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BRUNEL STREET WORKS, CANNING TOWN, LONDON BOROUGH OF NEWHAM

Geoarchaeological Deposit Model Report with Radiocarbon dating addendum

NGR: TQ 39600 81100

Site Code: BUL18

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1. NON-TECHNICAL SUMMARY

A program of geoarchaeological fieldwork and deposit modelling was instigated at the Brunel Street Works 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 put down across 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 geoarchaeological fieldwork and deposit modelling have contributed to our understanding of the Holocene stratigraphic sequence in this area of the Lower Lea Valley. Overlying the London Clay bedrock at the site is a sequence of Late Devensian Lea Valley Gravel, Holocene alluvial deposits and variable thicknesses of Made Ground, The site was previously mapped by Corcoran et al. (2011) as being on the edge of marginal Landscape Zone LZ1.3, characterised by the presence of Peat and a Lea Valley Gravel surface around -3m OD. By contrast, the deposits from Brunel Street Works are largely devoid of Peat, suggesting they have more in common with the central floodplain deposits of Landscape Zone 1.1b. Peat deposits with palaeoenvironmental potential are however recorded in two single boreholes from the southern part of the site. In QBH3, these are up to two metres in thickness, whilst in QBH4, they are only 15cm thick, but at a lower elevation to those recorded in QBH3. At nearby sites such as Caxton Works and St Luke's Square, such deposits have been radiocarbon dated from the middle Neolithic to Middle Bronze Age.

On the basis of elevation and thickness however, it is possible that both different periods / durations of peat formation may be represented in boreholes BS-QBH3 and QBH4 from Brunel Street Works. Radiocarbon dating of the peat in boreholes BS-QBH3 and BS-QBH4 is therefore recommended. If the results indicate a different and/or longer duration of peat formation to that represented in the sequences from 105-107 Tarling Road, Caxton Works and St Luke's Square, further palaeoenvironmental assessment / analysis should be pursued.

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 Brunel Street Works, Canning Town, London Borough of Newham (site code: BUL18; NGR: TQ 39600 81100; Figures 1 & 2). The work was commissioned by CgMs Consulting.

The area of investigation at Brunel Street Works 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. At its closest point, the western boundary of the site is within *ca.* 100m of 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 *ca.* 300m to the southeast of the most southerly point on the site. 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.

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 (LZ) characterised by their Holocene landscape history, based largely on sedimentary evidence derived from borehole records. The present site lies on the edge of LZ1.3, close to LZ1.1. LZ1.3 is described as an island of high ground, formed by sands rising to ca. 0.5m OD (Corcoran et al., 2011). However, the existing geotechnical records indicate that the site more closely resembles LZ1.1, 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.'*

It should be recognised however 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.

Recent geotechnical investigations at the present site, incorporating a total of 41 borehole records (Card Geotechnics Ltd, 2016) show the surface of the Lea Valley Gravel generally lying at between *ca*. -2 and -4m OD, although towards the centre of the site it rises to just below 0m OD (B2, WS12, WS13). In borehole WS31, towards the west and centre of the site, the Gravel surface is recorded at 0.31m OD. The Gravel is overlain by alluvium in the majority of records; where recorded it is between 0.2 (WS31) and 5.2m (C3) thick, and in places is described as 'organic', with either frequent organic matter or 'peaty clay' recorded in selected records (e.g. C4, WS24-WS26, WS30 and WS32). The geotechnical records indicate that organic matter may be more frequent within the alluvium towards the south-eastern end of the site. The sequence across the site is capped by between *ca*. 0.5 and 2.5m of Made Ground; in a small number of boreholes the Made Ground has truncated the entire Holocene alluvial sequence (WS11 and WS19).

2.2 Geoarchaeological, palaeoenvironmental and archaeological significance

The existing geotechnical records from the site thus indicate important variation in the height of the Gravel surface, and the type, thickness and character of the subsequent alluvial 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 Gravel may represent the location of pre-Holocene river terraces, former channels and bars; (2) the presence of peaty or highly organic alluvium may represent former terrestrial or semi-terrestrial land-surfaces, and (3) the various alluvial units represent periods of changing hydrological conditions. Thus by studying the sub-surface stratigraphy across the site in greater detail, it will be possible to build an 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 are carried out through the assessment/analysis of palaeoecological remains (e.g. pollen, plant macrofossils & insects) and radiocarbon dating.

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). As described above, the Gravel surface is particularly high towards the centre of the site, where it lies above -0.5m OD; such high Gravel topography is of increased archaeological potential, as evidenced at the nearby Fords Park Road (GLHER/ELO10265; see below). 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, '...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 close to the present site: at Caxton Works (Young & Batchelor, 2014a), St Luke's Square (Weale, 2008; Wicks, 2008) and 105-107 Tarling Road (Batchelor & Young, 2014b) immediately to the east, middle Neolithic to Middle Bronze Age peat horizons were identified, with evidence for the well-documented Neolithic lime decline at St Luke's Square and evidence of human activity (in the form of woodland clearance) at Tarling Road. In addition, at Dock Road (GLHER/ELO7446) *ca*. 200m to the south of the present site, a radiocarbon date from organic material in alluvial silts indicated deposition in the Late Neolithic or Early Bronze Age; at Victoria Dock Road (Barnett *et al*., 2010) immediately to the southeast, peat horizons radiocarbon dated to the Late Neolithic through to Late Bronze Age were recorded; and at Fords Park Road (GLHER/ELO10265) *ca*. 300m to the northeast evidence of Mesolithic and Bronze age occupation was identified on an upstanding 'island' of sandy sediment.

2.3 Aims and objectives

Further borehole records are required to enhance our understanding of the sub-surface stratigraphy of the Brunel Street Works site, and for any further assessment/analysis of the deposits (if necessary). Five significant research aims relevant to the geoarchaeological investigations at the site are outlined (Young, 2017):

1. To clarify the nature of the sub-surface stratigraphy across the site;
2. To clarify the nature, depth and extent of any alluvium and 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 in an academic journal.

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

1. To put down a minimum of four geoarchaeological boreholes across the site (QBH1-QBH4; see Figure 2);
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 and palaeoenvironmental assessment/analysis deemed necessary.

Aims 3 to 5 will be addressed through laboratory-based assessment/analysis, the potential for which will be confirmed after achieving Aims 1 and 2.

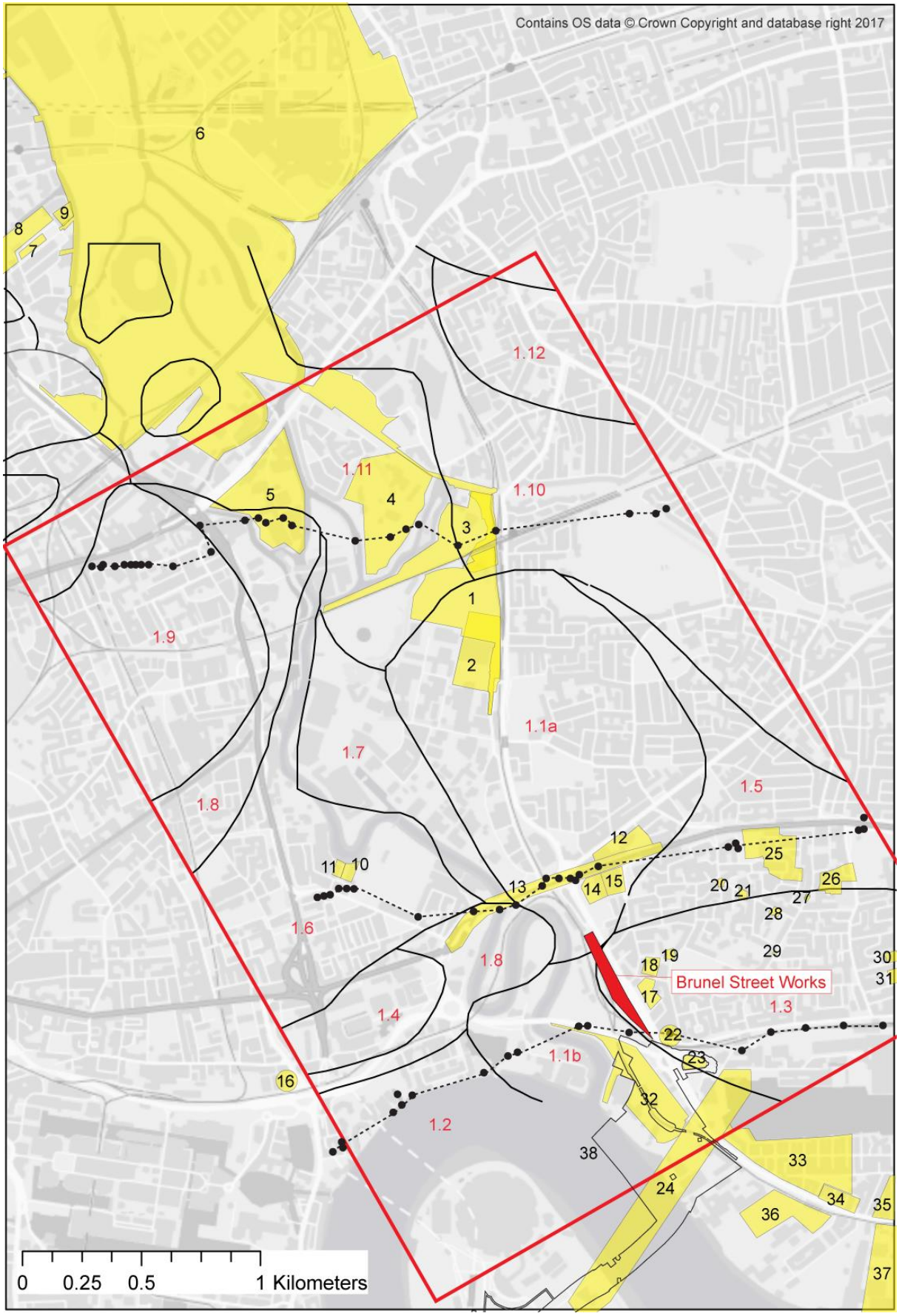
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Figure 1: Location of Brunel Street, Canning Town, London Borough of Newham and selected nearby sites: (1) Stephenson Street (Batchelor, 2017): (2) West Ham Bus Station (Batchelor A13et al., 2010) / Parcel Force Depot (Bull & Corcoran, 2007); (3) The Riverine Centre (Andrews, 2012); (4) Lee Tunnel (Yendell, 2011); (5) Strand East (Green & Batchelor, 2014); (6) the area encompassed by the Olympic Park (Powell, 2012); (7) 79-85 Monier Road (Batchelor et al., 2016a); (8) Neptune Wharf (Batchelor 2016b), (9) Omega Works (Spurr, 2005, 2006), (10) Leven Wharf (Young, 2015); (11) Devons Wharf (AIG, 2007); (12) Rathbone Market (Young et al., 2013a); (13) A13 Ironbridge-Canning Town (Stafford, 2012); (14) Canning Town Phase 2 (Young, 2014); (15) Canning Town Phase 1 (Green & Young, 2012); (16) Preston Road (Branch et al., 2007); (17) Caxton Works (Young & Batchelor, 2014a), (18) St Luke's Square (Weale, 2008; Wicks, 2008) and (19) 105-107 Tarling Road (Batchelor & Young, 2014); (20) The Pitts Head (Batchelor et al., 2013); (21) Fords Park Road (Eastbury et al., 2009); (22) 118 Victoria Dock Road (Barnett et al., 2010); (23) Tidal Basin Road (Young & Batchelor, 2013b); (24) The Cable Car (Batchelor et al., 2015); (25) Fife Road (Killock, 2012); (26) Butcher Street (Nicholls *et al.,* 2013); (27) Butchers Road Garages (Nicholls *et al.,* 2013); (28) Crediton Road (Nicholls *et al.,* 2013); (29) Butchers Road (Nicholls *et al.,* 2013); (30) Vandome Close (Nicholls *et al.,* 2013); (31) 81 Leslie Road; (32) Thames Wharf (MoLAS); (33) West Silvertown (Wilkinson et al., 2000); (34) Barnwood Court (Farid, 1997); (35) Fort Street (Crockett et al., 2003); (36) Peruvian Wharf (Batchelor et al., 2016c); (37) Royal Wharf (Batchelor et al., 2014); (38) Silvertown Tunnel (Young & Green, 2015). Also displayed are the interpreted Landscape Zones (LZ) of Map 2, investigated as part of the Lower Lea Valley Mapping Project (Corcoran *et al.*, 2011).

