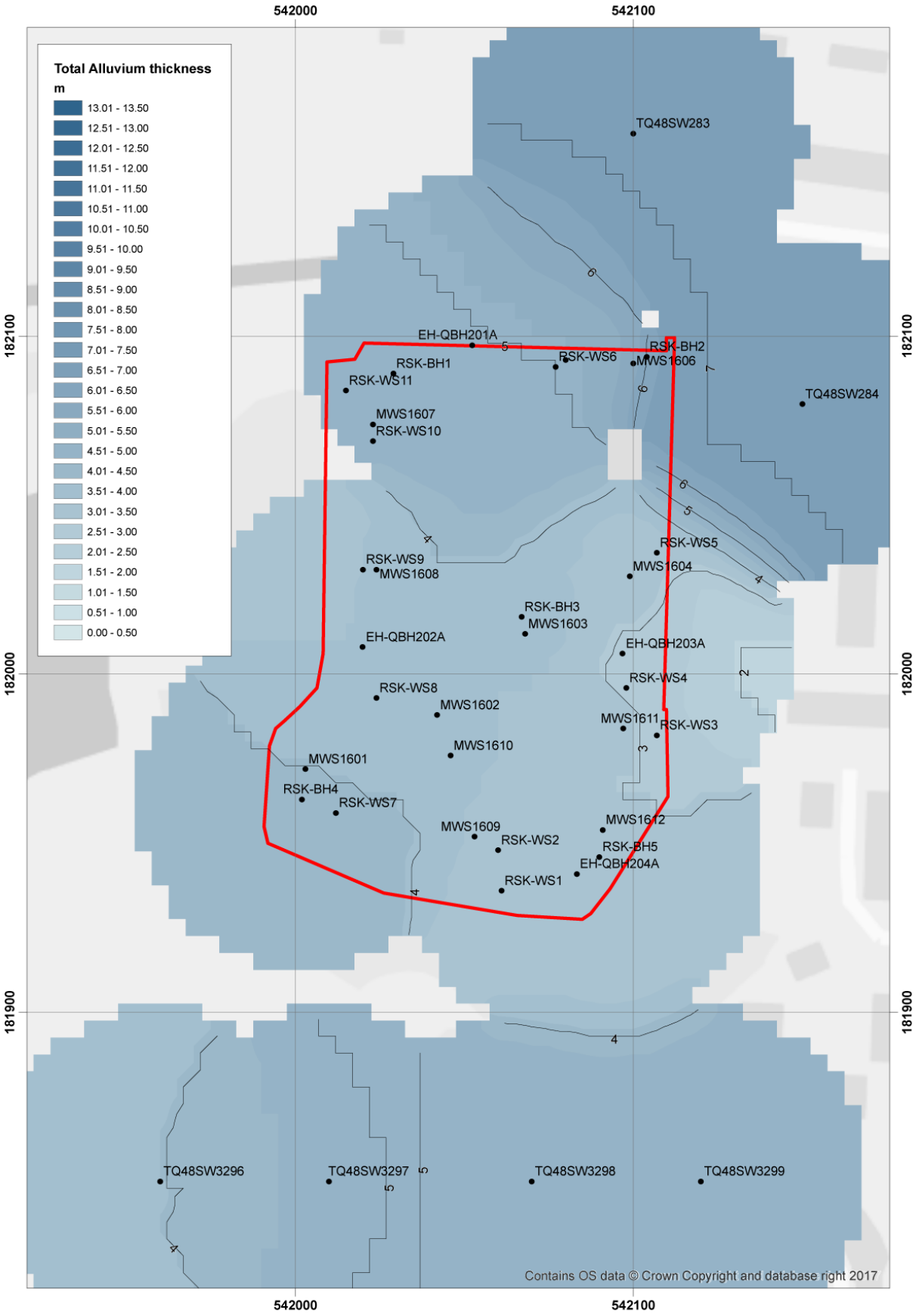

Figure 8: Thickness of the Total Alluvium (Lower Alluvium, Peat and Upper Alluvium) (m)

