A REPORT ON THE GEOARCHAEOLOGICAL DEPOSIT MODELLING ON LAND AT ROYAL WHARF, SILVERTOWN, LONDON BOROUGH OF NEWHAM

C.R. Batchelor, C.P. Green & D.S. Young
Quaternary Scientific (QUEST), School of Human and Environmental Sciences, University of Reading, Whiteknights, PO Box 227, Reading, RG6 6AB, UK

INTRODUCTION

This report summarises the findings arising out of the deposit modelling undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development at Royal Wharf, Silvertown, London Borough of Newham (National Grid Reference centred on: TQ 4085 7990; Figures 1 and 2). The Royal Wharf site is approximately 4 hectares in size, and lies on the floodplain of the Lower Thames where the Woolwich Reach of the river forms a broad southward bend. The ground across the area originally formed part of the natural floodplain of the Thames and is underlain by Holocene alluvial deposits (British Geological Survey (BGS) 1:50,000 Sheets 257 Romford 1996), which consisted of fine-grained mineral-rich sediments and peat. 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 the Lower Tertiary Lambeth Group.

No previous geoarchaeological or archaeological investigations have been carried out on the Royal Wharf site itself, but a number of detailed investigations have taken place in the surrounding area, largely confirming the general sequence of Late Devensian and Holocene deposits (e.g. West Silvertown [Wilkinson *et al*., 2000]; Fort Street [Wessex Archaeology, 2000; Crockett *et al*., 2002], Thames Barrier Park East [Green *et al*., 2006], Barnwood Court [Farid, 1997] and the London Cable Car North Intermediate Tower [Batchelor *et al*., in press]; see Figure 1). However, these investigations do demonstrate considerable variation in the height of the Shepperton Gravel surface, and the type, thickness and age of the subsequent Holocene deposits. Such variations are significant as they represent different environmental conditions that would have existed in a given location. For example: (1) substantial variations in the surface of the Shepperton Gravel may represent the location of former channels and bars (eyots); (2) the presence of soils and peat represent former terrestrial or semi-terrestrial land-surfaces, and (3) fine to medium-grained sediments such as sands, silts and clays represent periods of inundation/flooding by estuarine or fluvial waters. Thus by studying the sub-surface stratigraphy across a given area (i.e. the site and its surroundings), it is possible to build an understanding of the former landscapes and environmental changes that took place over space and time.

Furthermore, 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). Such archaeological evidence has been recorded at Fort Street just beyond the northern boundary of the site, where a Neolithic trackway was excavated above an elevated gravel surface (*ca*. -1.5m OD; Wessex Archaeology., 2000; Crockett et al., 2003). A similarly high gravel surface at the Royal Docks Community School to the north-east contained Mesolithic flints and various Bronze Age artefacts (Holder, 1998; Figure 1). Trackways and platforms have also been found towards the top of the Peat at Bellot Street in Greenwich (McLean, 1993; Philp, 1993; Branch *et al*., 2005), and in Beckton (e.g. Carew et al., 2003).

Organic-rich sediments (in particular peat) also have high potential to provide a detailed reconstruction of past environments through the assessment/analysis of palaeoecological remains (e.g. pollen, plant macrofossils & insects) and radiocarbon dating. So called palaeoenvironmental reconstructions have also been carried out on the sedimentary sequences from West Silvertown (Wilkinson et al., 2000), Fort Street (Wessex Archaeology, 2000) and the London Cable Car North Intermediate Tower (Batchelor *et al*., in press). Commonly the peat forms during the Middle Holocene between 6500 and 2500 cal BP equating to the Late Mesolithic, Neolithic, Bronze Age and Iron Age cultural periods. However, the sequences from West Silvertown and the London Cable Car North Intermediate Tower also included organic-rich deposits dating from the late Devensian / early Holocene (*ca*. 12,000 cal BP) equating to the early Mesolithic cultural period.

The aim of this report is to produce a model of the sub-surface stratigraphy of the site and its surroundings using a combination of the geotechnical and archaeological records resulting from previous investigations both on and immediately adjacent to the site. This model will be used to provide a reconstruction of the site’s former landscape and its evolution through time. These findings will also be used to guide recommendations for further archaeological, geoarchaeological and palaeoenvironmental investigations (if necessary).

Figure 1: Location of (1) Royal Wharf, Silvertown, London Borough of Newham and other selected archaeological sites nearby: (2) Fort Street (HW-FO94; Wessex Archaeology, 2000; Crockett et al., 2002); (3) Silvertown (BWC96; Wilkinson *et al*., 2000); (4) the Cable Car route (CAB11; Batchelor *et al*., in press) (A) North Station; (B) North Intermediate Tower; (C) North Tower; (D) South Tower; (E) South Station); (5) Tidal Basin Road (Young & Batchelor, 2013-a); (6) 118 Victoria Dock Road (Barnett *et al*., 2012); (7) St Luke's Square