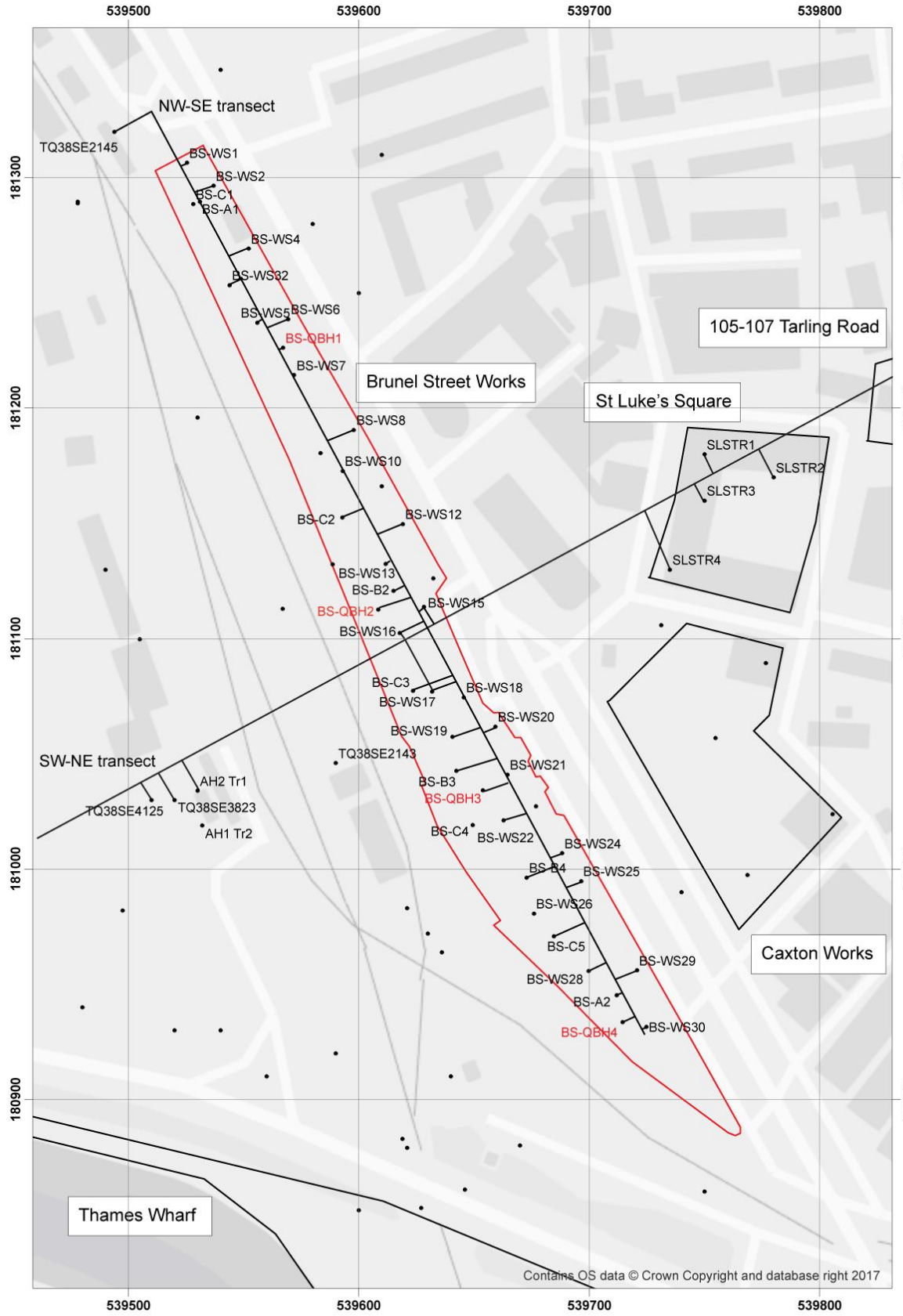

Figure 2: Location of boreholes across the Brunel Street Works site

3. METHODS

3.1 Field investigations

A total of four geoarchaeological boreholes (boreholes BS-QBH1 to BS-QBH4) were put down at the site in December 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 (see Table 1).

Table 1: Spatial co-ordinates for the geoarchaeological boreholes

Geoarchaeological borehole	Easting	Northing	Elevation
BS-QBH1	539567.15	181226.30	2.61
BS-QBH2	539608.51	181112.60	2.61
BS-QBH3	539653.81	181034.24	1.69
BS-QBH4	539714.52	180933.56	1.38

3.2 Lithostratigraphic description

Laboratory-based lithostratigraphic descriptions of the 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 Brunel Street was based on a review of 40 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. Models of surface height were generated for the Gravel, Lower Alluvium, Peat and Upper Alluvium using an Inverse Distance Weighted algorithm (Figures 3-5 & 8-9). Thickness of the Peat, total Holocene alluvium (incorporating the Lower Alluvium, Peat and Upper Alluvium) and Made Ground (Figures 6, 7, 10 & 11) were also modelled (also using an Inverse Distance Weighted algorithm). Borehole transects orientated NW-SE and SW-NE across the stury area are displayed in Figures 12 & 13.

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 13. Figures 3 to 11 are surface elevation and thickness models for each of the main stratigraphic units across the site and surrounding area; Figures 12 & 13 are two-dimensional transects across the site and surrounding area. 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 – widely present
Lower Alluvium – occasionally present
Lea Valley Gravel – widely present

4.1 Lea Valley Gravel

The Lower Lea Gravel was present in all boreholes that penetrated to the bottom of the Holocene sequence (Figures 3, 4, 12, 13); this included the four new geoarchaeological boreholes (BS-QBH1 to QBH4), and the majority of the geotechnical investigations carried out across the site and surrounding area. 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.

Across the site, the modelling exercise indicates that the surface of the Lea Valley Gravel generally rests between -2.0 and -3.0m OD. This is equivalent to the surface elevations recorded on nearby sites such as 105-107 Tarling Road (Batchelor & Young, 2014), St Luke's Square (Wicks, 2008), Caxton Works (Young & Batchelor, 2014a) and Thames Wharf (MoLAS). Towards the southern tip of the Brunel Street Works site however (and beyond its borders to the south and west), the Gravel

surface descends to -4m OD. This is considered likely to represent a former channel of the Lea, joining the River Thames further east than its current location. The Brunel Street Works contains a relatively high gravel surface towards the centre of the site (-1m OD), similar to that recorded towards just south of Canning Town Phases 1 & 2 (Figure 4).

4.2 Lower Alluvium

The Lower Alluvium was sporadically recorded (Figure 4), resting directly on the Lea Valley 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 and its tributaries was probably confined to a single meandering channel. During this period, the surface of the Lea Valley 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 Lea Valley Gravel.

The Lower Alluvium was only definitively recorded in two of the 40 records from the site (BS-QBH3 and BS-QBH4). These are both located on the southern part of the site as it drops into the aforementioned trough on the Lea Valley Gravel. In both cases the Lower Alluvium is extremely thin, measuring less than 20cm. Elsewhere, the Lower Alluvium is recorded at St Luke's Square, Caxton Street Works, and 105-107 Tarling Road, but is relatively thin and sporadically present.

4.3 Peat

Peat is recorded in only two records from Brunel Street Works; BS-QBH3 and BS-QBH4; the same as those in which the Lower Alluvium was noted. The Peat was generally silty and well humified. 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. Within BS-QBH3, the peat measures approximately 2m in thickness, whilst in BS-QBH4 it is only 15cm thick. The peat is however recorded at different elevations in each borehole (-3.16 to -1.07 in BS-QBH3, and -4.32 to -4.17m OD in BS-QBH4), suggesting that at least two periods of deposition are represented on the site.