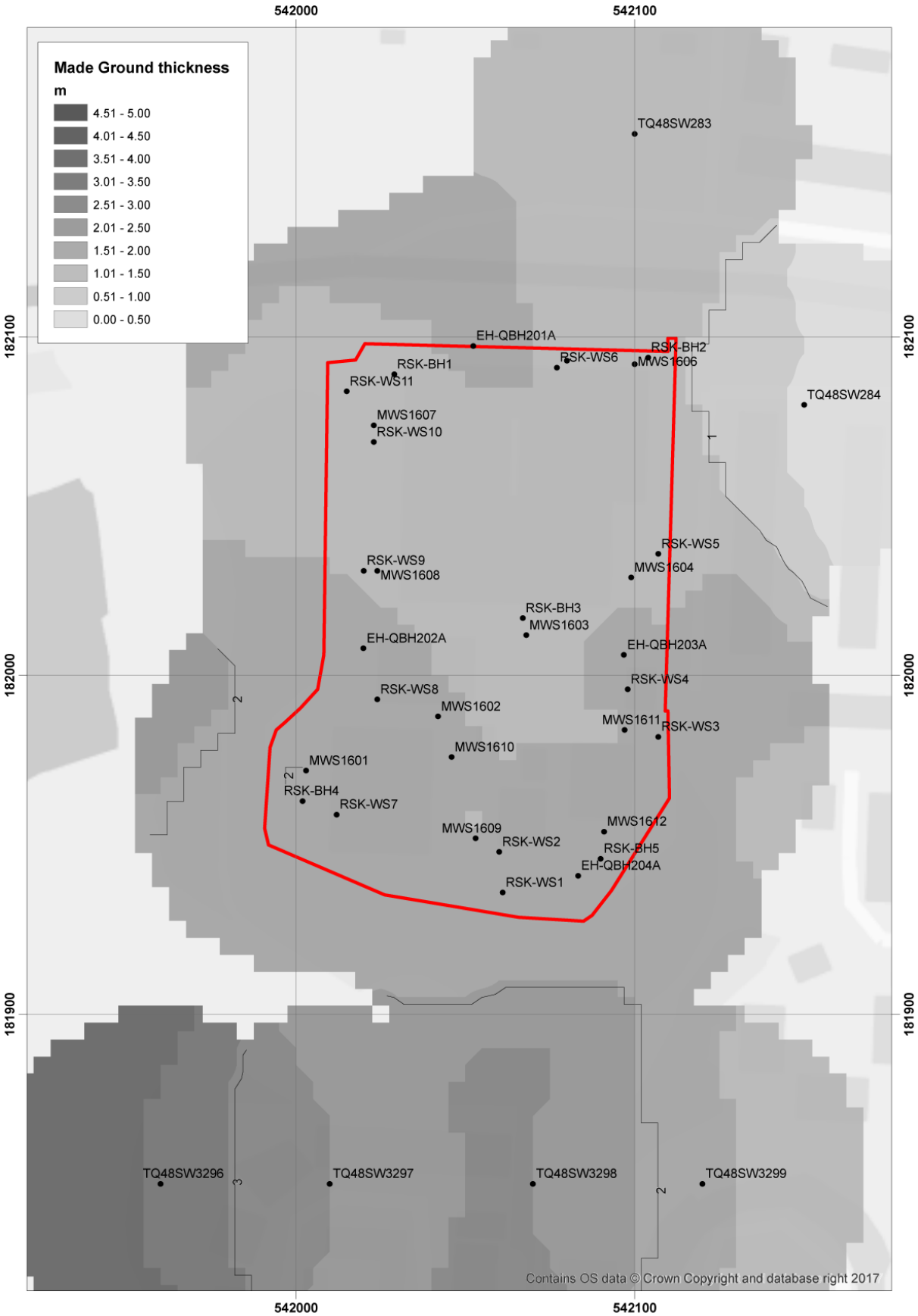

Figure 9: Thickness of Made Ground (m)