(LUC07; Weale, 2008; Wicks, 2010); (8) 105-107 Tarling Road (TAR13; Batchelor & Young, 2013); (9) Crediton Road (CDZ07; Eastbury *et al*., 2009); (10) Butchers Road (BUZ07; Eastbury *et al*., 2009); (11) Lower Lea Valley Mapping Project (Corcoran *et al*., 2011); (12) Vandome Close (VAD07; Eastbury *et al*., 2009); (13) Royal Docks Community School (PRG97; Holder, 1998); (14) Canning Town (Stafford, 2012); (15) Preston Road (PPP06; Branch *et al*., 2007); (16) East India Docks (Pepys, 1665); (17) East Ham FC (PRY00; Scaife, 2001); (18) Ferndale Street (HE-FE95; Divers, 1995); (19) Royal Albert Dock (RAD97; Batchelor, 2009); (20) Albert Road (AET01; Spurr *et al*., 2001); (21) North Woolwich Pumping Station (WW-PS93; Sidell, 2003); (22) Tunnel Avenue (GPF12; Batchelor, 2013); (23) Millennium Festival Site, Greenwich (BWP97; Bowsher & Corcoran, unknown; Corcoran, 2002); (24) Victoria Deep Water Terminal (TUA02; Corcoran, 2002); (25) Plot MO115, Greenwich Peninsula (CHB13; Young & Batchelor, 2013-b); (26) Plot MO117, Greenwich Peninsula (JHW13; Young & Batchelor, 2013-c); (27) Greenwich Millennium Village (Miller & Halsey, 2011); (28) Bellot Street (GLB05; Branch *et al*., 2005); (29) 72-88 Bellot Street (BSG93; McLean, 1993; Philp, 1993); (30) Greenwich Industrial Estate (GIE02; Morley, 2003); (31) Thames Barrier Park East (TBP06; Green *et al*., 2006); (32) Barnwood Court (HW-BC97; Farid, 1997). ***Contains Ordnance Survey data © Crown copyright and database right [2014]***

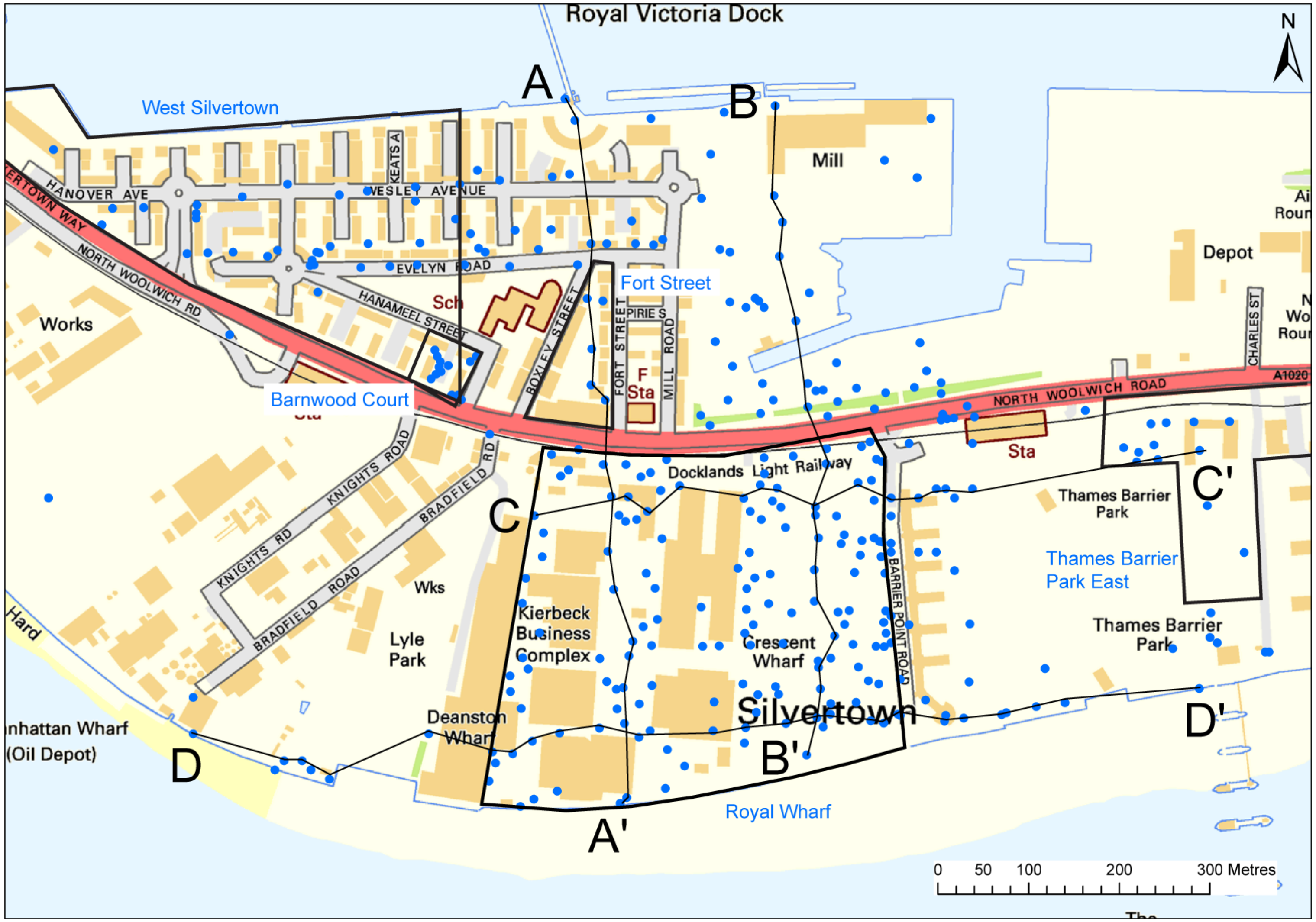

Figure 2: Detailed plan of Royal Wharf, London Borough of Newham, illustrating the location of the historical geotechnical and archaeological sequences both on and adjacent to the site. Borehole transect locations are also indicated. *Contains Ordnance Survey data © Crown copyright and database right [2014]*

