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GREENWICH PENINSULA PLOT 18.03, WEST PARKSIDE, ROYAL BOROUGH OF GREENWICH

Report on the Geoarchaeological Deposit Model & Radiocarbon Dating

NGR: TQ 397 792

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1. NON-TECHNICAL SUMMARY

A programme of radiocarbon dating was undertaken, following on from the results of geoarchaeological fieldwork and deposit modelling at the Plot 18.03 site. As a whole, these investigations were carried out in order to: (1) map the height and thickness of the deposits; (2) assess their geoarchaeological, archaeological and palaeoenvironmental significance and potential, and (3) ascertain the age of the peat horizon recorded at the site. In order to address these aims, two geoarchaeological boreholes were retained from the site, and a deposit model prepared using the new and existing geotechnical/geoarchaeological data for the site. The base of the peat in one of these boreholes (18.03.QBH2) was then radiocarbon dated.

The results of the deposit modelling indicate that the sediments present beneath Plot 18.03 are similar in character to those recorded elsewhere on Greenwich Peninsula; the Late Devensian Shepperton Gravel is overlain by a sequence of Holocene alluvial sediments, buried beneath modern Made Ground. The site lies on the northeastern edge of a possible Late Devensian/Early Holocene palaeochannel; the resultant topography across the site is highly variable, and towards the northeast, where the Gravel surface lies above -1m OD, there is potential for the survival of archaeological remains. Where the Gravel surface is lower, up to 3.1m of Holocene alluvial deposits are recorded, and here up to 0.5m of peat was recorded in two boreholes. These organic sediments are thin, and only locally present; in addition, radiocarbon dating of the base of the peat indicates that accumulation began here during the early Bronze Age, within the general age range of the peat recorded elsewhere on Greenwich Peninsula (late Mesolithic to late Bronze Age), and of similar age to environmental archaeological investigations that have already been undertaken nearby. On this basis, no further environmental archaeological assessment is recommended on the samples from Plot 18.03.

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 Greenwich Peninsula Plot 18.03, West Parkside, Royal Borough of Greenwich (National Grid Reference: TQ 397 792; Figures 1 & 2). Quaternary Scientific were commissioned by RPS Consulting Services Limited on behalf of Knight Dragon Developments Ltd to undertake the geoarchaeological investigations. The site is located towards the south of Greenwich Peninsula, bounded to the northeast by West Parkside and to the south by John Harrison Way (Figure 1). Greenwich Peninsula is formed and bounded by a meander of the Thames to the west, east and north of the site, and lies opposite the confluence of the River Lea. The ground across the area originally formed part of the natural floodplain of the Thames, and is underlain by river alluvium (British Geological Survey 1:50,000 sheets 256 North London 1993, 257 Romford 1996, 270 South London 1998, 271 Dartford 1998). This alluvium consists of fine-grained mineral-rich deposits and peat, and is mapped to the south to approximately the position of the A206 where it meets higher drier ground. Beneath the alluvium, sand and gravel is present and is assigned by Gibbard (1994) to

the Late Devensian Shepperton Gravel. The bedrock beneath this is mapped as the Palaeogene Lambeth Group – Clay, Silt and Sand. Ground level at the site is recorded at between *ca*. 4.5 and 5.0m OD (Ian Farmer Associates, 2016).

The results of previous geotechnical investigations at the site (Ian Farmer Associates, 2016) revealed a sequence of Shepperton Gravel overlain by alluvium, described in places as organic and containing pockets of peat, capped by Made Ground. In one borehole a peat horizon is recorded directly overlying the Gravel, between -0.44 and -0.94m OD (borehole 18.03.04). The Gravel surface was recorded at the site at between *ca*. -3.0 and -1.0m OD, and appears to fall sharply from the eastern area of the site (*ca*. -1.0m OD) to the west/northwest (*ca*. -3.0m OD). Elsewhere on Greenwich Peninsula (see Figure 1), relatively high Gravel surfaces (between *ca*. -1 and -1.7m OD) have been recorded on the Tunnel Avenue (Landscape Zone B; Batchelor, 2013) and Victoria Deep Water Terminal sites (Landscape Zone A; Corcoran, 2002); elsewhere, the Gravel surface drops to below -4m OD, interpreted as either localised hollows, or part of interconnected palaeochannels (see below). Peat has been identified elsewhere on Greenwich Peninsula, including at the Victoria Deep Water Terminal site (Corcoran, 2002), where peat accumulation was radiocarbon dated to 5280-4660 cal BP (Middle-Late Neolithic), whilst at the Cable Car South Station (*ca*. 50m to the east; Green et al., 2011), the beginning of accumulation was dated to ca. 5580-5310/5890-5610 cal BP (Middle Neolithic), continuing until at least 3380-3210 cal BP Late Bronze Age). At Greenwich Peninsula Central East (Young & Batchelor, 2015a) a complex sequence of alluvium and at least three intercalated peat horizons of between 0.1 and 1.0m thickness were recorded, dated to 6720-6500 cal BP (lower Peat; Late Mesolithic), 6190-5990 cal BP (middle Peat; Early Neolithic) and 3340 to 3080 cal BP (upper Peat; Middle Bronze Age). The peat horizons recorded across much of Greenwich Peninsula thus appear to have accumulated within the same general age range of 6700 to 3000 cal BP (late Mesolithic to late Bronze Age; broadly equivalent to Devoy's (1979) Tilbury III Peat).

2.2 Geoarchaeological, palaeoenvironmental and archaeological significance

The peat and the organic alluvium recorded at the Plot 18.03 site represents a period of semi-terrestrial conditions that may date to the Neolithic through to the Bronze Age. The palaeoenvironmental potential of the sequences was therefore be considered to be high; however, subsequent geoarchaeological investigations at the site have revealed that the organic sediments are thin, and only locally present (Young, 2017a). On the basis of the radiocarbon dates from sites elsewhere on the Peninsula, it is possible that the peat at the present site may have been accumulating at the same time as trackway construction occurred at the 72-88 Bellot Street (Mclean, 1993; Philp, 1993) and the Garage Site, Bellot Street (Branch *et al*., 2005) sites (Bronze Age) approximately 600m to the southwest. In addition, the existing records from the nearby area indicate a variable sequence of Holocene alluvial deposits resting, on a highly variable Shepperton Gravel surface. The different deposits recorded are significant as they represent different environmental conditions that would have existed in a given location. For example: (1) variations in the topography of the River Terrace Gravels could indicate the position of former channels and islands on the floodplain; (2) the presence of soils and peat represent former terrestrial or semi-

terrestrial land-surfaces, and (3) the less organic alluvial deposits of sands/silts/clays represent periods of varying hydrological conditions on the floodplain. At present, our understanding is that the Plot 18.03 site lies at the interface between slightly raised and deeper gravel surfaces, potentially indicative of a channel-marginal setting, overlain by organic-rich deposits and peat. By studying the sub-surface stratigraphy across the site in greater detail, it is possible to build a greater understanding of the former landscapes and environmental changes that took place over space and time at this location of Greenwich Peninsula.

Organic-rich sediments (in particular peat) also have high potential to provide a detailed reconstruction of prehistoric environments on both the wetland and dryland. In particular, there is the potential to increase knowledge and understanding of the interactions between hydrological change, human activity, vegetation succession and climate in this area of the Middle Thames Valley. Vegetation changes include the early Holocene/early Mesolithic transition from pine-dominated to mixed-deciduous dominated woodland; the late Mesolithic/Neolithic decline of elm woodland, the Neolithic colonisation and decline of yew woodland; the late Neolithic/early decline of wetland and dryland woodland. Such investigations are carried out through the assessment/analysis of palaeoecological remains (e.g. pollen, plant macrofossils & insects) and radiocarbon dating. So called palaeoenvironmental reconstructions have been carried out on the sedimentary sequences from elsewhere in this general area, including at the Victoria Deep Water Terminal site (Corcoran, 2002), at the Cable Car South Station (Green et al., 2011), Greenwich Peninsula Central East (Young & Batchelor, 2015a), Enderby Wharf (Batchelor et al., 2015) and Alcatel-Lucent Telegraph Works (Young & Batchelor, 2015b).

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 structure) and palaeoenvironmental record (e.g. changes in vegetation composition). As stated above, such evidence was identified in the form of a Bronze Age trackway at the 72-88 Bellot Street (Mclean, 1993; Philp, 1993) and Garage Site, Bellot Street (Branch *et al.*, 2005) sites (Bronze Age) approximately 600m to the southwest.