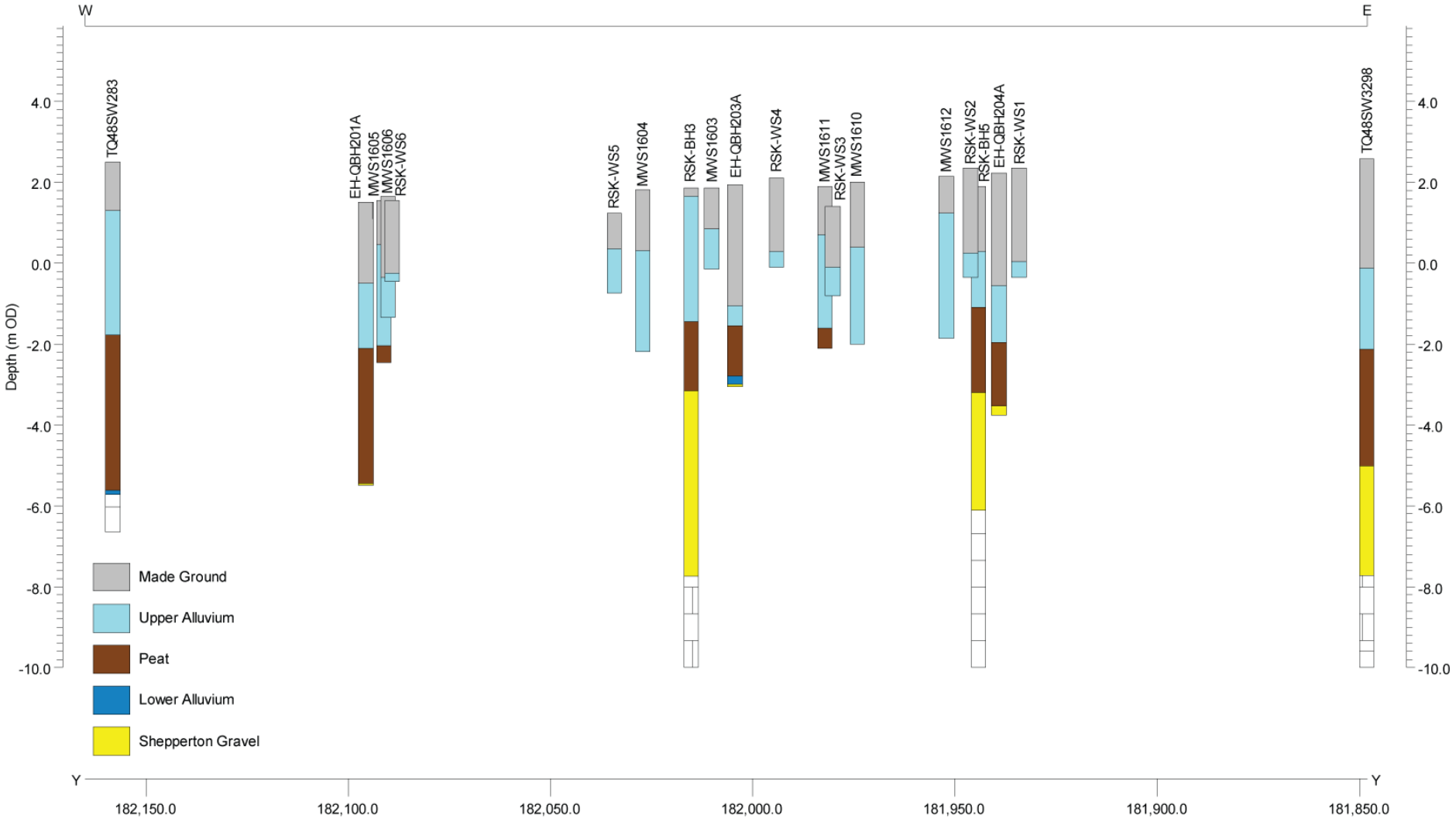

Figure 10: North-south transect of boreholes across the East Ham Industrial Estate site

Table 2: Lithostratigraphic description of borehole EH-QBH201A, East Ham Industrial Estate, Beckton, London Borough of Newham

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
1.50 to -0.50	0 to 2.00	Made Ground	MADE GROUND
-0.50 to -1.50	2.00 to 3.00	10YR 5/1; As4; Stiff grey clay with occasional soft chalk-like gravel inclusions and black mottling; oxidises to brown; unknown contact into:	UPPER ALLUVIUM
-1.50 to -2.00	3.00 to 3.50	10YR 5/1; As4; Grey clay, occasionally blocky in nature; unknown contact into:	
-2.00 to -2.11	3.50 to 3.61	10YR 5/1 to 10YR 4/1; As4 to As3 Sh1, Dl+; Grey clay gradually transitioning into dark grey organic clay with detrital plant remains; sharp contact into:	
-2.11 to -2.50	3.61 to 4.00	10YR 2/1; Sh2, Tl[2]2; Humo 3-4; Black moderately humified wood and unidentifiable peat; diffuse contact into:	PEAT
-2.50 to -5.45	4.00 to 6.95	10YR 2/1; Sh3, Tl[2]1; Humo 3-4; Black moderately humified wood and unidentifiable peat; unknown contact into:	
-5.45 to -5.50	6.95 to 7.00	10YR 2/1; Gg2, As1, Sh1; Black gravel with organic-clay	GRAVEL