METHODS

Deposit modelling

The reconstruction of the sedimentary architecture beneath the site and its surroundings was undertaken using records from 337 archived sequences. In the present investigation, modelling was undertaken using RockWorks v16 software. The term 'deposit modelling' describes any method used to depict the sub-surface arrangement of geological deposits, but particularly the use of computer programmes to create contoured maps or three dimensional representations of contacts between stratigraphic units. The first requirement is to classify the recorded borehole sequences into uniformly identifiable stratigraphic units. At the sub-station site five stratigraphic units were recognised: (1) Shepperton Gravel; (2) Lower Alluvium; (3) Peat; (4) Upper Alluvium and (5) Made Ground.

How effectively Rockworks portrays the relief features of stratigraphic contacts or the thickness of sediment bodies depends on the number of data points (e.g. boreholes) per unit area and the extent to which these points are evenly distributed across the modelled area. The portrayal is also affected by the significance assigned to these data points, in terms of the extent of the area around the point to which the data are deemed to apply. This can be predetermined for each data set. Obviously the larger the chosen distance the less reliable the overall portrayal. In the present case the distance chosen for each data point has been set to a radius of 50m; thus for complete coverage across any given site, the boreholes must be spaced on a grid of approximately 100m intervals.

Because the boreholes are not uniformly distributed over the area of investigation, the reliability of the models is variable. In general, reliability improves from the boundaries of the modelled area, where edge effects adversely influence the reconstructions, towards the core area of the site where mutually supportive data are likely to be available from several adjacent boreholes

Reliability is also affected by the quality of the stratigraphic records which in turn are affected by the nature of the sediments and/or their post-depositional disturbance during previous stages of land-use on the site. Quality is also affected where boreholes have been 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.

Finally, 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.

RESULTS, INTERPRETATION AND DISCUSSION OF THE DEPOSIT MODELLING

The results of the deposit modelling are displayed in Figures 3 to 13; Figures 3 to 9 represent surface elevation and thickness models for each of the main stratigraphic units. Figures 10 to 13 are 2-dimensional transects across the site from N to S and W to E. The results of the deposit modelling indicate that the number and spread of the boreholes logs accessed within the site is sufficient to permit modelling with a high level of confidence across the majority of the site. In the area immediately surrounding the site, borehole coverage is good to the north, north-west and east of the site is sufficient to enable modelling, but to the west and north-east there is an insufficient number of data-points available.

The full sequence of sediments recorded in the boreholes comprises:

Made Ground
Upper Alluvium – widely present
Peat – only locally present
Lower Alluvium – only locally present, occasionally peaty
Gravel (Shepperton Gravel)

The Shepperton Gravel

The Shepperton Gravel was present beneath the Holocene alluvial sediments in all the boreholes that penetrated to the bottom of the Holocene sequence. It comprises the deposits of a high-energy braided river system which, while it was active would have been characterised by longitudinal gravel bars (eyots) 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 results of the deposit modelling of the Shepperton Gravel indicate the presence of a broad upstanding gravel surface mainly between -3m and -4m OD with a well-defined southern margin that extends WNW-ESE across the Royal Wharf site (Figure 3; Figure 10-13). Towards the north of the modelled area the gravel surface falls gently away in a northward direction. To the south of this more elevated gravel area, in the southern part of the Royal Wharf site, the gravel surface falls away steeply towards the modern channel of the River Thames. This downward slope is apparently dissected by a number of depressions with roughly N-S alignments. Some of these depressions are substantially deep; in boreholes BH218 and BH216 for example, the gravel surface is recorded at -8.25m OD and -7.20m OD respectively (Figure 3). This broad relief pattern is most clearly apparent in the model displaying total alluvium thickness (Figure 8), but can also be made out in the modelled surfaces of the Shepperton Gravel (Figure 3), Lower Alluvium (Figure 4) and Peat (Figure 5).

The more elevated gravel surface on the northern half of the Royal Wharf site and beyond has a gently undulating relief which probably indicates the presence of low gravel bars and intervening channels, but in general the relief amplitude is only 1.0-2.0m. On northern half of the Royal Wharf site, the gravel surface is rarely recorded above -2.50m OD. Towards the north-east of the site, a single window sample records gravel at -1.63m OD (WS11; Transect B-B' - Figure 10), but since neighbouring sequences indicate a gravel surface in excess of -2.50m OD, this is considered to be an anomaly. On the Fort Street site just to the north of Royal Wharf however, the high gravel surface reaches approximately -1.5m OD and the sediments above it contain a Neolithic trackway (Wessex Archaeology, 2000; Crockett *et al*., 2003).

Other features of note in the Shepperton Gravel model include a west-east aligned trough recorded between approximately -4.50 and -5.00m immediately to the north and north-east of Fort Street. This trough may be representative of a former channel orientated parallel to the Thames. Finally, the trough in the gravel surface towards the very north of the modelled area, is considered to represent an artificially low level consequent of the construction of the Royal Victoria Dock (Figure 3; Transect A-A' – Figure 10); this is also suggested by the model of the Made Ground surface (Figure 9).