Peat is recorded more consistently on the nearby sites of 105-107 Tarling Road (-1.5 to -2.0m OD Batchelor & Young, 2014), St Luke's Square (-0.61 to -2.03m OD; Wicks, 2008) and Caxton Works (-0.2 and -1.9m OD; Young & Batchelor, 2014a). Radiocarbon dating of these horizons indicates that the peat accumulated between 5730-5600 and 3630-3460 cal BP at 105-107 Tarling Road; between 5660-5580 and 3570-3440 cal BP at St Luke's Square and between 4960-4840 and 4390-4100 cal BP at Caxton Works. The peat at these sites was therefore between 0.5 and 1.7m in thickness, generally accumulating between -2 and 0m OD, and spanning the middle Neolithic to middle Bronze Age periods. However, on the basis of the lower elevation and variable thickness of

the peat at Brunel Street, it is possible that it accumulated over a different / duration to that represented at these nearby sites.

4.4 Upper Alluvium

Across much of the site, the Upper Alluvium appears to rest directly on the Lea Valley Gravel (or Peat where present). 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. The surface of the Upper Alluvium is relatively even, generally lying around 1m OD (Figures 9, 12 & 13).

The Total Alluvium thickness (incorporating Lower Alluvium, Peat and Upper Alluvium) is displayed in Figure 10. 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

Up to 2m of Made Ground caps the Holocene alluvial sequence across the majority of the site (Figure 11). Closer to the current course of the River Lea, historical geotechnical records indicate up to 12m of ground raising.

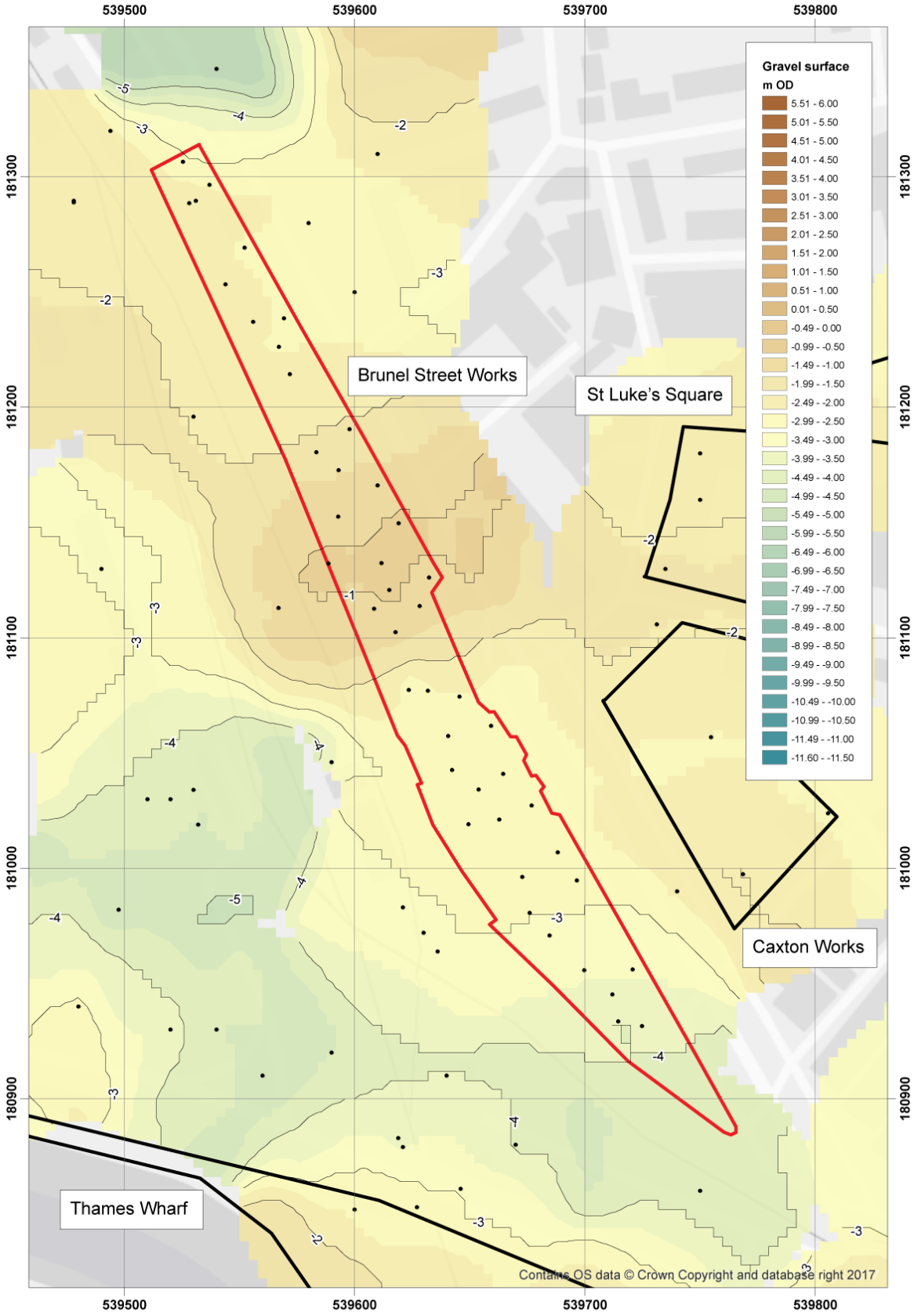

Figure 3: Gravel surface (m OD)

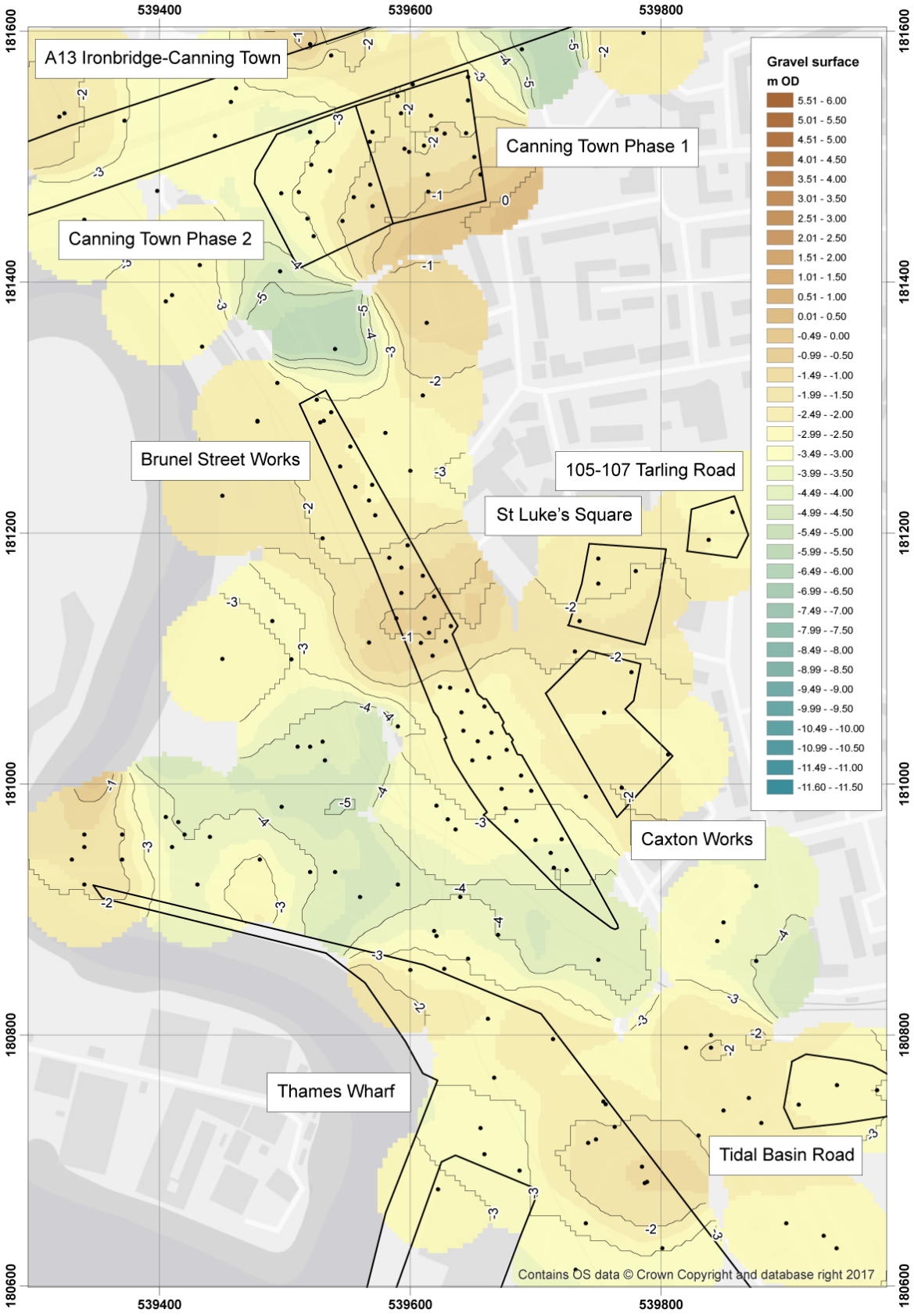

Figure 4: Wider Gravel surface (m OD)