NB – No/poor recovery in many of the samples – specifically 4.5 to 5.0m, 5.5 to 6.5m bgl

Table 3: Lithostratigraphic description of borehole EH-QBH202A, East Ham Industrial Estate, Beckton, London Borough of Newham

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
1.91 to -0.43	0 to 2.34	Made Ground; sharp contact into:	MADE GROUND
-0.43 to -1.09	2.34 to 3.00	10YR 5/1; As4; Stiff grey clay with occasional soft chalk-like gravel inclusions and black mottling; oxidises to brown; diffuse into:	UPPER ALLUVIUM
-1.09 to -1.70	3.00 to 3.61	10YR 4/1; As4; Dark grey clay; diffuse contact into:	
-1.70 to -1.81	3.61 to 3.72	10YR 4/1; As4, Sh+, Dl+; Dark grey clay with traces of organic remains and detrital wood; diffuse contact into:	
-1.81 to -1.87	3.72 to 3.78	10YR 5/1; As3, Dl1, Sh+; Grey clay with detrital wood and traces of organic remains; diffuse contact into:	
-1.87 to -2.02	3.78 to 3.93	10YR 4/1 to 10YR 4/2; Sh3, As1, Tl/Th+; Humo 4; Dark grey to dark greyish brown well humified unidentifiable peat and clay with traces of wood and herbaceous peat; diffuse contact into:	PEAT
-2.02 to -2.09	3.93 to 4.00	10YR 2/1; Sh2, Tl[2]2; Humo 3-4; Black moderately humified wood and unidentifiable peat; diffuse contact into:	
-2.09 to -3.59	4.00 to 5.50	10YR 2/1; Sh3, Tl[2]1; Humo 3-4; Black moderately humified wood and unidentifiable peat; unknown contact into:	
-3.59 to -3.64	5.50 to 5.55	10YR 4/1; As2, Sh1, Gg1; Dark grey organic-rich clay with gravel; sharp contact into:	LOWER ALLUVIUM

-3.64 to -3.82	5.55 to 5.73	10YR 5/1; As2, Gg2; Grey gravelly clay; diffuse contact into:	GRAVEL
-3.82 to -3.89	5.73 to 5.80	10YR 5/1; Gg2, Ga1, As1; Grey clayey sandy gravel.	

Table 3: Lithostratigraphic description of borehole EH-QBH203A, East Ham Industrial Estate, Beckton, London Borough of Newham

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
1.95 to -1.05	0 to 3.00	Made Ground	MADE GROUND
-1.05 to -1.55	3.00 to 3.50	10YR 5/1; As4; Stiff grey clay with occasional soft chalk-like gravel inclusions and black mottling; oxidises to brown;; diffuse into:	UPPER ALLUVIUM
-1.55 to -2.78	3.50 to 4.73	10YR 2/1; Sh3, Tl[2]1; Humo 3-4; Black moderately humified wood and unidentifiable peat; unknown contact into:	PEAT
-2.78 to -3.00	4.73 to 4.95	10YR 4/1 to 10YR 5/1; As2, Ga1, Tl1; Dark grey to grey sandy clay with wood peat remains; sharp contact into:	LOWER ALLUVIUM
-3.00 to -3.05	4.95 to 5.00	10YR 5/1; Gg2, Ga1, As1; Grey clayey sandy gravel.	GRAVEL

Table 4: Lithostratigraphic description of borehole EH-QBH204A, East Ham Industrial Estate, Beckton, London Borough of Newham

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
2.24 to -0.56	0 to 2.80	Made Ground	MADE GROUND
-0.56 to -1.26	2.80 to 3.50	10YR 5/1; As3, Ag1; Grey clay with occasional brick fragments; diffuse contact into:	UPPER ALLUVIUM
-1.26 to -1.96	3.50 to 4.20	10YR 5/1; As4; Grey clay; unknown contact into:	
-1.96 to -3.52	4.20 to 5.76	10YR 2/1; Sh3, Tl[2]1; Humo 3-4; Black moderately humified wood and unidentifiable peat; unknown contact into:	PEAT
-3.52 to -3.76	5.76 to 6.00	10YR 5/1; As2, Gg1, Ga1; sandy gravelly clay. One unusually square piece of wood measuring 5 x 2.5 x 1cm in size was projecting into the top of the unit.	GRAVEL