The Holocene alluvial sequence

The sediments overlying the Shepperton Gravel surface in chronological order consist of the Lower Alluvium (Figure 4), Peat (Figures 5 & 6) and Upper Alluvium (Figure 7). The Lower Alluvium is defined here as a generally silty or sandy (sometimes organic) deposit that accumulated during the Early to Middle Holocene (Mesolithic cultural period) within a fluvial or estuarine environment. In many cases across the Lower Thames Valley it is separated from the more clayey and inorganic Middle to Late Holocene Upper Alluvium by a thick horizon of Peat representative of a shift towards semi-terrestrial environment supporting the growth of fen woodland. Across the modelled area, the Peat is not always present, generally preventing definitive distinction between the Lower Alluvium and Upper Alluvium.

The Holocene sequences display a fairly well-marked spatial pattern across the modelled area. This is most clearly seen in a comparison between the modelled thickness of the Peat (Figure 6) and the modelled total thickness of the alluvial sequence (Figure 8). In the southern part of the Royal Wharf site, the Peat is almost completely absent and the limited sequences in which it does occur tend to overlie the more elevated parts of the gravel surface (i.e. the areas intervening between the N-S depressions that dissect the gravel surface in this area of the site). Thicker occurrences of Peat are recorded on the upstanding gravel area on the northern part of the Royal Wharf site and to the north of it, though even in these areas Peat development is irregular (see Figure 6). Where present, the Peat generally varies between 1 and 3m thick, although thicker horizons up to 4m are occasionally recorded (e.g. BH229; Transect A-A' – Figure 10). At nearby sites, radiocarbon dating has demonstrated the Peat and organic-rich deposits accumulated over several millennia, spanning multiple cultural periods – *ca*. 12,000 to 2500 cal BP at West Silvertown, (Wilkinson *et al*., 2000), *ca*. 5500 to 3500 cal BP at Fort Street (Wessex Archaeology, 2002; Crockett *et al*., 2003) and *ca*. 4000 to 500 cal BP at Thames Barrier Park East (Green *et al*., 2006).

The areas of greater total alluvium thickness (including Lower Alluvium, Peat and Upper Alluvium; Figure 8) lie to the south of the upstanding gravel area, in the southern part of the Royal Wharf site and in the north of the modelled area where the gravel surface falls away gently to the north. These are areas in which Peat is thin, patchily present or absent, thus the bulk of the alluvial sequence is mineral sediment. This is clearly apparent in the N-S cross sections A-A, B-B and in the E-W cross section D-D (Figures 10, 11 and 13) where the thickness of the alluvium (represented as Upper Alluvium) is greatest in the south of the modelled area, where the gravel surface falls away steeply southward.

Finally, an upper Peat horizon was recorded within the Upper Alluvium of a small collection of test-pits towards the south-east of the site (e.g. TP911.4 – Transect B-B'; Figures 5 & 11). The elevation of this Peat is unusually high however (over 2m OD), when compared to the likely natural level of the Thames floodplain prior to artificial raising (0 to 1m OD). Thus it is uncertain whether or not this represents a natural or redeposited Peat horizon.

Holocene landscape evolution

The pattern of alluvial deposits indicates the presence of two contrasting landscapes within the Royal Wharf site, and in the wider modelled area, throughout much of the Holocene. In the southern part of the Royal Wharf site it seems likely that deposition of mineral-rich alluvium reflects the presence of active river channels, probably the main channel of the River Thames and short N-S aligned steams draining off the slightly more elevated area to the north. Peat formation here was restricted to the more elevated remnants of the gravel surface between the depressions in which fluvial deposition persisted for much of the

Holocene.

In the northern part of the Royal Wharf site and further north there are no obvious deep depressions that might have been the site of Peat formation early in the Holocene. Moreover the pattern of Peat accumulation indicated by the modelling of Peat thickness (Figure 6) shows very little relationship to the relief of the surface of the Shepperton Gravel/Lower Alluvium on which the Peat rests as is suggested by modelling exercises elsewhere along the River Thames (see below). This might reflect post-formational erosion of the Peat, or it may reflect a pattern of formation controlled by subtle variations of relief and hydrological conditions which are not recognisable at the level of resolution possible in the modelling exercise.

CONCLUSIONS & RECOMMENDATIONS

The distribution of sediments on the Royal Wharf site is quite different to those recorded during recent large-scale modelling exercises carried out on the Greenwich Peninsula (e.g. Batchelor *et al*., 2012) and further along the Lower Thames Valley floodplain (e.g. the Barking Reach [Green *et al*., in press] and on the Plumstead and Erith Marshes [Quest, in prep]), where thicker Peat horizons tend to be associated with areas of lower rather than higher Shepperton Gravel topography. There are however, some similarities with the conditions described by Corcoran et al (2011) in the Lower Lee valley where they were able to recognise contrasts between areas affected by persistent Holocene river activity and characterised by mineral-rich sediment sequences, and more stable areas where Peat accumulation had occurred.