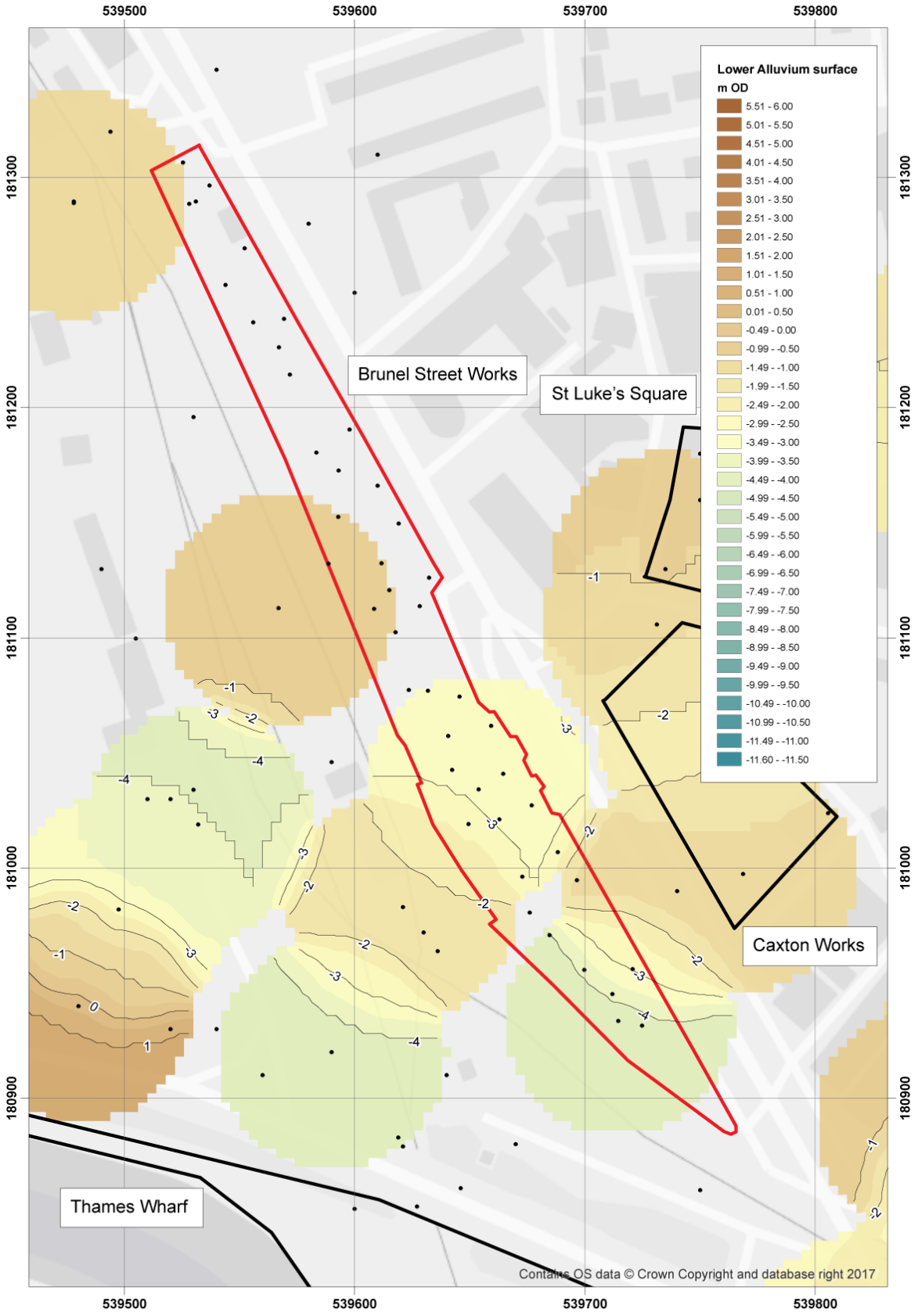

Figure 5: Lower Alluvium surface (m OD)

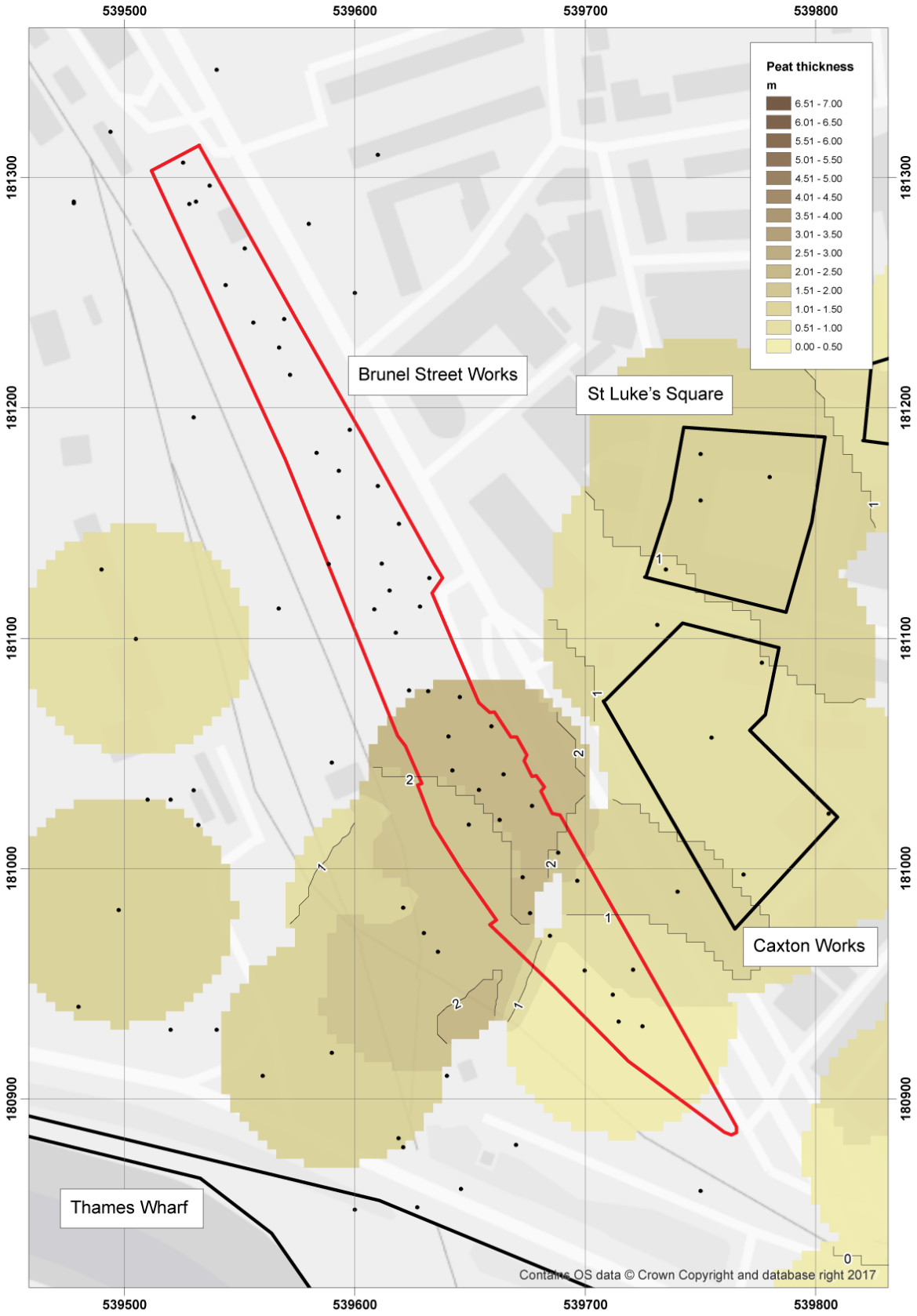

Figure 6: Peat thickness (m)

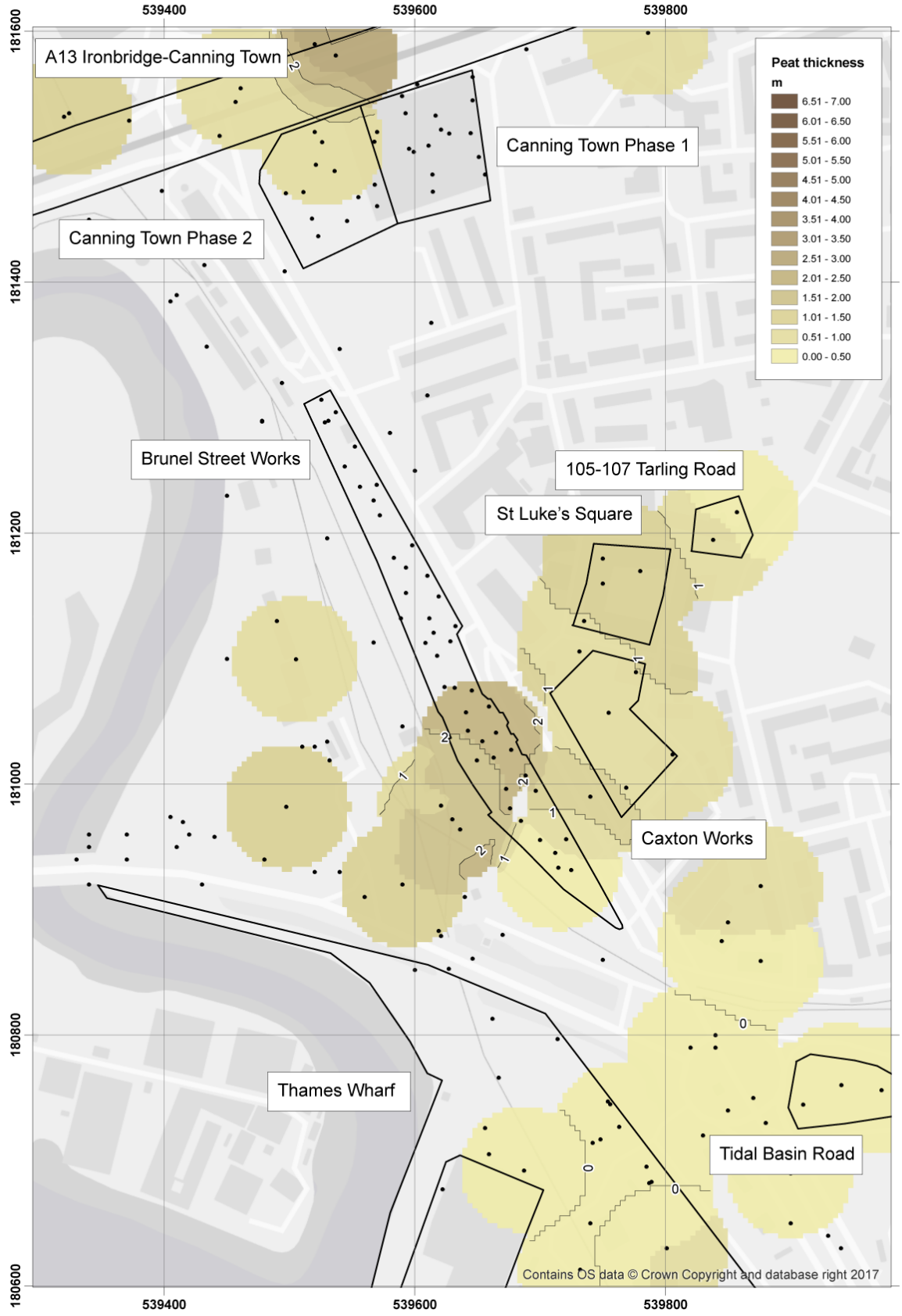

Figure 7: Wider Peat thickness (m OD)