2.3 Aims and objectives

On the basis of the geoarchaeological, palaeoenvironmental and archaeological potential of the site, further records were required to enhance our understanding of the sub-surface stratigraphy of Plot 18.03, and for any further assessment/analysis of the deposits (if necessary). Five research aims relevant to the geoarchaeological investigations were outlined within the written scheme of investigation for the site (Young, 2017b), as follows:

1. To clarify the nature of the sub-surface stratigraphy across the site
2. To clarify the nature, depth, extent and date of any former land surfaces, alluvial and peat deposits;
3. To compare the results of the investigation to the other sites in the area of Greenwich Peninsula;

4. To investigate whether the sequences contain any artefact or ecofact evidence for prehistoric or historic human activity;
5. To investigate whether the sequences contain any evidence for natural and/or anthropogenic changes to the landscape (wetland and dryland);
6. To integrate the new geoarchaeological record with ongoing investigations in the area of Greenwich Peninsula (including those carried out as a response to the Historic England Archaeological Brief and Plot Specific WSI), and other recent work in the local area, for publication in an academic journal.

In order to address the first two of these aims, the following objectives were proposed:

1. To retrieve undisturbed continuous samples from two targeted borehole locations for laboratory-based investigation;
2. To use the stratigraphic data from the new locations, and existing records to produce a deposit model of the major depositional units across the site;
3. To make recommendations for any further geoarchaeological, palaeoenvironmental and archaeological investigation at the mitigation stage.


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Figure 1: Location of (1) Greenwich Peninsula Plot 18.03, Royal Borough of Greenwich and selected other geoarchaeological and archaeological sites nearby: (2) Greenwich Peninsula Plot 19.05 (Young & Batchelor, 2017); (3) Plot MO115 (Young & Batchelor, 2013b); (4) Plot MO117 (JHW13; Young & Batchelor, 2013a); (5) Greenwich Millennium Village (Miller & Halsey, 2011); (6) Land between A102(M) & Bugsby's Way (GPN98); (7) The Leisure Site, Bugsby's Way (BW99); (8) Land between A102(M) & Bugsby's Way (GPN98); (9) Enderby Wharf, Christchurch Way (Batchelor *et al*., 2015a); (10) Alcatel-Lucent Telegraph Works (Young & Batchelor, 2015b); (11) Greenwich Wharf (Nicholls *et al*., 2017); (12) Plot MO401 (Batchelor, 2014); (13) Bellot Street (GLB05; Branch *et al*., 2005); (14) 72-88 Bellot Street (BSG93; McLean, 1993; Philp, 1993); (15) Tunnel Avenue (GPF12; Batchelor, 2013); (16) Greenwich Peninsula Central East (Young & Batchelor, 2015a); (17) The Cable Car route (CAB11; Batchelor *et al*., 2015b); (18) Victoria Deep Water Terminal (TUA02; Corcoran, 2002).

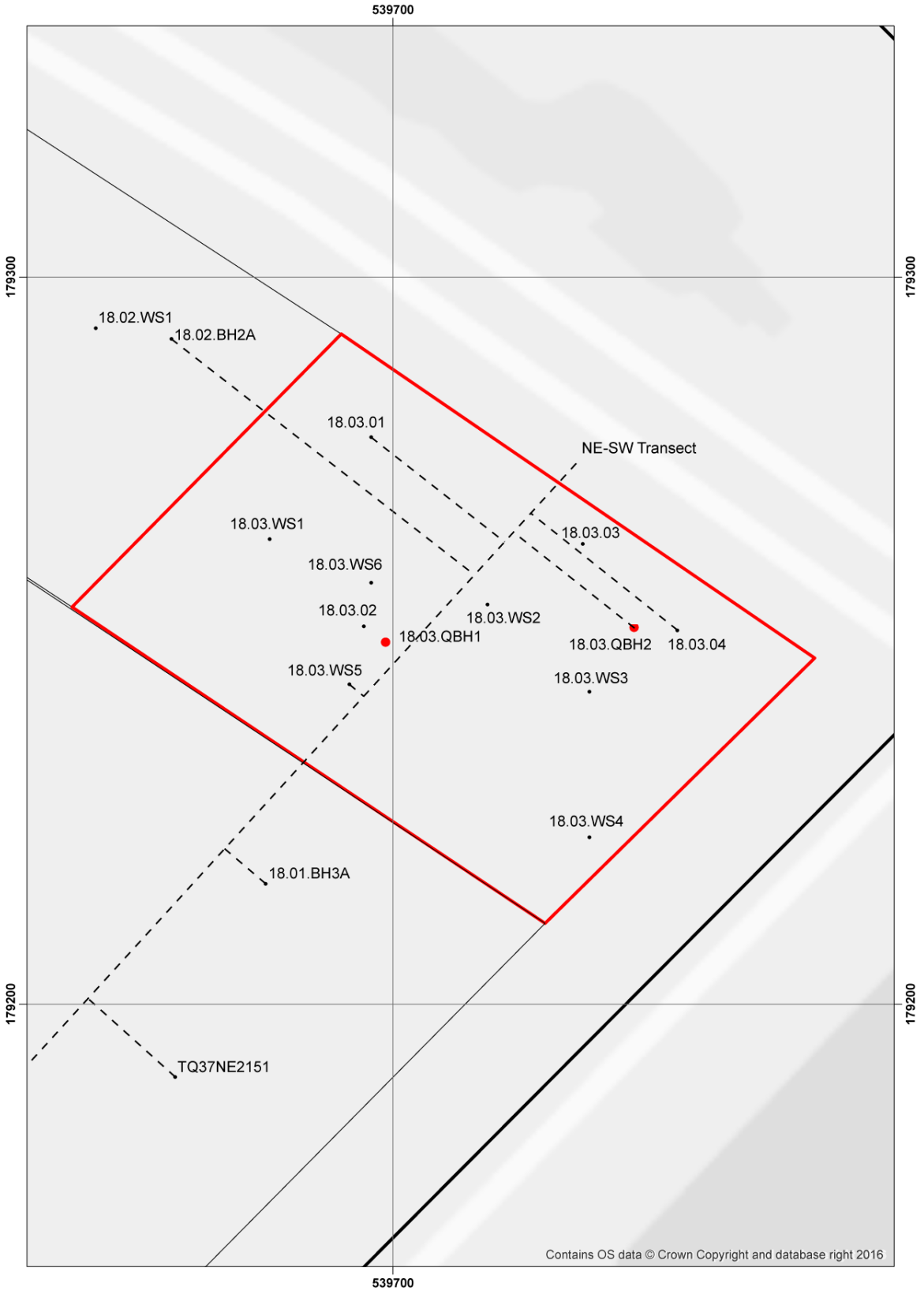

Figure 2: Location of previous geotechnical boreholes, the new geoarchaeological boreholes (18.03.QBH1 and 18.03.QBH2) and British Geological Survey (BGS) archive boreholes at Greenwich Peninsula Plot 18.03, Royal Borough of Greenwich.

3. METHODS

3.1 Field investigations

Two geoarchaeological boreholes (boreholes 18.03.QBH1 and 18.03.QBH2) were put down at the site in March 2017 by Quaternary Scientific (Figure 2). The borehole core samples were recovered using an Eijkelkamp window sampler and gouge set using an Atlas Copco TT 2-stroke percussion engine. 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.

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 results are displayed in Tables 1 and 2.

3.3 Deposit modelling

The deposit model for the Plot 18.03 site was based on a review of 12 borehole records for the site itself, including the two new geoarchaeological boreholes and ten previous geotechnical records (Figure 2). This new data was incorporated in to the existing Quest data set for Greenwich Peninsula and the London Borough of Newham, incorporating over 4000 geotechnical, geoarchaeological and archaeological interventions (see Young *et al.*, in press and Figure 11). Sedimentary units from the boreholes were classified into seven groups: (1) Bedrock, (2) Gravel, (3) Sand, (4) Lower Alluvium. (5) Peat, (6) Upper Alluvium and (7) Made Ground. The classified data for groups 1-7 were then input into a database within the RockWorks 16 geological utilities software, the output from which was generated using ArcMap 10. A northeast to southwest borehole transect across the site 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 4, 5, 6 and 8). Thickness of the Peat, total Holocene alluvium (incorporating the Lower Alluvium, Peat and Upper Alluvium) and Made Ground (Figures 7, 9 and 10) were also modelled (also using an Inverse Distance Weighted algorithm).

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 site; for the model of the wider area (Figure 11), a 100m radius is used in order to more easily place the site in its wider topographical context. 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.

3.4 Radiocarbon dating

One subsample of unidentified twig wood (<2-3 growth rings) was extracted from towards the base of the peat in borehole 18.03.QBH2 for radiocarbon dating. The sample was submitted for AMS radiocarbon dating to the BETA Analytic Radiocarbon Dating Facility, Miami, Florida. The results have been calibrated using OxCal v4.2 (Bronk Ramsey, 1995; 2001 and 2007) and the IntCal13 atmospheric curve (Reimer *et al*., 2013). The results are displayed in Figure 3 and in Table 3.