The results of the deposit modelling exercise are considered to make a valuable contribution to our knowledge and understanding of the evolution of the floodplain landscape along this stretch of the Lower Thames Valley, against which the archaeological record can considered. It is therefore recommended that the results are used to produce a publication that builds upon similar recent regional site investigations carried out along the Barking Reach, Plumstead and Erith Marshes, Greenwich Peninsula and Lower Lea Valley. A lack of sufficiently deep boreholes in four areas of the Royal Wharf site have resulted in voids in the model of the Shepperton Gravel surface (Figure 3); it is recommended that geoarchaeological boreholes are put down in these areas of the site to complete the study, and that the peat sequences present are radiocarbon dated to improve the chronological framework of deposition. The placement of these boreholes will also enable investigation of the suspect Peat horizon in the Upper Alluvium identified towards the south-east of the site

(TP911.4 – Figure 5). No palaeoenvironmental investigations are recommended however, since detailed reconstructions have already been carried out in the nearby area (e.g. the London Cable Car [Batchelor *et al*., in press], Fort Street [Wessex Archaeology, 2000; Crockett *et al*., 2003] and West Silvertown [Wilkinson et al., 2000]).

Finally, the results of the deposit modelling provide an indication of the archaeological potential of the site. Towards the south of the site, this is considered to be relatively low due to the greater depth of the Shepperton Gravel and largely inorganic sediments overlying it. The peat sediments from the northern part of the site have higher potential, particularly when considering the presence of the known archaeological remains on the Fort Street site. However, even this is considered to be moderate at best, since the surface of the Shepperton Gravel is rarely above -2.50m OD.

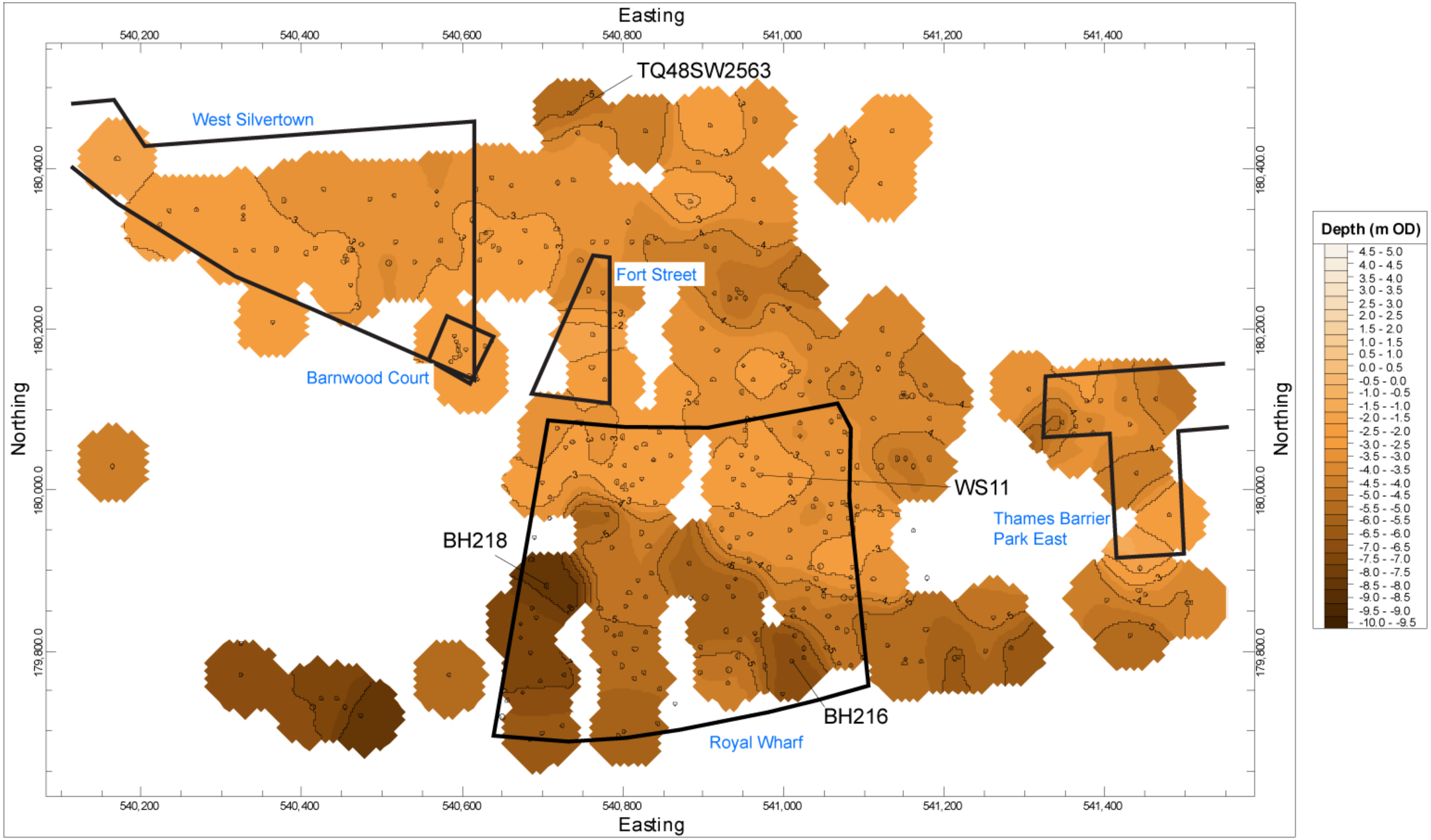

Figure 3: Modelled surface of the Shepperton Gravel (metres OD)