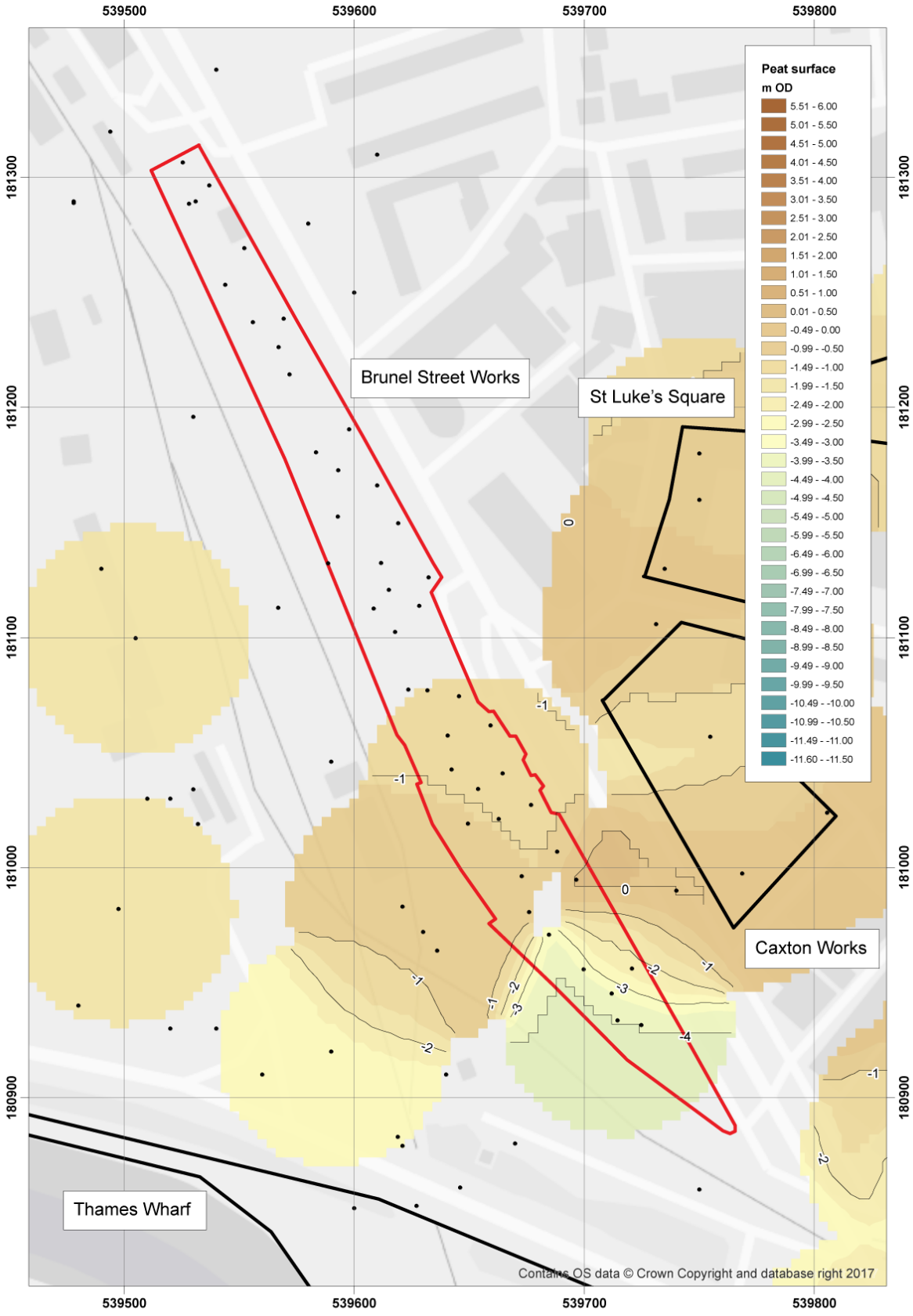

Figure 8: Peat surface (m OD)

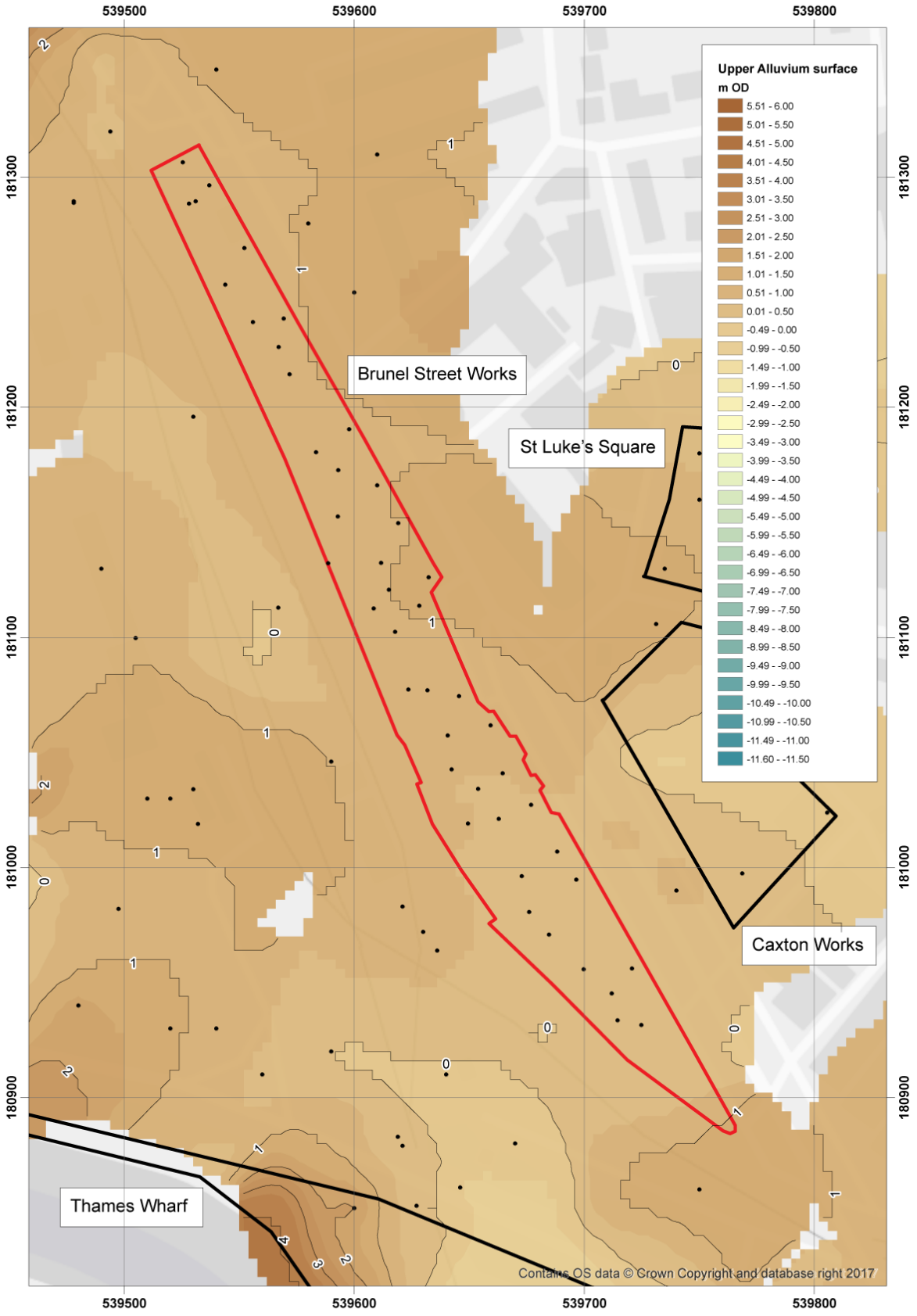

Figure 9: Upper Alluvium surface (m OD)

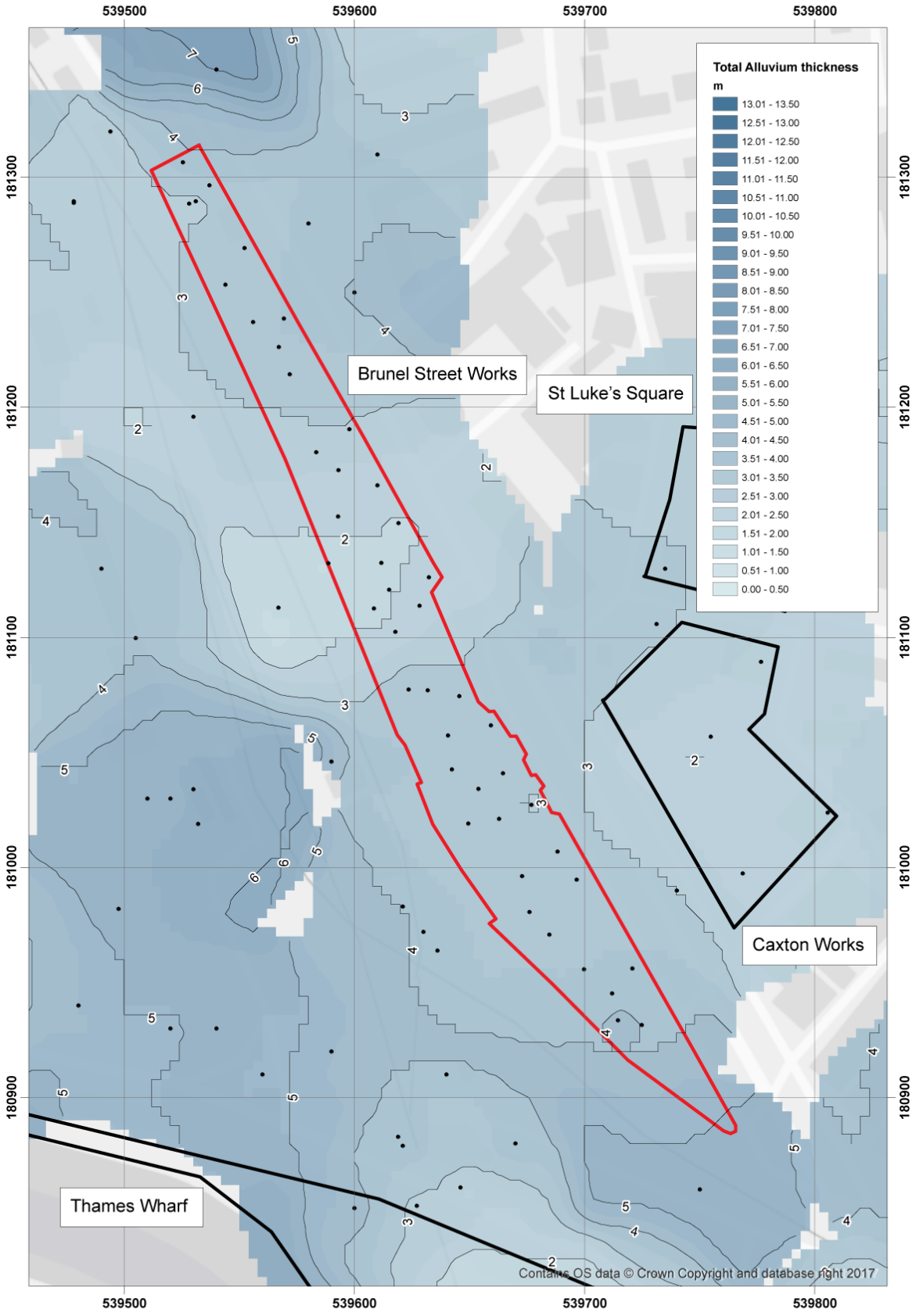

Figure 10: Total Alluvium thickness (Lower Alluvium, Peat and Upper Alluvium) (m)