Figure 11: Photograph of the unusually square fragment of wood at the base of the sequence in EH-BH201A

5. CONCLUSIONS & RECOMMENDATIONS

Geoarchaeological fieldwork and deposit modelling was instigated at the East Ham Industrial Estate site in order to: (1) map the height and thickness of the deposits; (2) assess their geoarchaeological, archaeological and palaeoenvironmental significance and potential, and (3) prepare recommendations for geoarchaeological assessment. In order to address these aims, four geoarchaeological boreholes were retained from the site. These were described under laboratory-based conditions and integrated with stratigraphic data from existing records to produce a deposit model of the major depositional units across the site.

The results of the deposit modelling indicate that the sediments present beneath the East Ham Industrial Estate site are similar to those recorded elsewhere in the Lower Thames Valley. A sequence of Shepperton Gravel is overlain by a sequence of Holocene alluvial sediments, buried beneath modern Made Ground. The mapped topographic surface and thickness of the deposits are broadly consistent with those recorded at other sites lying at this point along the floodplain edge. However, at East Ham Industrial Estate, the Shepperton Gravel surface descends in both a northerly and southerly direction from the centre of the site to depths of up to -5.5m OD. Lower Alluvium is occasionally recorded above the Shepperton Gravel, but is more commonly directly overlain by a thick horizon of Peat measuring up to 3-4m in thickness, potentially representing around 4000 years of accumulation over multiple cultural periods. The Peat is overlain by Upper Alluvium, capped by Made Ground.

Significant archaeological remains have been found within the floodplain deposits to the east of the site. These include probable Mesolithic and Neolithic lithics at Prince Regent Lane and Freemasons Road (Stafford et al., 2012); *in situ* Neolithic pottery, lithics, charcoal and charred grain at A13 Woolwich Manor Way (Stafford et al., 2012), Golfers Driving Range (Carew, 2006) & A13 Woolwich Manor Way (Stafford et al., 2012) and Bronze Age trackway and platform structures located towards the surface of the peat at Beckton Nursery (Divers, 1995), Beckton 3D (Meddens, 1996). At Golfers Driving Range, the Bronze Age trackway and plat form was recorded between -1.85 and -1.5m OD. Thus, on the basis of the Peat surface height at East Ham Industrial Estate (-1 to -2m OD), the potential for archaeological remains should be considered to exist. The difference between East Ham Industrial Estate is the topography of the underlying Shepperton Gravel surface, which as above, deepens northwards, before rising to the terrace edge. At sites such as Golfers Driving Range, the Shepperton Gravel surface rises immediately northwards, though whether this has any impact upon the potential for archaeological remains to exist at the current site is uncertain. The unusual wood fragment from EH-BH204A has been retained for identification by a timber specialist if deemed appropriate; however, it was recorded at a substantial depth and its origin is uncertain.

As outlined in section 2.2; even in the absence of archaeological remains, the sediments have the potential to contain a wealth of further information on the past landscape, through the assessment/analysis of palaeoecological remains (e.g. pollen, plant macrofossils and insects) and radiocarbon dating. So called environmental archaeological or palaeoenvironmental investigations

can identify the nature and timing of changes in the landscape, and the interaction of different processes (e.g. vegetation change, human activity, climate change, hydrological change) thereby increasing our knowledge and understanding of the site and nearby area. In the case of human activity, palaeoenvironmental evidence can include: (1) decreases in tree and shrub pollen suggestive of woodland clearance; (2) the presence of herbs indicative of disturbed ground, pastoral and/or arable agriculture; (3) charcoal/microcharcoal suggestive of anthropogenic or natural burning, and (4) insect taxa indicative of domesticated animals. Such investigations are routinely carried out where required as part of planning conditions across the Lower Thames Valley and its tributaries, instructed by the LPA Archaeological Advisor.