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

The results of the deposit modelling are displayed in Figures 3 to 11. Figure 3 is a two-dimensional northeast-southwest transect of selected boreholes across the area of the site, whilst Figures 4 to 10 are surface elevation and thickness models for each of the main stratigraphic units at the site. Figure 11 is an updated surface elevation model for the Gravel across the wider area of Greenwich Peninsula taking into the results of the work on Plot 18.03. 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.

The full sequence of sediments recorded in the boreholes comprises:

Made Ground
Upper Alluvium – widely present
Peat – locally present
Lower Alluvium – locally present
Gravel – widely present; not reached in all boreholes

4.1 Gravel

The Shepperton Gravel was present in all the boreholes that penetrated to the bottom of the Holocene sequence (five of the 12 records). 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.

Within the area of the site, the surface of the Gravel varies between -3.02 (18.03.01) and -0.94m OD (18.03.04) (Figures 3 and 4); towards the northeast it is recorded at between -1.19 (18.03.QBH2) and -0.94m OD (18.03.04), whilst towards the west it falls to between -3.02 and -2.31m OD (18.03.02). Beyond the site, the model indicates that the Gravel surface falls more steeply towards the southwest, to between -4 and -5m OD in the area of Plot 18.01 (see Figures 3 and 4). The surface topography is thus uneven within the area of the site, and the wider model of the Gravel surface (see Figure 11) indicates that the site is located on the northern margins of a Late Devensian or Early Holocene channel, aligned broadly northwest-southeast.

This depression in the Shepperton Gravel surface is one of a number of palaeochannels identified in the Late Devensian/Early Holocene topography of Greenwich Peninsula (see Figure 11 and Young *et al*., in press). Perhaps one of the more substantial of these channels, and to which the channel identified to the southwest of the present site might be tributary/subsidiary, is that aligned broadly west-east and underlying the Alcatel-Lucent (Batchelor *et al*., 2015), Enderby Wharf (Batchelor & Young, 2015) and 20 Horn Lane (Batchelor & Young, 2017) sites. Within this channel the Gravel surface is recorded at depths of around -4m OD, similar to that recorded within the channel to the southwest of the present site. Towards its eastern end at 20 Horn Lane and Greenwich Millennium Village (Miller & Halsey, 2011), the Shepperton Gravel is lower, ranging between -4 and -8m OD. Similarly towards the south-east, a deep depression is evident beneath the Greenwich Industrial Estate site (Morley, 2003), potentially representing a channel draining off the terrace edge towards the present day River Thames. Towards the north of 20 Horn Lane and further onto the main area of Greenwich Peninsula, the Shepperton Gravel surface is recorded in various places down to -4m OD representing the presence of further smaller, but potentially important channels. For example, towards the north-east of the Tunnel Avenue site the Gravel surface drops to below -4m OD. It does the same towards the south-west and south-east of the MO115 (Landscape Zone B; Young & Batchelor, 2013a) and MO117 (Landscape Zones A and B; Young & Batchelor, 2013b) sites, in the far south-eastern corner of Greenwich Millennium Village (Miller & Halsey, 2011), and across much of the Greenwich Peninsula Central East site (Young & Batchelor, 2015a). In addition, smaller 'patches' of lower gravel surface >-4m OD were recorded towards the centre and south-western areas of the Millennium Festival Site (Landscape Zone D; Bowsher & Corcoran, unknown). These areas of lower Gravel surface have been interpreted as either localised hollows, or part of interconnected palaeochannels.

Towards the northeastern area of Plot 18.03 site and beyond, the Gravel surface rises to between *ca*. -2 and -1m OD. Similar, relatively high Gravel surfaces (between *ca*. -1 and -1.7m OD) were recorded towards the north of the Peninsula on the Tunnel Avenue (Landscape Zone B; Batchelor, 2013) and Victoria Deep Water Terminal sites (Landscape Zone A; Corcoran, 2002). These topographic features represent small, but potentially important former islands. Wherever the Gravel surface reaches such elevations, it is more likely to represent the former River Terrace of

the Kempton Park Gravel, deposited during the middle-late Pleistocene. Such terraces have negligible potential for Palaeolithic remains since the Kempton Park Gravel was deposited during a period when hominid remains have not previous been recorded in the British Isles. They do however, represent areas of greater archaeological potential as they would have been raised above the surrounding floodplain. This is demonstrated by prehistoric trackway remains found within the overlying Peat at Bellot Street (e.g. Branch *et al.*, 2005).

4.2 Lower Alluvium

In two of the twelve records within the area of the site (both geoarchaeological boreholes), a unit of sandy silt is recorded either directly overlying the Shepperton Gravel (18.03.QBH2) or forming the basal unit (18.03.QBH1). It should be noted that its absence in the geotechnical borehole logs may be a result of difficulties differentiating this unit from the overlying Upper Alluvium in such logs.

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 surface of the Lower Alluvium is recorded in the two sequences at -0.81 (18.03.QBH1) and -0.64m OD (18.03.QBH2); beyond the margins of the site, the Lower Alluvium surface is generally recorded at between *ca.* -2 and 0m OD (Figure 5).

4.3 Peat

In two of the 12 boreholes towards the east of the site a horizon of peat was recorded, either overlying the Shepperton Gravel (18.03.QBH2) or the Lower Alluvium (18.03.04). Although limited to a very small area of the site, it is indicative of a transition towards semi-terrestrial (marshy) conditions, supporting the growth of sedge fen/reed swamp and/or woodland communities at this location. The surface of the Peat is relatively even, lying at -0.14 (18.03.QBH2) and -0.44m OD (18.03.04) (Figure 6), and it is present in thicknesses of 0.5m in both boreholes (Figure 7). Across the wider area (see Figure 6) the surface of the Peat is consistently recorded at between *ca.* 0 and -1m OD, with thicknesses (see Figure 7) of between *ca.* 0.5 and 2m.

The base of the peat in borehole 18.03. QBH2 (-0.54 to -0.64m OD) was radiocarbon dated to 3970 to 3730 cal BP (2020-1780 cal BC), indicating that peat accumulation began at this location during the early Bronze Age. The peat at the Plot 18.03 site thus falls within the general age range of the peat recorded elsewhere on Greenwich Peninsula. Across Greenwich Peninsula more

generally, peat is frequently recorded in thicknesses of up to 3m, with greater thicknesses often recorded in areas where the Shepperton Gravel topography is lower. Thick peat horizons have been recorded just to the south, at the Alcatel-Lucent (Batchelor *et al*., 2015) and Enderby Wharf (Batchelor & Young, 2015) sites for example. At these sites, the Peat has been dated to from the early to late Neolithic period, and middle Neolithic to Bronze Age periods respectively. Peat has been identified elsewhere on Greenwich Peninsula, including at the Victoria Deep Water Terminal site (Corcoran, 2002), where peat accumulation was radiocarbon dated to 5280-4660 cal BP (Middle-Late Neolithic), whilst at the Cable Car South Station (*ca*. 50m to the east; Green et al., 2011), the beginning of accumulation was dated to ca. 5580-5310/5890-5610 cal BP (Middle Neolithic), continuing until at least 3380-3210 cal BP Late Bronze Age). At Greenwich Peninsula Central East (Young & Batchelor, 2015a) a complex sequence of alluvium and at least three intercalated peat horizons of between 0.1 and 1.0m thickness were recorded, dated to 6720-6500 cal BP (lower Peat; Late Mesolithic), 6190-5990 cal BP (middle Peat; Early Neolithic) and 3340 to 3080 cal BP (upper Peat; Middle Bronze Age). The peat horizons recorded across much of Greenwich Peninsula thus appear to have accumulated within the same general age range of 6700 to 3000 cal BP (late Mesolithic to late Bronze Age; broadly equivalent to Devoy's (1979) Tilbury III Peat).

4.4 Upper Alluvium

The Upper Alluvium rests was recorded in all records across the site, resting either on the Peat, Lower Alluvium or Shepperton Gravel. 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 this unit at Plot 18.03 (Figure 8) is variable, recorded at between 0.08 (18.03.01) and 2.36m OD (18.03.WS5); in the wider area, the surface of the Upper Alluvium is generally recorded at between *ca*. 0 and 2m OD (see Figure 8).

The thickness of the Holocene alluvial sequence (incorporating the Lower Alluvium, Peat and Upper Alluvium) is displayed in Figure 9. This thickness tends to reflect the model of the Gravel surface, with greater thicknesses recorded in areas of lower Gravel topography and vice versa, as might be expected; within the area of the present site between 1.7 (18.03.03) and 3.1m (18.03.01) is recorded, with thicker sequences towards the west.