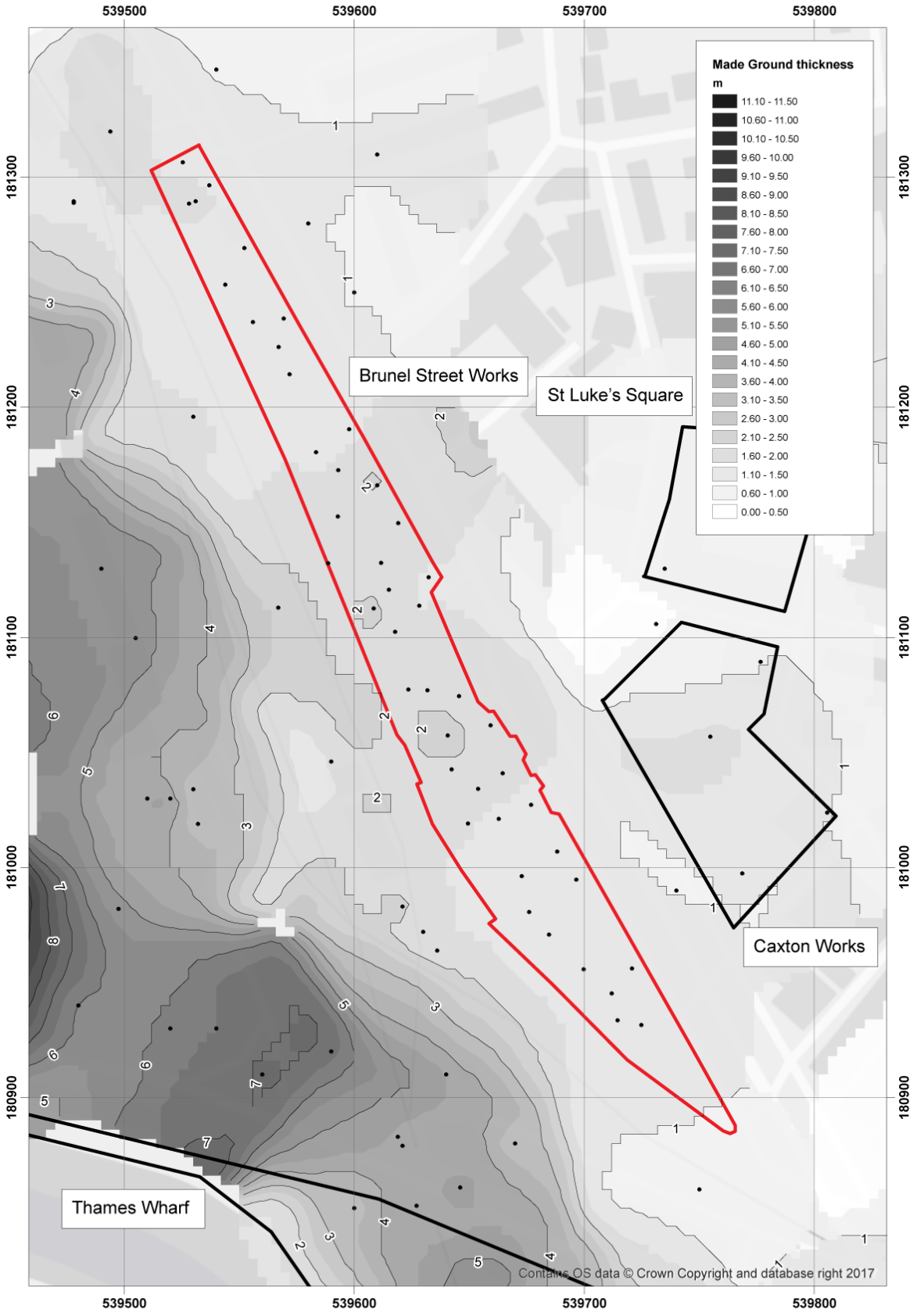

Figure 11: Made Ground thickness (m)

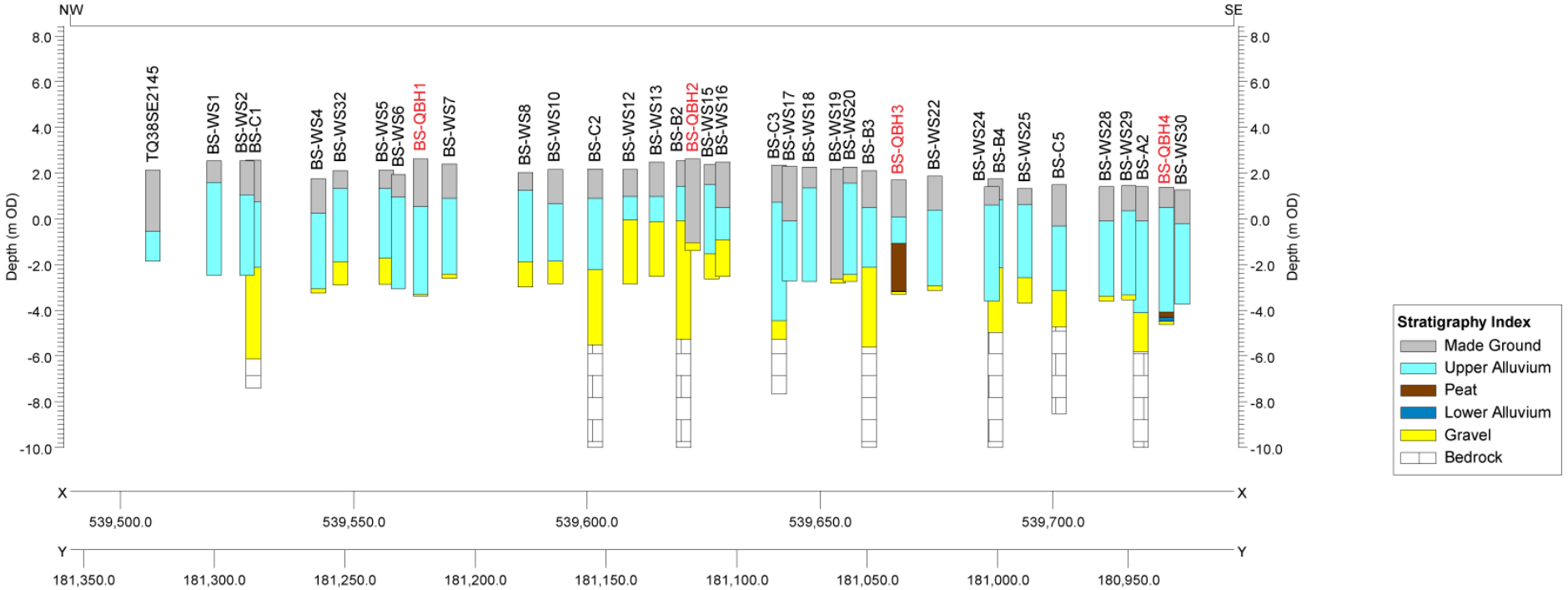

Figure 12: Northwest – southeast transect of boreholes across the Brunel Street Works site

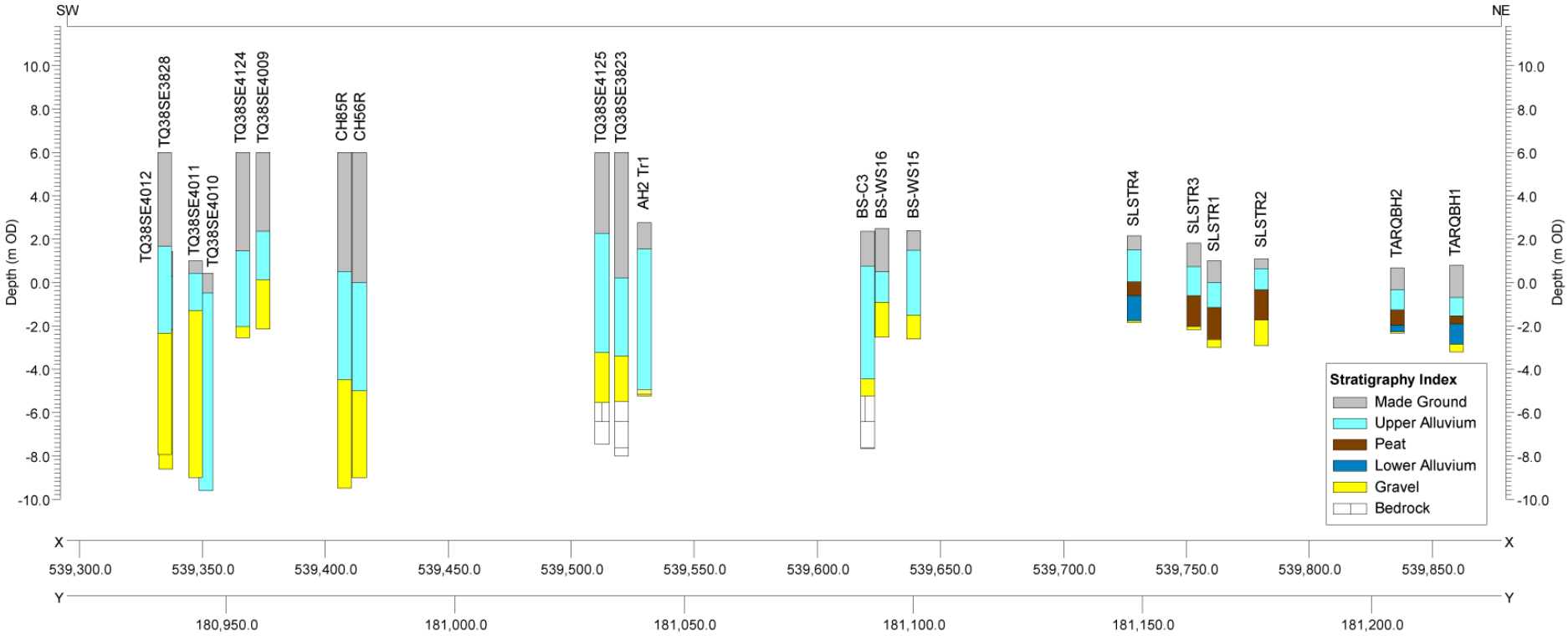

Figure 13: Southwest – northeast transect of boreholes across Brunel Street Works and adjacent sites