Additional boreholes are due to be put down and monitored on the site to ground-truth and improve the resolution of the existing deposit model. However, in addition to this, it is strongly recommended that a borehole in the area of EH-BH201A is repeated, due to the very poor recovery of material during the initial drilling exercise. This borehole is of particular interest because the opportunity to obtain such thick peat sequences overlying a deep gravel surface is rare in this area of the Lower Thames Valley, and may provide important palaeoenvironmental data. In particular, because of the lower elevation and greater peat thickness, it could represent accumulation from an earlier date and for a longer period than that of previous nearby sites. Following this, radiocarbon dating and an assessment of the palaeoecological remains should be carried out to establish whether their concentration, preservation & diversity is sufficient to achieve the overall aims of the project (see section 2.3).

6. REFERENCES

Batchelor, C.R. (2009) *Middle Holocene environmental changes and the history of yew (Taxus baccata L.) woodland in the Lower Thames Valley*. Unpublished PhD thesis, University of London

Batchelor, C.R. & Green, C.P. (2016) *Peruvian Wharf, North Woolwich Road, Silvertown, London Borough of Newham: Geoarchaeological Deposit Model Report*. Quaternary Scientific (QUEST) Unpublished Report February 2016; Project Number 182/15.

Batchelor, C.R., Branch, N.P., Carew, T., Elias, S.E., Gale, R., Laffery, G.E., Matthews, I.P. Meddens, F., Vaughan-Williams A. & Webster, L. (in prep) Middle Holocene environmental history and human activities at Beckton, Lower Thames Valley (London, UK). *The Holocene* (in prep).

Batchelor, C.R. Young, D.S. & Allott, L. (2015) *75 Berwick Road, Canning Town, London Borough of Newham*. Quaternary Scientific (QUEST) Unpublished Interim Report October 2015; Project Number 134/15.

Branch, N.P., Batchelor, C.R., Cameron, N.G., Coope, R., Densem, R., Gale, R., Green, C.P. & Williams (2012) Holocene Environmental Changes at Hornchurch Marshes, London, UK: implications for our understanding of the history of *Taxus* (L.) woodland in the Lower Thames Valley. *The Holocene*, **22 (10)** 1143-1158.

Branch, N., Canti, M., Clark, P. and Turney, C. (2005) *Environmental Archaeology: theoretical and Practical Approaches*. Edward Arnold, London.

Carew, T., Meddens, F., Batchelor, R., Branch, N., Elias, S., Goodburn, D., Vaughan-Williams, A., Webster, L. & Yeomans, L. (2009) human-Environmental interactions at the wetland edge in East London: trackways, platforms and Bronze Age responses to environmental change. *London and Middlesex Archaeology Society*, **6**: 1-34.3.

Corcoran, J., Halsey, C., Spurr, G., Burton, E. and Jamieson, D. (2011) *Mapping past landscapes in the Lower Lea Valley: A geoarchaeological study of the Quaternary sequence*. Museum of London Archaeology, MOLA Monograph 55.

Divers, D. (1995) *Archaeological Excavation of the former Beckton Nursery*. Newham Museum Service Unpublished Report.

Gibbard, P.L. (1985) *Pleistocene History of the Middle Thames Valley*. Cambridge University Press, Cambridge.

Gibbard, P.L. (1994) *Pleistocene History of the Lower Thames Valley*. Cambridge University Press, Cambridge.

Green, C. P., Batchelor, C. R., Austin, P. J., Brown, A. D., Cameron, N. G., & Young, D. S. (2014). Holocene alluvial environments at Barking, Lower Thames Valley (London, UK). *Proceedings of the Geologists' Association*, 125(3), 279-295.

Holder, N. (1998) *An Archaeological Excavation Assessment and Updated Project Design for Royal Docks Community School Site, Prince Regent Lane, Newham*. MoLAS Unpublished Report.

Jarrett, C. (1996). *Archaeological evaluation at the East Beckton District Centre*. Newham Museum Service Unpublished Report.

Meddens, F.M. (1996) Sites from the Thames Estuary Wetlands, England and their Bronze Age use. *Antiquity*, 70, 325-334.

IDOM Merebrooks (2016) *East Ham Industrial Estate, Beckton: Geo-environmental assessment*. Bellway Homes, Thames Gateway Limited Gea-17855bn-16-157 Rev A June 2016.

Nicholls, M., Corcoran, J., Eastbury, E., Cotton, J., Scaife, R.C., Whittaker, J.E., Macphail, R.I., Cameron, N., & Stewart, K. (2013) A prehistoric eyot at Canning Town, Newham: a geoarchaeological investigation. *The Essex Society for Archaeology and History* 4, 3-25.