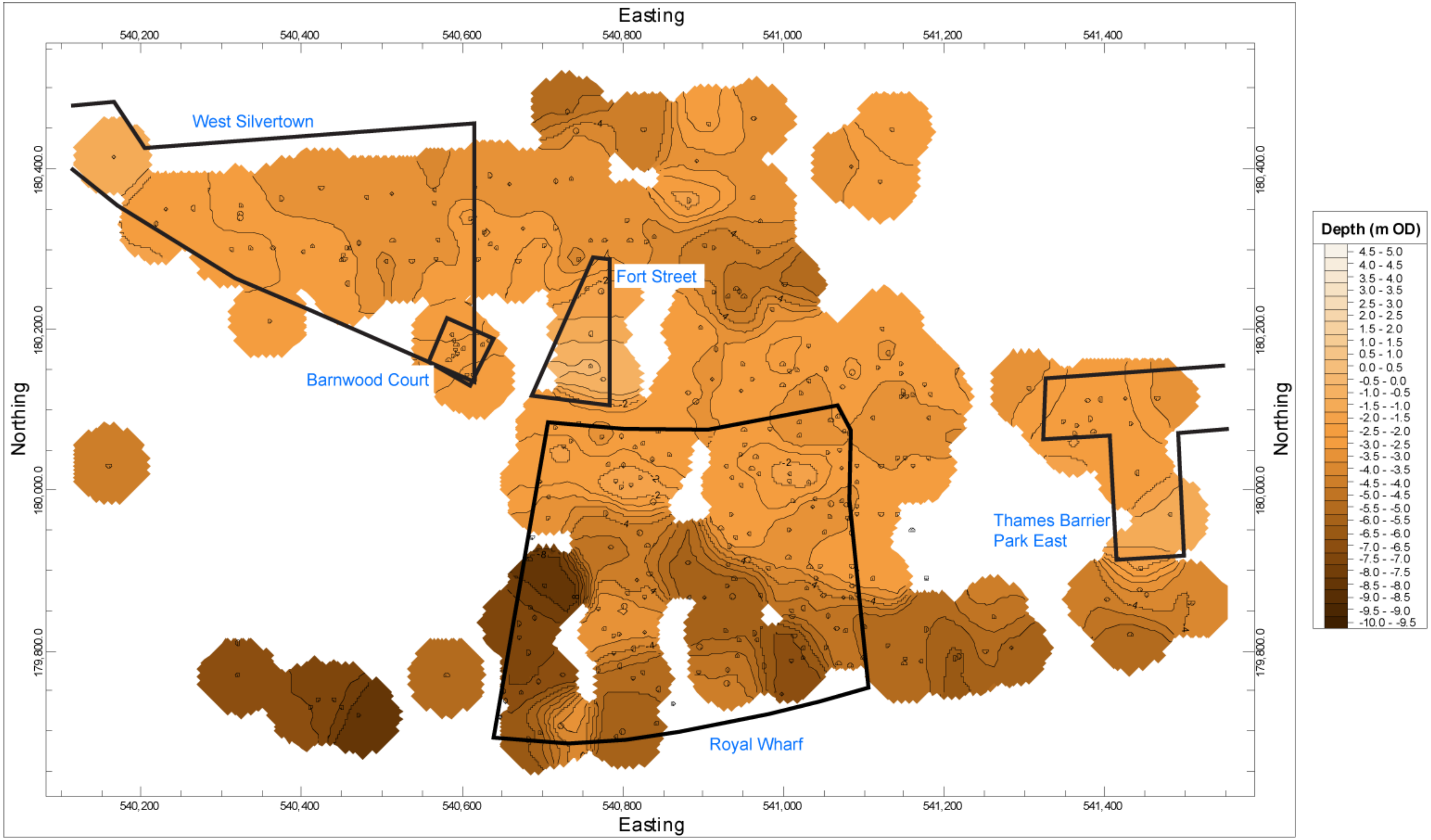

Figure 4: Modelled surface of the Lower Alluvium (metres OD)