Table 2: Lithostratigraphic description of borehole BS-QBH1, Brunel Street Works

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
2.61 to 0.56	0 to 2.05	Made Ground	MADE GROUND
0.56 to -0.89	2.05 to 3.50	Gley 2 6/1; As3, Ag1; Bluish grey silty clay with some faint mottling; diffuse contact into:	UPPER ALLUVIUM
-0.89 to -1.39	3.50 to 4.00	Gley 2 6/1; As2, Ag1, Ga1; Bluish grey silty sandy clay; faintly laminated; diffuse contact into:	
-1.39 to -3.29	4.00 to 5.90	Gley 2 6/1; Ag3, As1, Ga+; Bluish grey silty clay with some horizontal beds of sand, especially at 5.50-5.60m bgl; sharp contact into:	
-3.29 to -3.39	5.90 to 6.00	10YR 5/1; Gg3, Ga1; Grey sandy flint gravel; sub-angular to rounded clasts up to 20mm in size.	LEA VALLEY GRAVEL

Table 3: Lithostratigraphic description of borehole BS-QBH2, Brunel Street Works

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
2.61 to 0.91	0 to 1.70	Made Ground	MADE GROUND
0.91 to -1.39	3.65 to 4.00	10YR 5/1; Gg2, Ga2; Grey sandy flint gravel; sub-angular to rounded clasts up to 20mm in size.	LEA VALLEY GRAVEL

Table 3: Lithostratigraphic description of borehole BS-QBH3, Brunel Street Works

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
1.69 to 0.09	0 to 1.60	Made Ground	MADE GROUND
0.09 to -0.31	1.60 to 2.00	Gley 2 6/1; As2, Ag2; Bluish grey silty clay; diffuse contact into:	UPPER ALLUVIUM
-0.31 to -1.07	2.00 to 2.76	7.5YR 4/1; As3, Ag1, Dl+, Dh+; Dark grey silty clay with traces of detrital plant remains; very sharp contact into:	
-1.07 to -1.96	2.76 to 3.65	7.5YR 2.5/1; Sh2, Ag2, Th+, Tl+; Humo 4; Black very well-humified silty unidentifiable peat with traces of wood and herbaceous peat; sharp contact into:	PEAT
-1.96 to -2.20	3.65 to 3.89	7.5YR 3/1; Ag3, As1 Dl+; Very dark grey clayey silt with traces of detrital wood; diffuse contact into:	
-2.20 to -3.16	3.89 to 4.85	7.5YR 2.5/1; Sh2, Ag1, Th21, Humo 2; Black moderately humified wood and unidentifiable peat with silt; diffuse contact into:	
-3.16 to -3.21	4.85 to 4.90	Gley 1 2.5/N; Ag4, As+, Sh+, Gg+; Black silt with traces of clay, gravel and organic remains; very sharp contact into:	LOWER ALLUVIUM
-3.21 to -3.31	4.90 to 5.00	10YR 5/1; Gg3, Ga1; Grey sandy flint gravel; sub-angular to rounded clasts up to 30mm in size.	LEA VALLEY GRAVEL

Table 4: Lithostratigraphic description of borehole BS-QBH4, Brunel Street Works

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
1.38 to 0.48	0 to 0.90	Made Ground	MADE GROUND
0.48 to -0.62	0.90 to 2.00	Gley 2 6/1; As3, Ag1; Bluish grey silty clay with some faint mottling; diffuse contact into:	UPPER ALLUVIUM
-0.62 to -2.62	2.00 to 4.00	Gley 2 6/1; As3, Ag1; Bluish grey silty clay with occasional peat lenses; diffuse contact into:	
-2.62 to -3.06	4.00 to 4.44	2.5Y 6/2; Ag2, As1, Dl1, Sh+; Light greyish brown clayey silt with detrital wood and traces of organic remains; diffuse contact into:	
-3.06 to -3.16	4.44 to 4.54	10YR 4/1; Ag2, Sh2, Dl+, Dh+; Very dark greyish brown organic silt with traces of detrital plant remains and wood; very diffuse contact into:	
-3.16 to -3.51	4.54 to 4.89	Gley 2 4/1; Ag3, As1; Dark bluish grey clayey silt with traces of Mollusca fragments; diffuse contact into:	
-3.51 to -4.07	4.89 to 5.45	2.5Y 4/3; Ag3, As1, Dl+; Dark olive brown clayey silt with traces of wood; diffuse contact into:	
-4.07 to -4.32	5.45 to 5.70	10YR 3/3; Sh3, Ag1; Humo 3; Dark brown well humified silty unidentifiable peat; diffuse contact into:	PEAT
-4.32 to -4.49	5.70 to 5.87	10YR 3/1; Gg2, Sh2; Humo3; Dark brown well humified gravelly unidentifiable peat; sharp contact into:	
-4.49 to -4.62	5.87 to 6.00	10YR 5/1; Gg3, Ga1; Grey sandy flint gravel; sub-angular to rounded clasts up to 20mm in size.	LEA VALLEY GRAVEL

5. CONCLUSIONS & RECOMMENDATIONS

A program of geoarchaeological fieldwork and deposit modelling was instigated at the Brunel Street Works 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 put down across 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 geoarchaeological fieldwork and deposit modelling have contributed to our understanding of the Holocene stratigraphic sequence in this area of the Lower Lea Valley. Overlying the London Clay bedrock at the site is a sequence of Late Devensian Lea Valley Gravel, Holocene alluvial deposits and variable thicknesses of Made Ground, The site was previously mapped by Corcoran et al. (2011) as being on the edge of marginal Landscape Zone LZ1.3, characterised by the presence of Peat and a Lea Valley Gravel surface around -3m OD. By contrast, the deposits from Brunel Street Works are largely devoid of Peat, suggesting they have more in common with the central floodplain deposits of Landscape Zone 1.1. Peat deposits are however recorded in two single boreholes from the southern part of the site. In QBH3, these are up to two metres in thickness, whilst in QBH4, they are only 15cm thick, but at a lower elevation to those recorded in QBH3. At nearby sites such as Caxton Works and St Luke's Square, such deposits have been radiocarbon dated from the middle Neolithic to Middle Bronze Age. On the basis of elevation and thickness however, it is possible that both different and/or longer periods of peat formation may be represented in boreholes BS-QBH3 and QBH4 from Brunel Street Works.

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.

It is recommended in the first instance, that radiocarbon dating of the peat in boreholes BS-QBH3 and BS-QBH4 is undertaken. If the results indicate a different and/or longer duration of peat formation to that represented in the sequences from Caxton Works and St Luke's Square, further palaeoenvironmental assessment / analysis should be pursued.

6. ADDENDUM: RADIOCARBON DATING

6.1 Introduction & Methodology

Following the recommendations made in Section 5, range-finder radiocarbon determinations were carried out on material from the base of the peat horizons in BS-QBH3 and BS-QBH4. Plant macrofossils (seeds or wood) were preferentially extracted for dating, and this was achieved on material extracted from the base of BS-QBH3. In BS-QBH4, insufficient plant macrofossil remains were present, and thus the humic acid and humin fractions of bulk peat samples were selected for radiocarbon dating; this meant that the majority of the peat was used for radiocarbon dating. The samples were 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 Figures 14-15 and in Table 5.

6.2 Results, Interpretation & Discussion

The results of the radiocarbon dating indicates that the Peat in BS-QBH3 started accumulating around 5850-5600 cal BP, during the early Neolithic, whilst the Peat in BS-QBH4 began forming around 10,750-10,520 cal BP at the beginning of the Mesolithic. Thus, two different periods of Peat formation occurred on the Brunel Street site.

The early Neolithic date recorded in BS-QBH3 is very similar to the commencement of Peat formation at St Luke's Square (5640-5490 cal BP; Wicks, 2010) and Tarling Road (5710-5600 cal BP; Batchelor & Young, 2014). At Caxton Street, accumulation started slightly later around 4960-4840 cal BP (Young & Batchelor, 2014). At Brunel Street, the Peat in BS-QBH3 began forming at a lower elevation (-3.16m OD), in comparison to these other three sites (ca. -2m OD), but this is not considered overly significant, as such differences are recorded fairly frequently across the Lower Thames Valley and its tributaries.

The Mesolithic aged Peat however, indicates the accumulation of organic-sediment within abandoned channel during the early Holocene period, perhaps as the Lea moved from a braided to meandering pattern. It is a unique record from the four closely located sites of Brunel Street, St Luke's Square, Tarling Road and Caxton Street. Furthermore, such aged sequences are relatively rare across the Lower Thames and its tributaries in general. One of the few examples includes the sequence from the North-Tower on the London Cable Car route, approximately 800m to the south. Here, peat and organic-rich deposits were recorded from -5.5m OD and dated to 10,700-10,510 cal BP (Batchelor *et al*., 2015).