RSA Geotechnics Ltd (2001) *East Ham Industrial Estate, Newham Way, Beckton, London, E6*: *Ground Investigation Report.* RSA Geotechnics Unpublished Report No 8142, June 2016.

Scaife, R.G. (2001) East Ham FC, Pennyroyal Avenue, Beckton, London E6, an Environmental Assessment. Unpublished HAT Report 903.

Stafford, E., Goodburn, D. & Bates, M. (2012) *Landscape and Prehistory of the East London Wetlands: Investigations along the A13 DBFO Roadscheme*, *Tower Hamlets, Newham and Barking and Dagenham, 2000-20003*. Oxford Archaeology, Oxford.

Tamblyn, W.S. (1994) *Archaeological evaluation of Beckton areas A and B Tollgate Road, Beckton, London Borough of Newham*. Newham Museum Service Unpublished Report.

Tröels-Smith, J. (1955) Karakterisering af løse jordater (Characterisation of unconsolidated sediments), *Danm. Geol. Unders., Ser IV* 3, 73.

Truckle, N. and Sabel, K. (1994) *Beckton Alps Ski Slope, Newham Way, East Ham E6, London Borough of Newham*. Newham Museum Service Unpublished Report.

Young, D.S. (2016) *Battersea Power Station (Phase 2), London Borough of Wandsworth: geoarchaeological deposit model report*. Quaternary Scientific (QUEST) Unpublished Report February 2016; Project Number 135/14

Young, D.S. (2017) *Greenwich Peninsula, Peninsula Ward, London Borough of Royal Greenwich: Geoarchaeological and Palaeoenvironmental Written Scheme of Investigation*. Quaternary Scientific (QUEST) Unpublished Report May 2017; Project Number 052/16.

Young, D.S. & Batchelor, C.R. (2017) *Beam Park Riverside (Phase 1 Surcharging), London Boroughs of Havering and Barking & Dagenham: Desk-Based Geoarchaeological Deposit Model Report*. Quaternary Scientific (QUEST) Unpublished Report March 2017; Project Number 216/16.

7. APPENDIX 1: OASIS

OASIS ID: quaterna1-286946

Project details

Project name	East Ham Industrial Estate
Short description of the project	Four geoarchaeological boreholes were put down across the site, and deposit modelling was carried out. The results of the deposit modelling indicate that the sediments present beneath the East Ham Industrial Estate site are similar to those recorded elsewhere in the Lower Thames Valley. A sequence of Shepperton Gravel is overlain by a sequence of Holocene alluvial sediments, buried beneath modern Made Ground. The palaeoenvironmental potential is high, and the potential for archaeology is considered to exist.
Project dates	Start: 18-04-2017 End: 07-06-2017
Previous/future work	No / Yes
Any associated project reference codes	EHA17 - Sitecode
Type of project	Environmental assessment
Site status	None
Current Land use	Industry and Commerce 1 - Industrial
Monument type	PEAT Uncertain
Significant Finds	PEAT Uncertain
Survey techniques	Landscape

Project location

Country	England
Site location	GREATER LONDON NEWHAM EAST HAM East Ham Industrial Estate
Study area	300 Square metres
Site coordinates	TQ 42060 82020 51.518709246407 0.047732958596 51 31 07 N 000 02 51 E Point

Project creators

Name of Organisation	Quaternary Scientific (QUEST)
Project brief originator	Consultant
Project design originator	Dr C.R. Batchelor
Project director/manager	C.R. Batchelor
Project supervisor	C.R. Batchelor
Type of sponsor/funding body	Developer

Project archives

Physical Archive Exists?	No
Digital Archive Exists?	No
Paper Archive recipient	LAARC
Paper Media available	"Report"

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	EAST HAM INDUSTRIAL ESTATE, BECKTON LONDON BOROUGH OF NEWHAM Geoarchaeological Deposit Model Report
Author(s)/Editor(s)	Batchelor, C.R.
Other bibliographic details	Quaternary Scientific (QUEST) Unpublished Report June 2017; Project Number 011/17
Date	2017
Issuer or publisher	Quaternary Scientific
Place of issue or publication	University of Reading

Entered by	Christopher Batchelor (c.r.batchelor@reading.ac.uk)
Entered on	7 June 2017