4.5 Made Ground

Between 2.2 and 4.7m of Made Ground caps the Holocene alluvial sequence across the site (Figure 10).

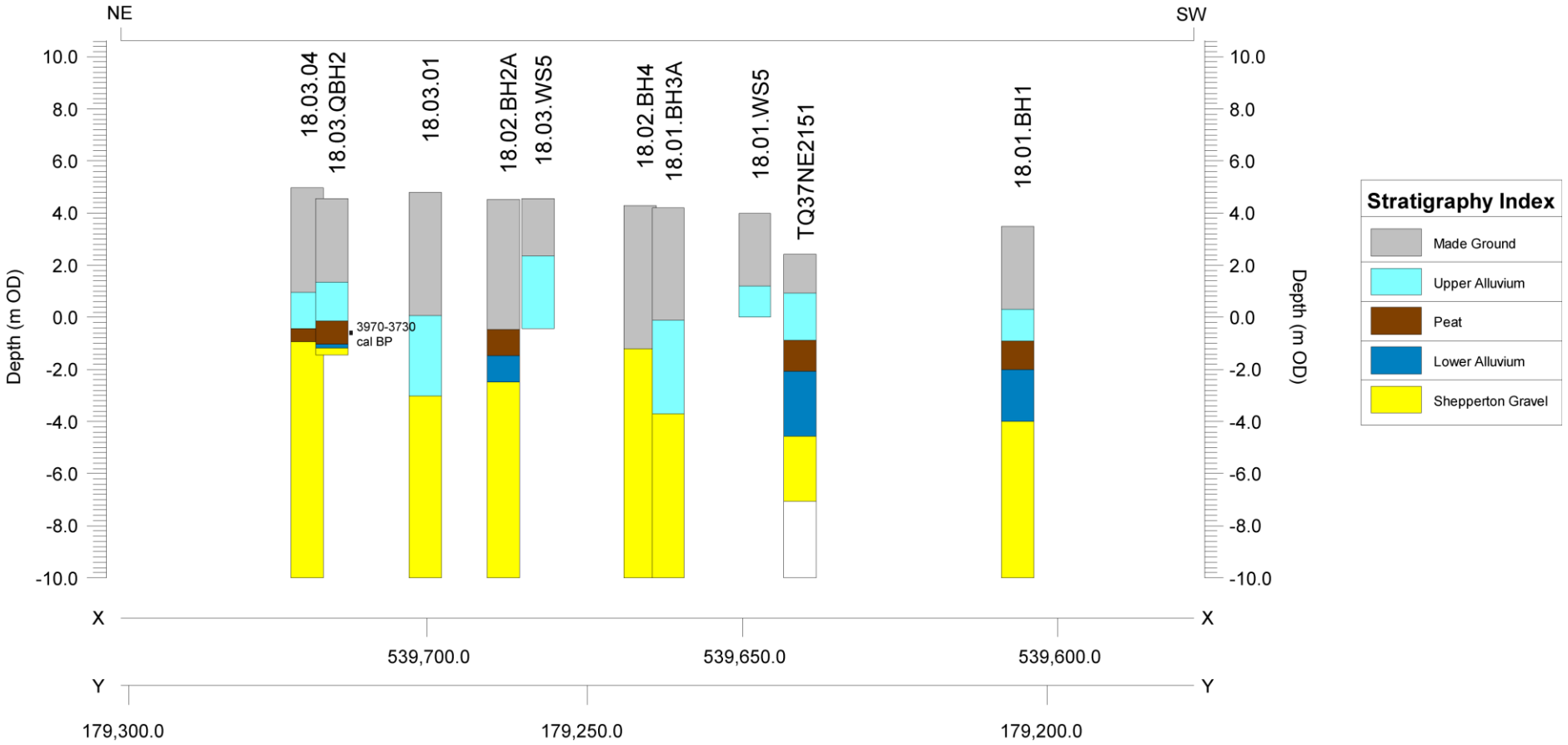

Figure 3: Northeast-southwest transect of selected boreholes across Greenwich Peninsula Plot 18.03 site.

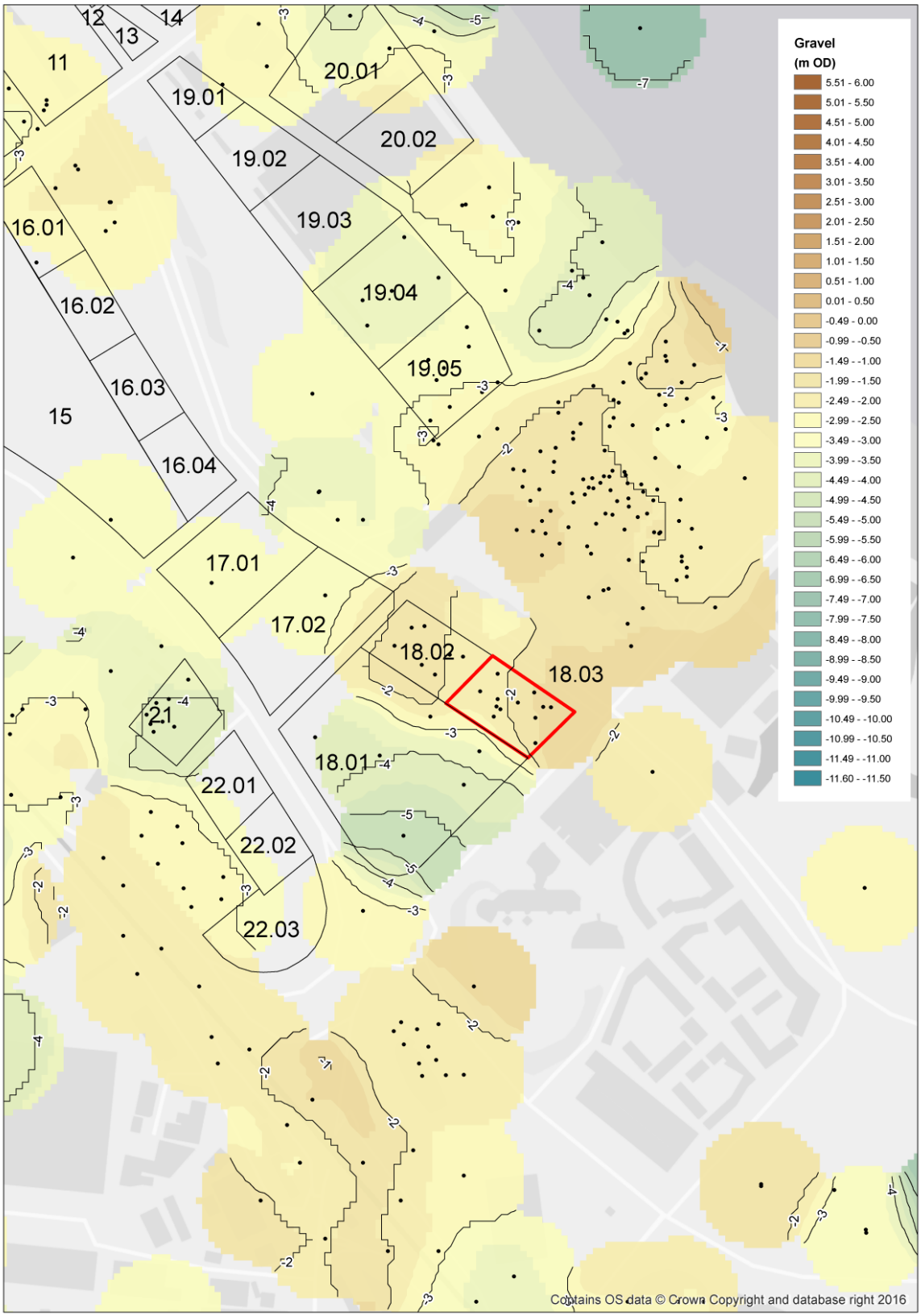

Figure 4: Top of the Gravel (m OD)