6.3 Conclusions & Recommendations

Due to the close proximity of previously investigated sequences dating from the early Neolithic at St Luke's Square, Tarling Road and Caxton Street, no further palaeoenvironmental work is recommended on the sequence from BS-QBH3. The sequence of Peat from BS-QBH4 however, provides a relatively rare opportunity to provide a palaeoenvironmental reconstruction for the early Mesolithic period. Furthermore, early Holocene channels such as this, might form a 'mappable'

network with those from other landscape zones and the West Silvertown area (Corcoran et al., 2011). As such, further work is both warranted and recommended. Due to the relatively thin nature of the unit in BS-QBH4 (<50cm), the amount that can be achieved on the remaining material is restricted. It should however be possible to provide some basic quantification of the environmental history of the local area during this period.

Table 5: Results of the borehole of the borehole BS-QBH3 & BS-QBH4 radiocarbon dating, Brunel Street Works

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-487081 AMS	BS-QBH3; base of Peat	-3.11 to -3.16	4970 ± 30	3900-3660 cal BC (5850-5600 cal BP)	-25.5
BETA-487080 AMS	BS-QBH4; humin fraction from Peat	-4.22 to -4.24	9440 ± 30	8800-8630 cal BC (10,750-10,580 cal BP)	-27.9
BETA-487079 AMS	BS-QBH4; humic acid fraction of Peat	-4.22 to -4.24	9390 ± 30	8760-8570 cal BC (10,710-10,520 cal BP)	-28.4

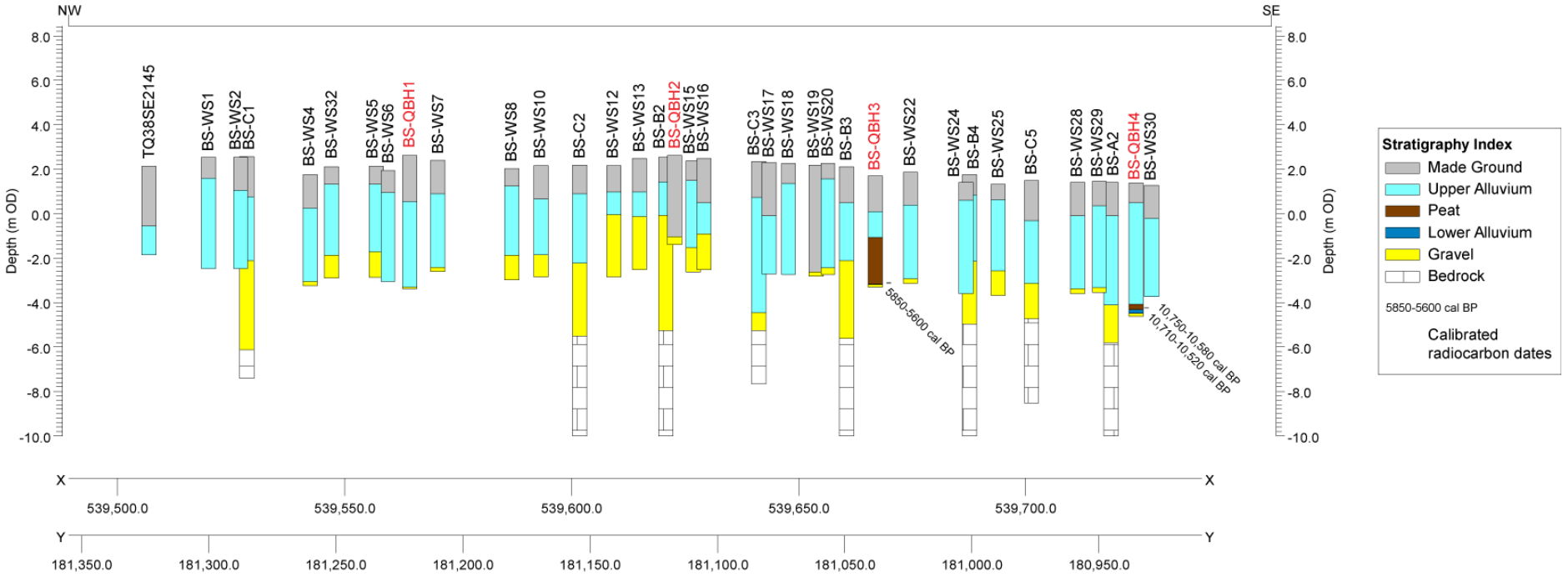

Figure 14: Northwest – southeast transect of boreholes across the Brunel Street Works site, incorporating the radiocarbon determinations from BS-QBH3 and BS-QBH4

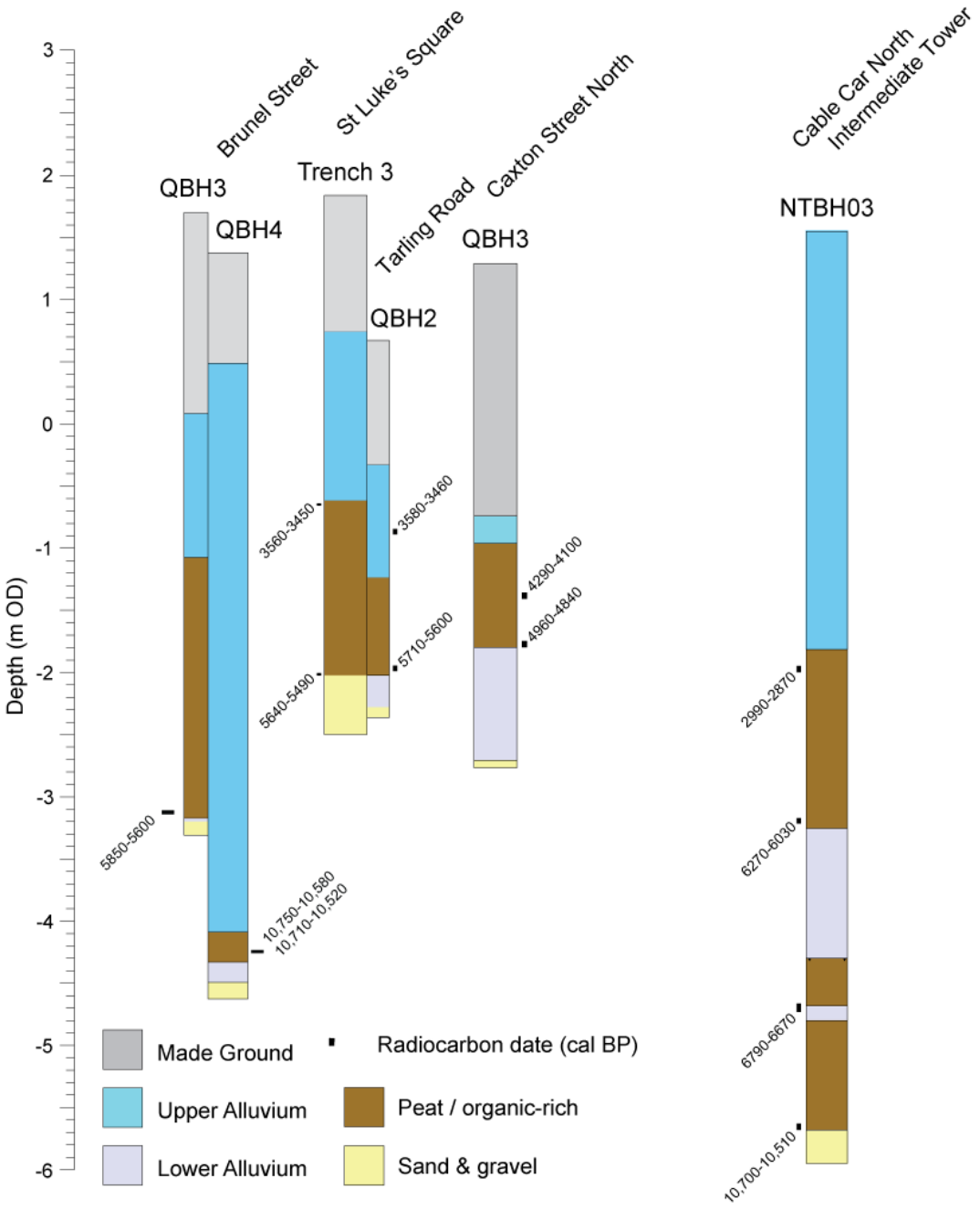

Figure 15: Transect of radiocarbon dated sequences across the nearby area

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8. APPENDIX 1: OASIS

Project details

Project name	Brunel Street Works
Short description of the project	A program of geoarchaeological fieldwork and deposit modelling was undertaken on the site. The results record Pleistocene Gravels overlain by inorganic alluvium across much of the site. The archaeological potential is considered relatively low. The palaeoenvironmental potential is similarly limited, with the exception of two boreholes from the south of the site. Here, peat deposits were recorded of differing thickness / elevation. Radiocarbon dating, potentially followed by assessment/analysis was recommended.
Project dates	Start: 27-11-2017 End: 09-01-2018
Previous/future work	No / Yes
Any associated project reference codes	BUL18 - Sitecode
Type of project	Environmental assessment
Monument type	PEAT Uncertain
Significant Finds	PEAT Uncertain
Survey techniques	Landscape

Project location

Country	England
Site location	GREATER LONDON NEWHAM CANNING TOWN Brunel Street Works
Study area	20000 Square metres
Site coordinates	TQ 39600 81100 51.511056122807 0.011932413815 51 30 39 N 000 00 42 E Point

Project creators

Name of Organisation	Quaternary Scientific (QUEST)
Project brief originator	Consultant
Project design originator	D.S. Young
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 recipient Archive	LAARC
Paper available Media	"Report"

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	BRUNEL STREET WORKS, CANNING TOWN, LONDON BOROUGH OF NEWHAM Geoarchaeological Deposit Model Report
Author(s)/Editor(s)	Batchelor, C.R.
Author(s)/Editor(s)	Young, D.S.
Other bibliographic details	Quaternary Scientific (QUEST) Unpublished Report December 2017; Project Number 112/17
Date	2018
Issuer or publisher	Quaternary Scientific (QUEST)
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Entered by	Christopher Batchelor (c.r.batchelor@reading.ac.uk)
Entered on	9 January 2018