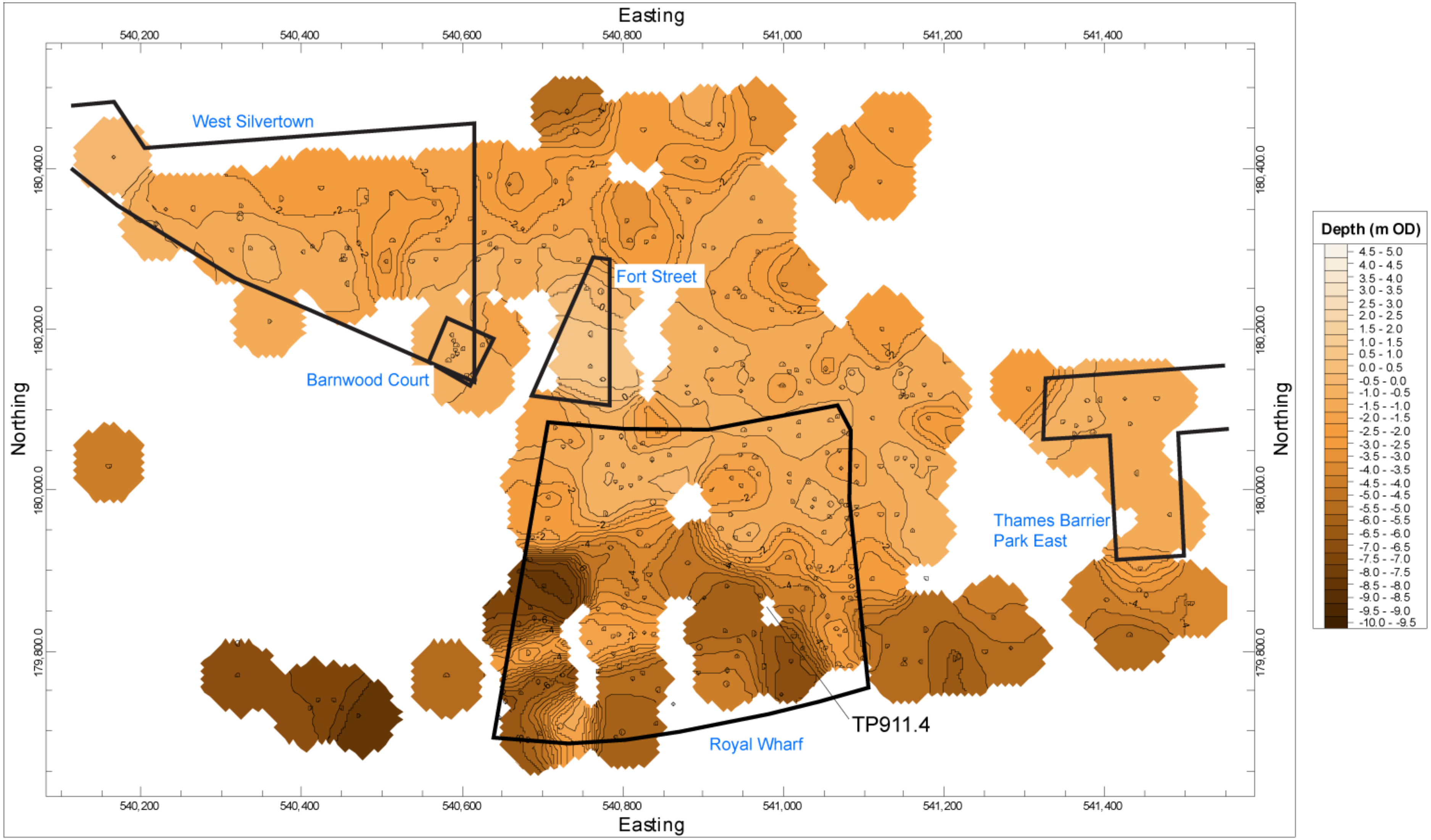

Figure 5: Modelled surface of the Peat (metres OD)