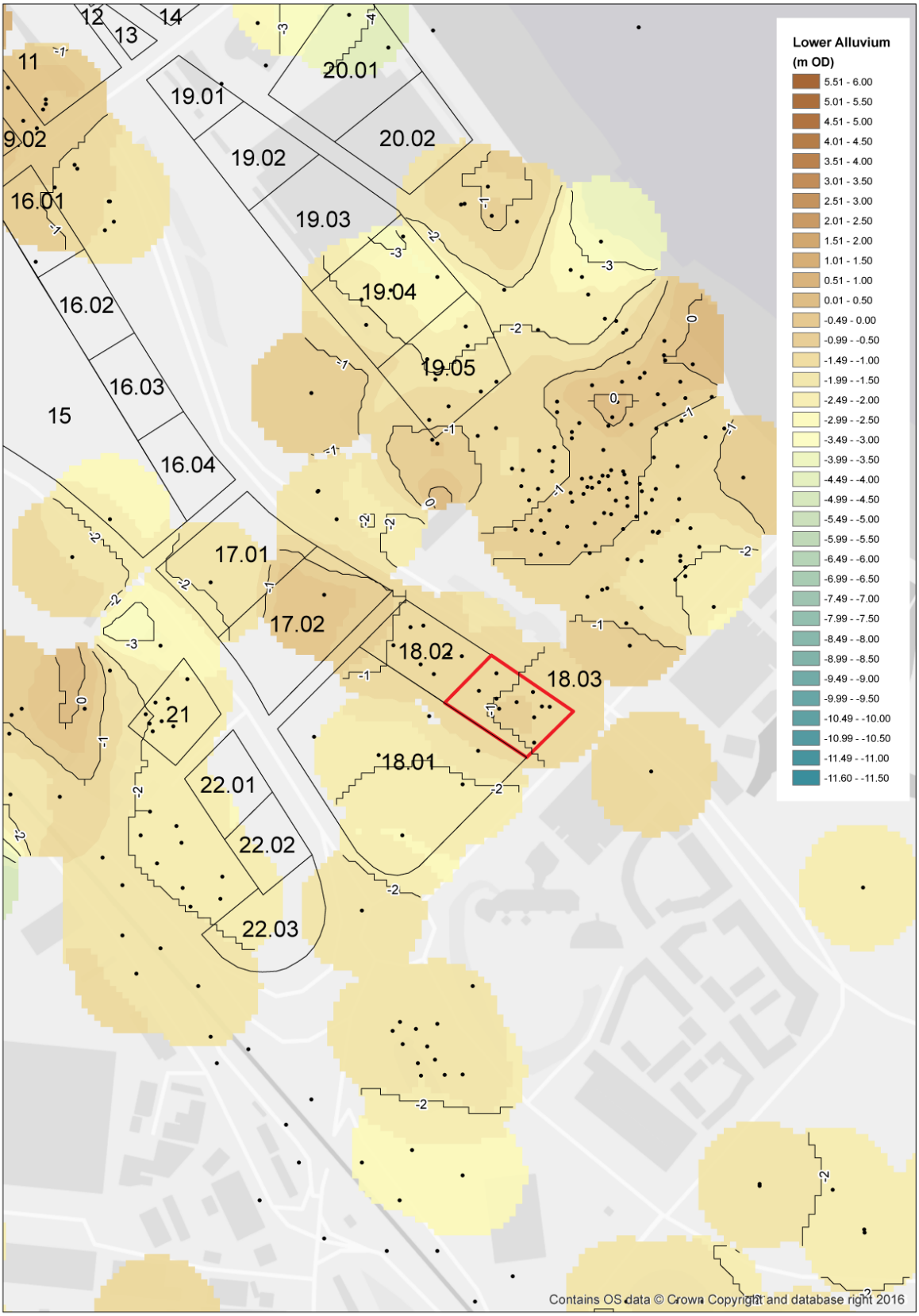

Figure 5: Top of the Lower Alluvium (m OD)

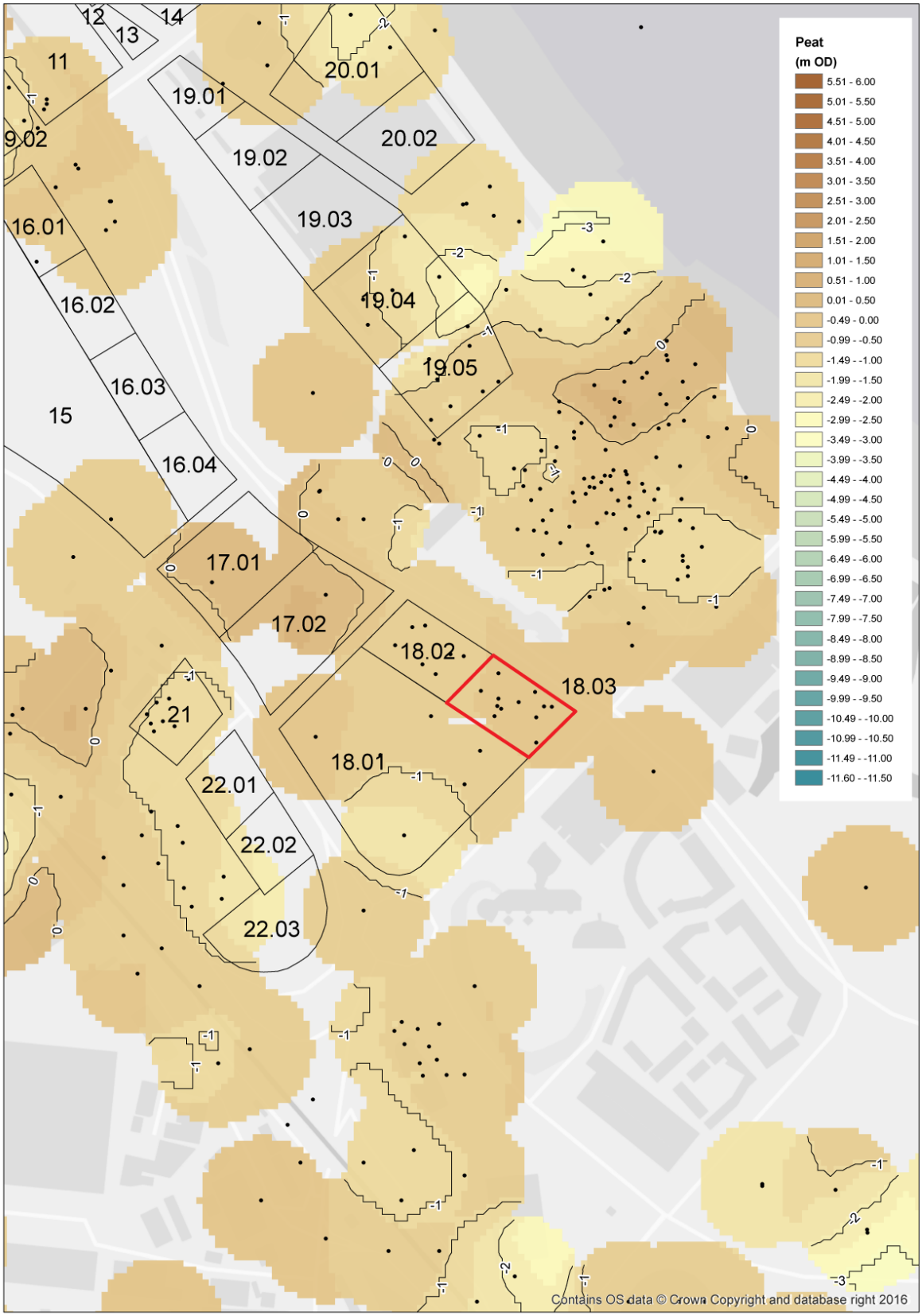

Figure 6: Top of the Peat (m OD)

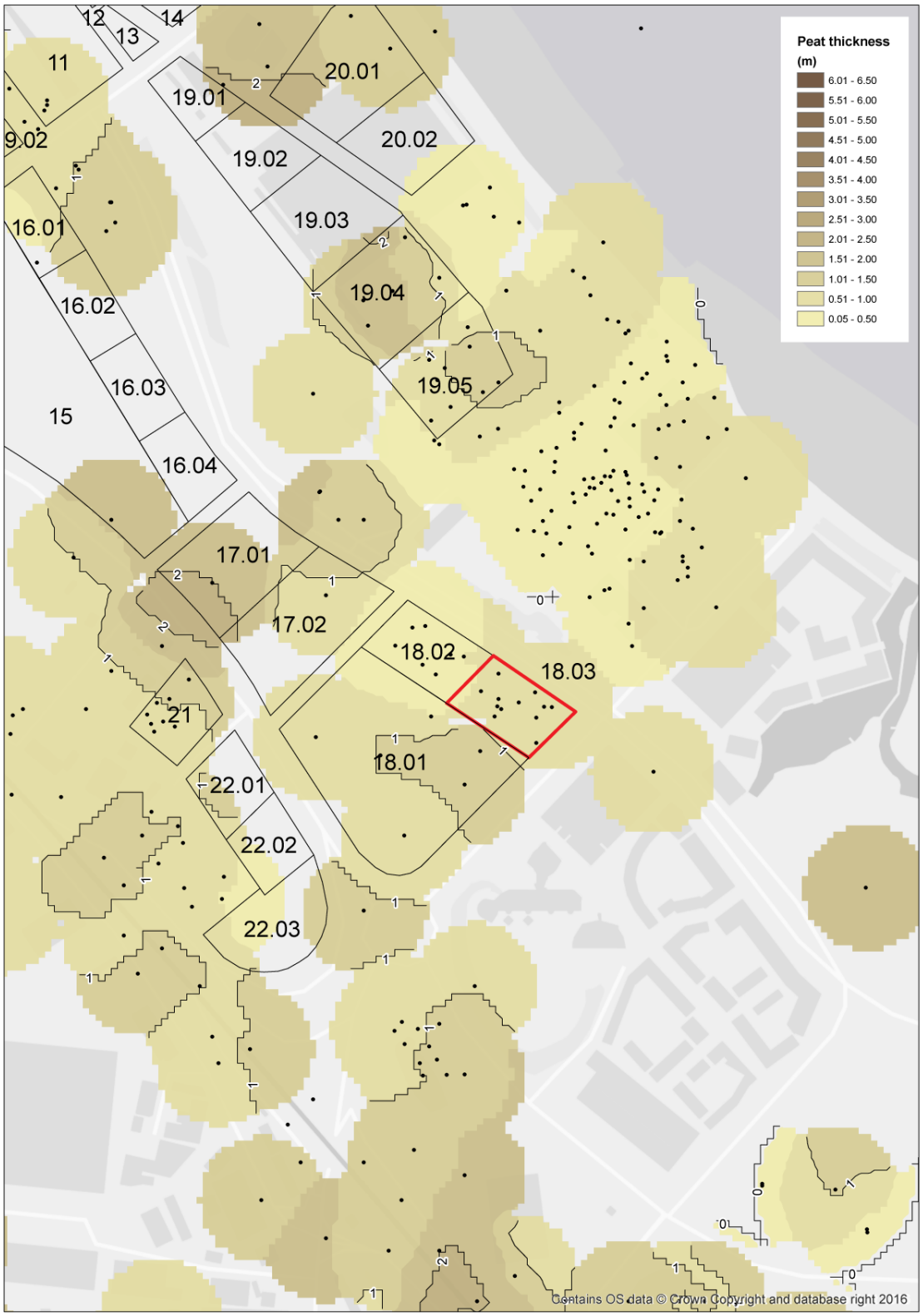

Figure 7: Thickness of the Peat (m)

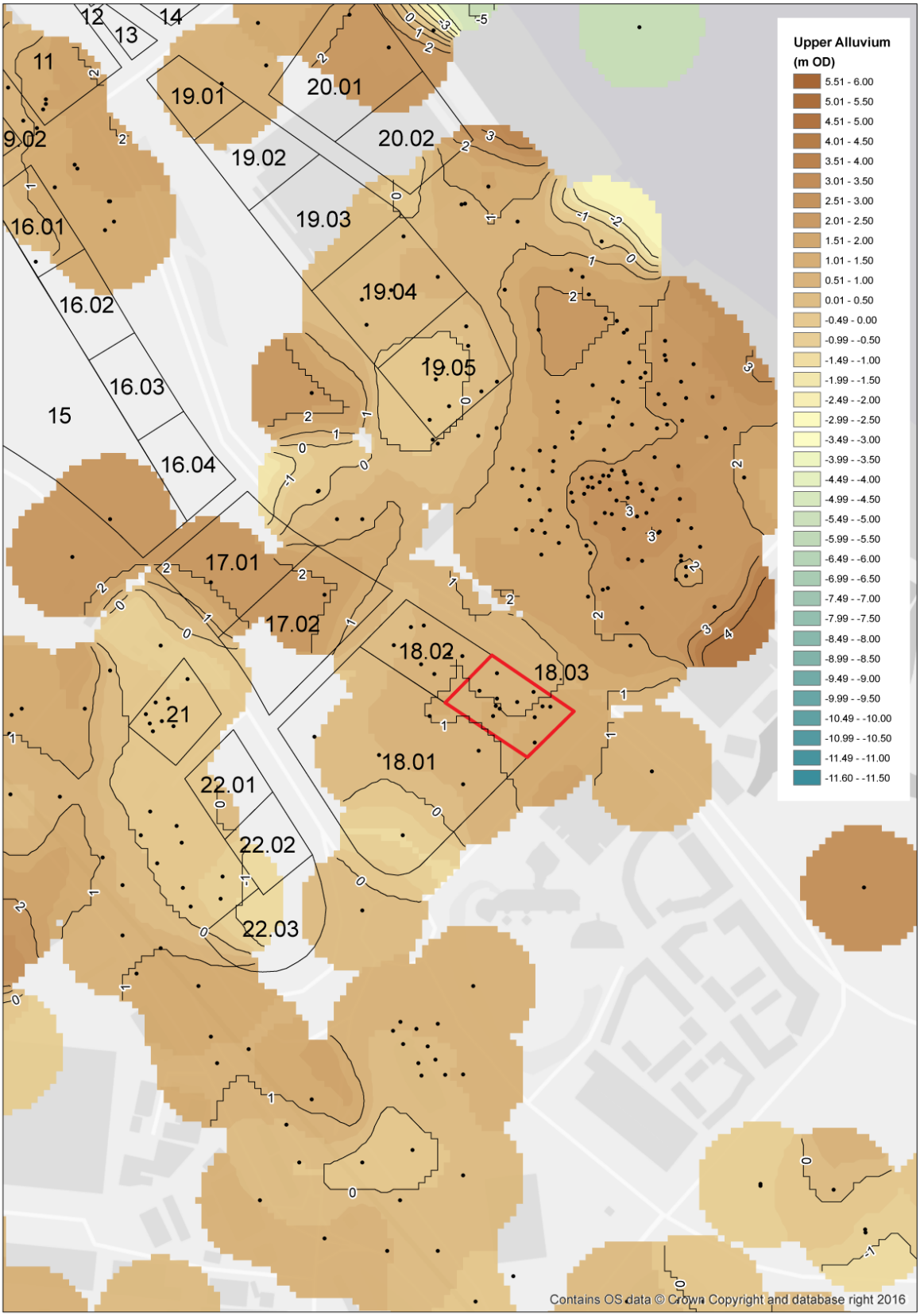

Figure 8: Top of the Upper Alluvium (m OD)

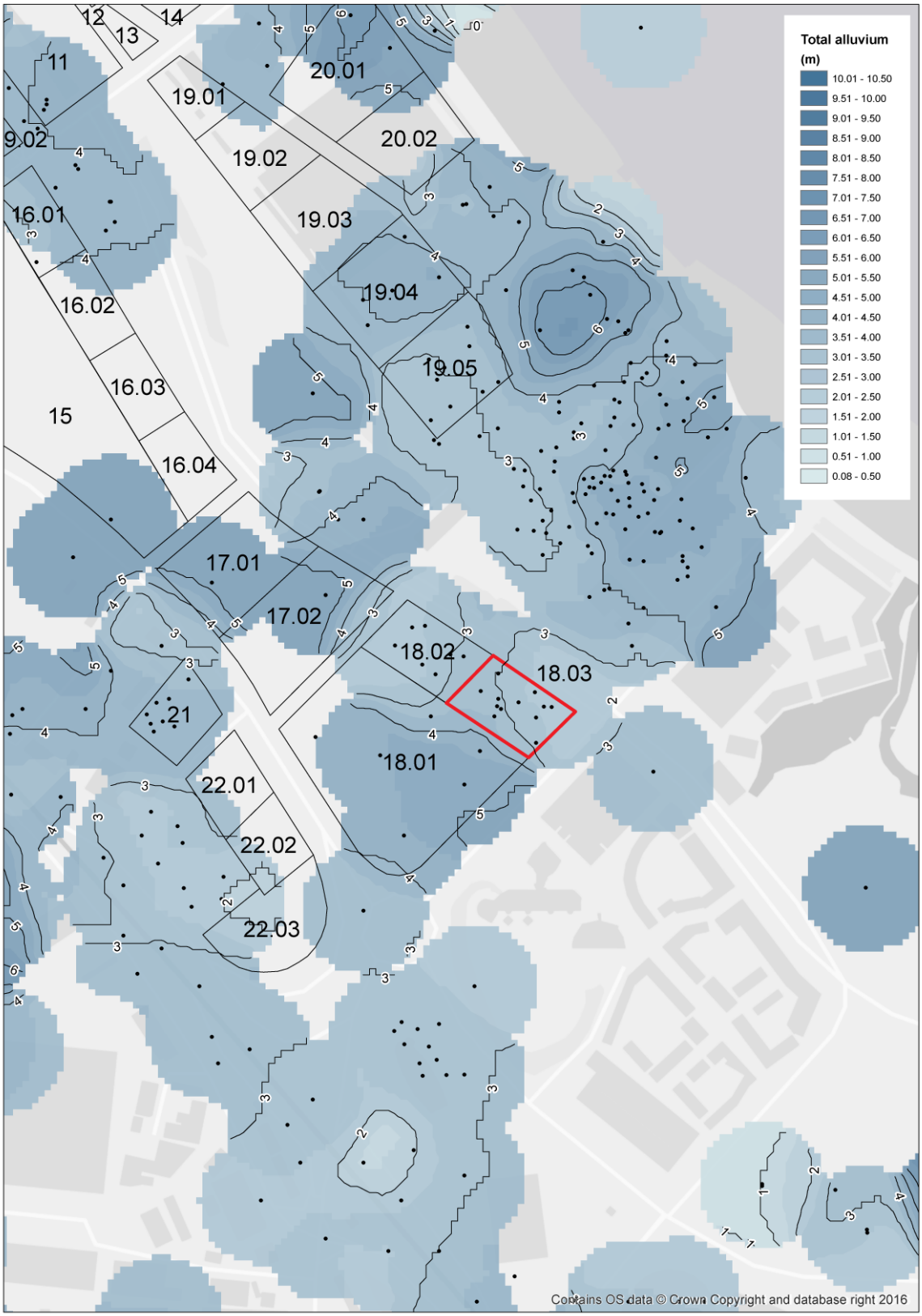

Figure 9: Thickness of the Total Alluvium (Lower Alluvium, Peat and Upper Alluvium) (m)

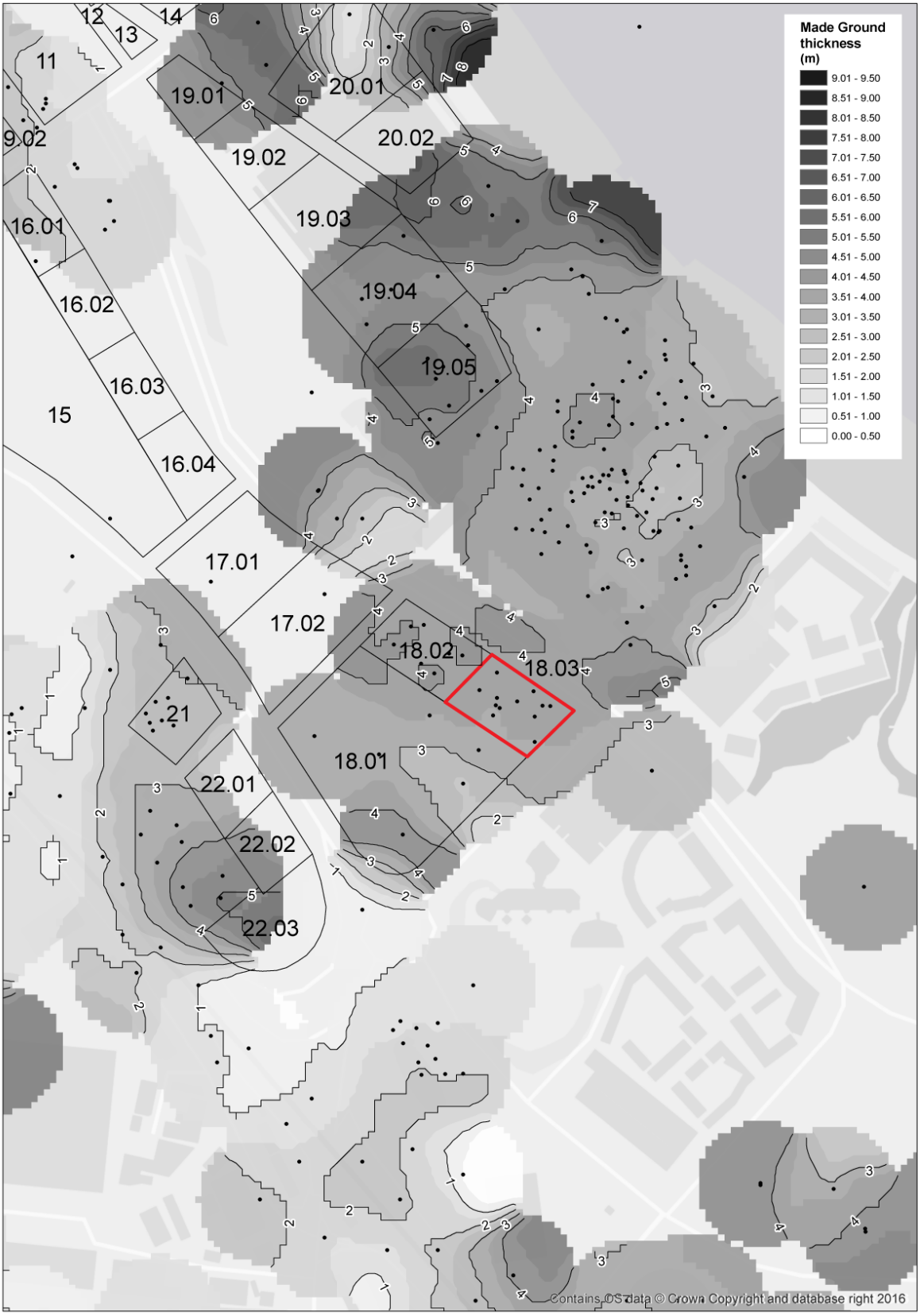

Figure 10: Thickness of Made Ground (m)

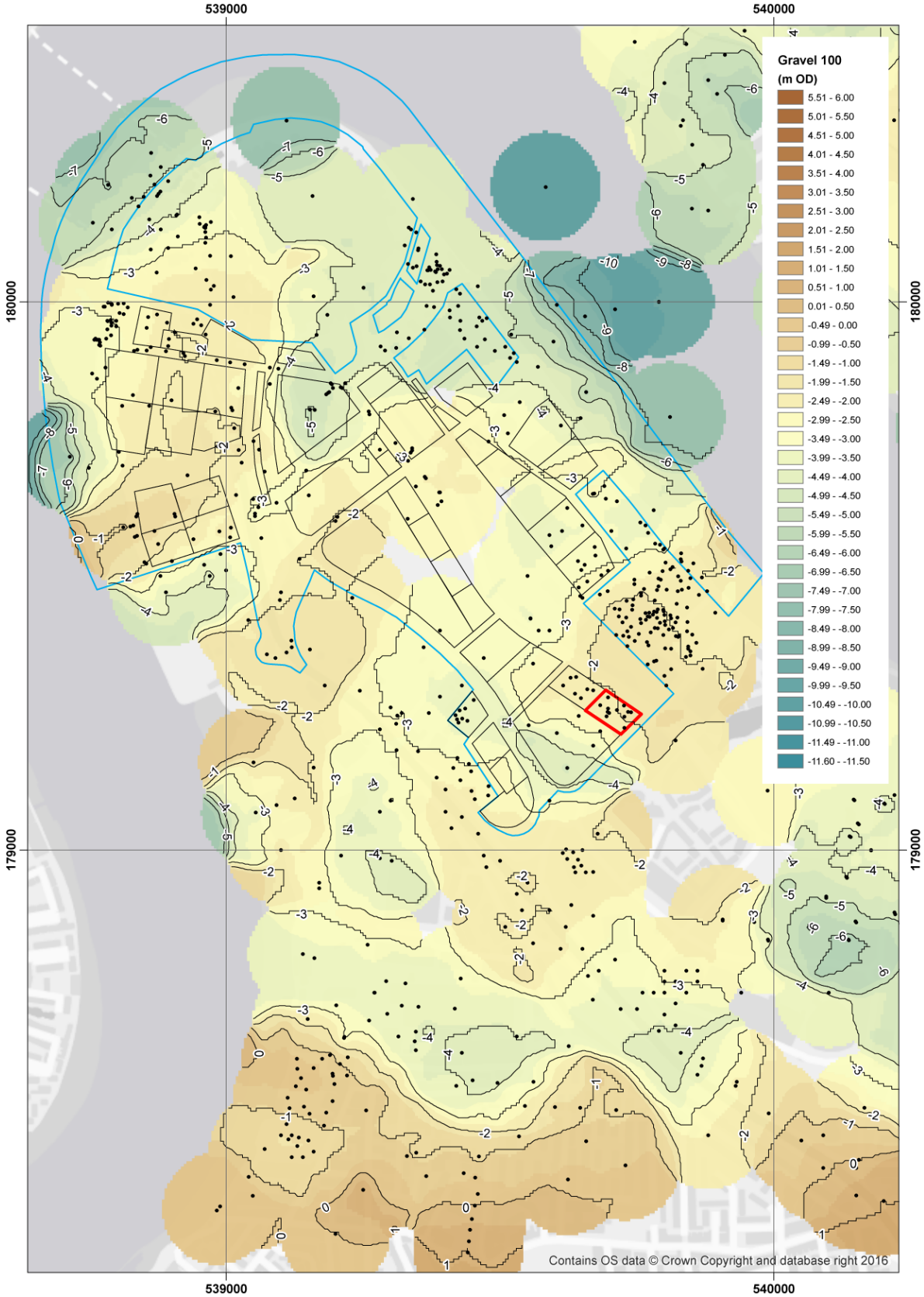

Figure 11: Top of the Gravel across the wider area of Greenwich Peninsula (m OD)

Table 1: Lithostratigraphic description of borehole 18.03.QBH1, Plot 18.03, Greenwich Peninsula, Royal Borough of Greenwich.

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
4.19 to 0.59	0.00 to 3.60	Made Ground	MADE GROUND
0.59 to 0.19	3.60 to 4.00	Redeposited alluvium	
0.19 to -0.81	4.00 to 5.00	10YR 4/1; Ag2 As2 Dl+ Sh+; dark grey silt and clay with a trace of detrital wood and organic matter. Diffuse contact in to:	UPPER ALLUVIUM
-0.81 to -1.81	5.00 to 6.00	10YR 4/1; Ag2 As2 Ga+ Dl+; dark grey silt and clay with a trace of sand and detrital wood.	LOWER ALLUVIUM
Borehole abandoned at 6m bgl/-1.81m OD due to hydrocarbon contamination			

Table 2: Lithostratigraphic description of borehole 18.03.QBH2, Plot 18.03, Greenwich Peninsula, Royal Borough of Greenwich.

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
4.56 to 1.36	0.00 to 3.20	Made Ground	MADE GROUND
1.36 to -0.14	3.20 to 4.70	As3 Ag1; silty clay with black mottling. Diffuse contact in to:	UPPER ALLUVIUM
-0.14 to -0.44	4.70 to 5.00	2.5YR 2.5/2; Sh2 Th^{3}1 Ag1 Tl+; humo. 3; dark reddish brown, well humified herbaceous, silty peat with a trace of wood. Diffuse contact in to:	PEAT
-0.44 to -0.64	5.00 to 5.20	2.5YR 2.5/2; Sh3 Tl^{1}1 Th+ Ag+; humo. 2; dark reddish brown, moderately humified woody peat with a trace of herbaceous material and silt. Diffuse contact in to:	
-0.64 to -0.94	5.20 to 5.50	10YR 4/2; As2 Ag1 Sh1 Dl+; dark greyish brown organic silty clay with a trace of detrital wood. Diffuse contact in to:	LOWER ALLUVIUM
-0.94 to -1.24	5.50 to 5.80	Gley1 4/10Y; Ga2 Gg2; dark greenish grey sand and gravel. Flint clasts, well-rounded to sub-angular, average 20mm in diameter. Diffuse contact in to:	SHEPPERTON GRAVEL
-1.24 to -1.44	5.80 to 6.00	Gley1 4/10Y; Gg3 Ga1; dark greenish grey sandy gravel. Flint clasts, well-rounded to sub-angular, average 20mm in diameter.	

Table 3: Results of the radiocarbon dating, borehole 18.03.QBH2, Plot 18.03, Greenwich Peninsula, Royal Borough of Greenwich.

Laboratory code / Method	Material and location	Depth (m OD)	Uncalibrated radiocarbon years before present (yr BP)	Calibrated age BC/AD (BP) (2-sigma, 95.4% probability)	δ13C (‰)
Beta- 471001 AMS	QBH2 – base of peat; twig wood	-0.54 to -0.64	3570 ± 30 BP	3970 to 3730 cal BP (2020-1780 cal BC)	-28.8

5. CONCLUSIONS & RECOMMENDATIONS

A programme of radiocarbon dating was undertaken following on from the results of geoarchaeological fieldwork and deposit modelling at the Plot 18.03 site. As a whole, these investigations were carried out in order to: (1) map the height and thickness of the deposits; (2) assess their geoarchaeological, archaeological and palaeoenvironmental significance and potential, and (3) ascertain the age of the peat horizon recorded at the site. In order to address these aims, two 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 base of the peat in one of these boreholes (18.03.QBH2) was radiocarbon dated.

The results of the deposit modelling indicate that the sediments present beneath Plot 18.03 are similar in character to those recorded elsewhere on Greenwich Peninsula, and in the Lower Thames Valley more generally. The Late Devensian Shepperton Gravel is overlain by a sequence of Holocene alluvial sediments, buried beneath modern Made Ground. The site lies on the northeastern edge of a possible Late Devensian/Early Holocene palaeochannel, orientated broadly northwest-southeast and perhaps either tributary or subsidiary to other channels identified in this area of the Peninsula (see Figure 11). The resultant topography across the site is highly variable; towards the west and the main axis of this channel, the Gravel surface lies below -3m OD, whilst towards the northeast it lies at just above -1m OD. Archaeological remains have been found within the floodplain deposits nearby to the site. These include the Bronze Age trackways at Bellot Street (Branch *et al.*, 2005; McLean, 1993; Philp, 1993). These remains have been recorded in association with an underlying (Kempton Park) Gravel surface of -2m OD or higher. There is therefore potential for archaeological remains beneath the northeastern and eastern areas of Plot 18.03, although such horizons may be deeply buried.

Where the Gravel is lower, up to 3.1m of Holocene alluvial deposits are recorded, with between 1.7 and 2.55m recorded towards the east. Limited to a relatively small area towards the east of the site, up to 0.5m of peat was recorded in two boreholes. The results of radiocarbon dating of the base of the peat in borehole 18.03. QBH2 (-0.54 to -0.64m OD) indicated that peat accumulation began here during the early Bronze Age (3970 to 3730 cal BP/2020-1780 cal BC). The peat at the Plot 18.03 site thus falls within the general age range of the peat recorded elsewhere on Greenwich Peninsula (late Mesolithic to late Bronze Age). At the present site the organic sediments are thin, and only locally present, perhaps as a result of subsequent erosion by fluvial activity. Alternatively, it is possible that peat only formed with a small floodplain hollow limited to the area of the two boreholes in which it is identified. On this basis, and given that the peat at the site is of similar age to environmental archaeological investigations that have already been undertaken elsewhere on Greenwich Peninsula (e.g. Victoria Deep Water Terminal (Corcoran, 2002), the Cable Car South Station (Green *et al.*, 2011), Greenwich Peninsula Central East (Young & Batchelor, 2015a), Enderby Wharf (Batchelor *et al.*, 2015) and Alcatel-Lucent Telegraph Works (Young & Batchelor, 2015b)), no further assessment work is recommended.

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7. APPENDIX 1: OASIS

OASIS ID: quaterna1-284000

Project details

Project name	Plot 18.03, Greenwich Peninsula
Short description of the project	A programme of radiocarbon dating was undertaken, following on from the results of geoarchaeological fieldwork and deposit modelling at the Plot 18.03 site. The results of the deposit modelling indicate that the sediments present beneath Plot 18.03 are similar in character to those recorded elsewhere on Greenwich Peninsula; the Late Devensian Shepperton Gravel is overlain by a sequence of Holocene alluvial sediments, buried beneath modern Made Ground. The site lies on the northeastern edge of a possible Late Devensian/Early Holocene palaeochannel; the resultant topography across the site is highly variable, and towards the northeast, where the Gravel surface lies above -1m OD, there is potential for the survival of

	archaeological remains. Where the Gravel surface is lower, up to 3.1m of Holocene alluvial deposits are recorded, and here up to 0.5m of peat was recorded in two boreholes. These organic sediments are thin, and only locally present; in addition, radiocarbon dating of the base of the peat in indicates that accumulation began here during the early Bronze Age, within the general age range of the peat recorded elsewhere on Greenwich Peninsula (late Mesolithic to late Bronze Age), and of similar age to environmental archaeological investigations that have already been undertaken elsewhere on Greenwich Peninsula. On this basis, no further environmental archaeological assessment is recommended on the samples from Plot 18.03.
Project dates	Start: 01-01-2017 End: 29-08-2017
Previous/future work	No / No
Type of project	Environmental assessment
Significant Finds	PEAT Early Bronze Age
Survey techniques	Landscape

Project location

Country	England
Site location	GREATER LONDON GREENWICH GREENWICH Plot 18.03
Postcode	SE10 0FQ
Site coordinates	TQ 397 792 51.493956181007 0.012620058541 51 29 38 N 000 00 45 E Point

Project creators

Name of Organisation	Quaternary Scientific (QUEST)
Project brief originator	RPS
Project design originator	D.S. Young
Project director/manager	C.R. Batchelor
Project supervisor	D.S. Young
Type of	Developer

sponsor/funding body	

Project archives

Physical Archive Exists?	No
Digital Archive Exists?	No
Paper Archive recipient	LAARC
Paper Contents	''Environmental'',''Stratigraphic''
Paper Media available	''Report''

Entered by	Daniel Young (d.s.young@reading.ac.uk)
Entered on	29 August 2017