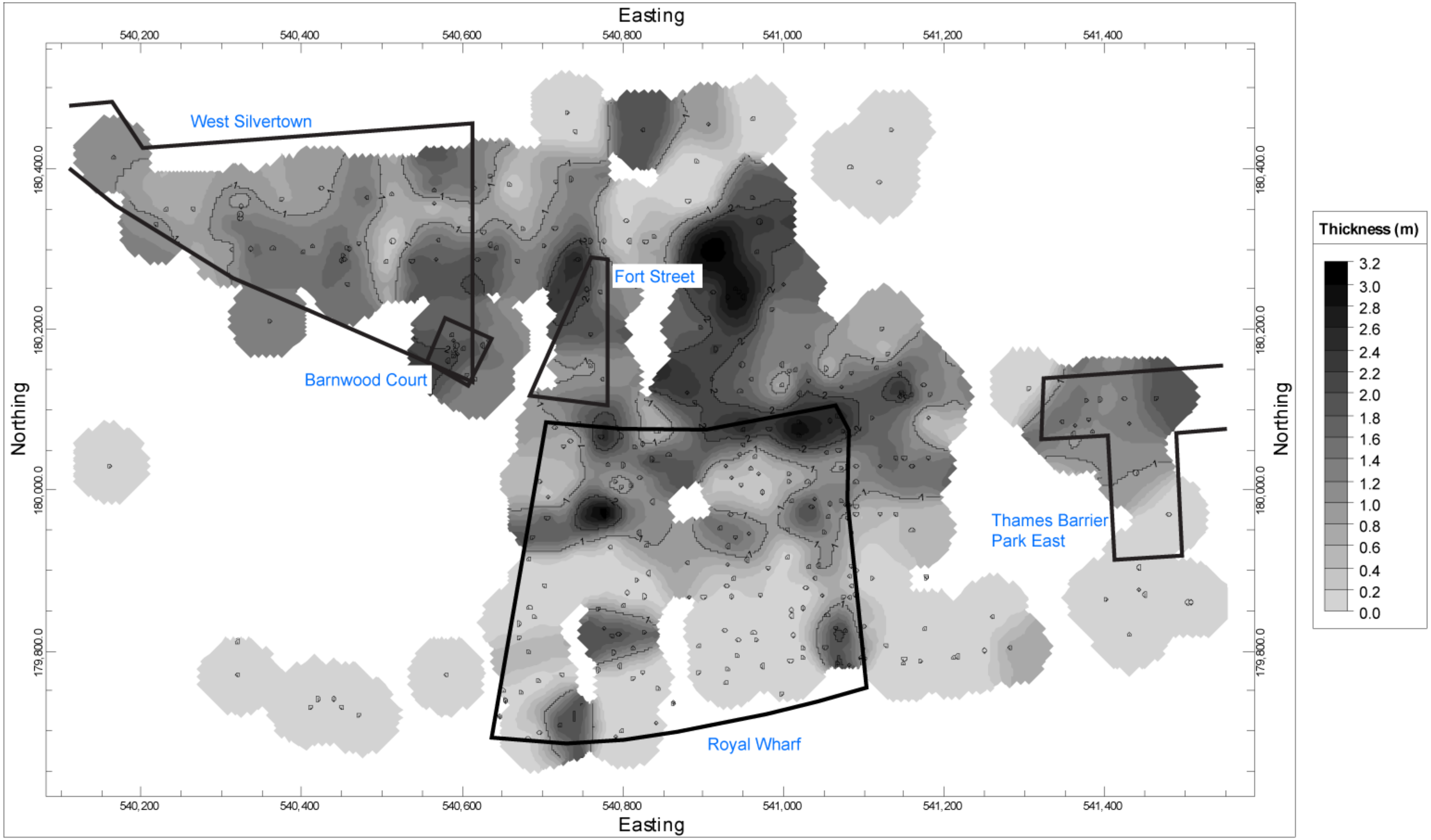

Figure 6: Modelled thickness of the Peat (metres)

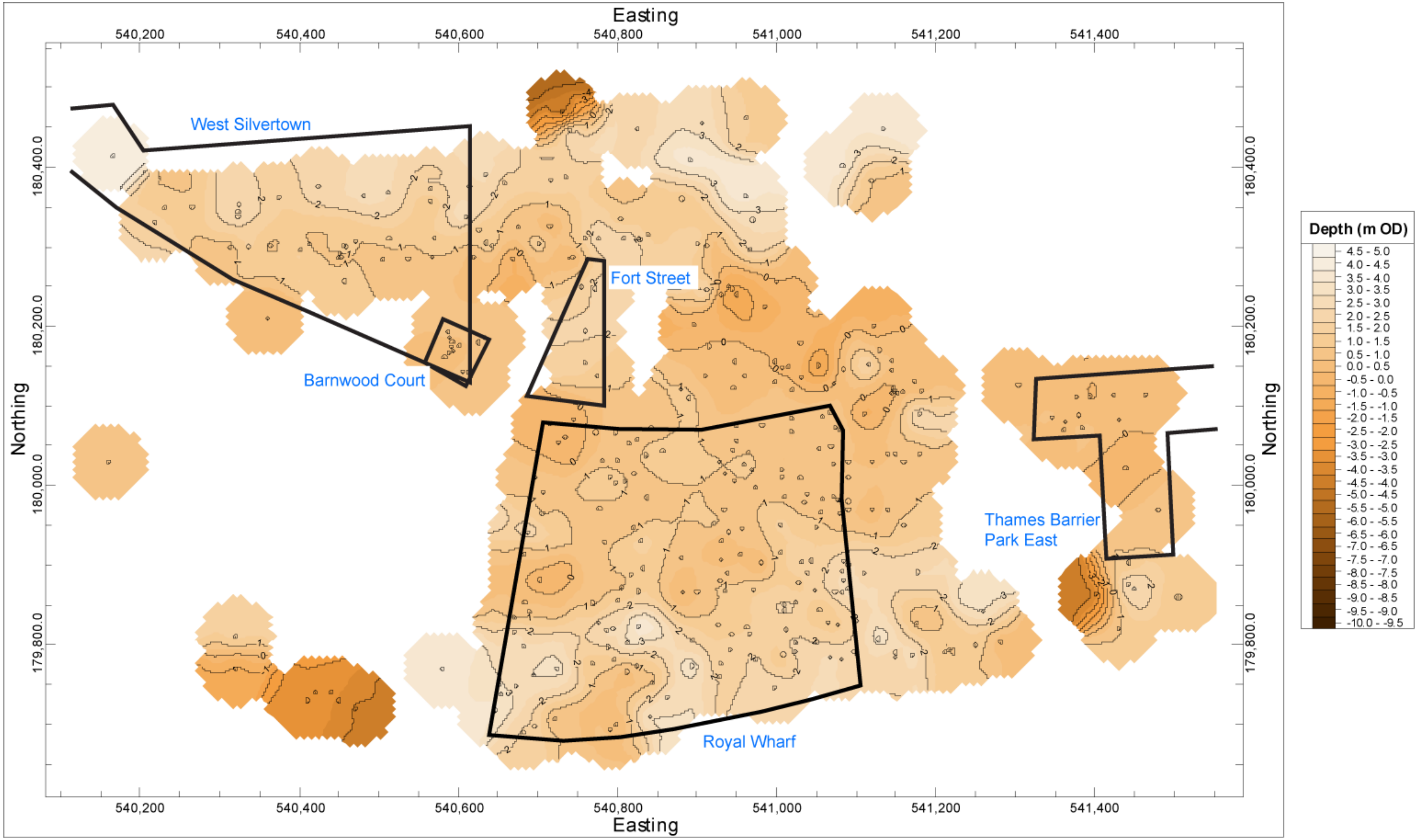

Figure 7: Modelled surface of the Upper Alluvium (metres OD)

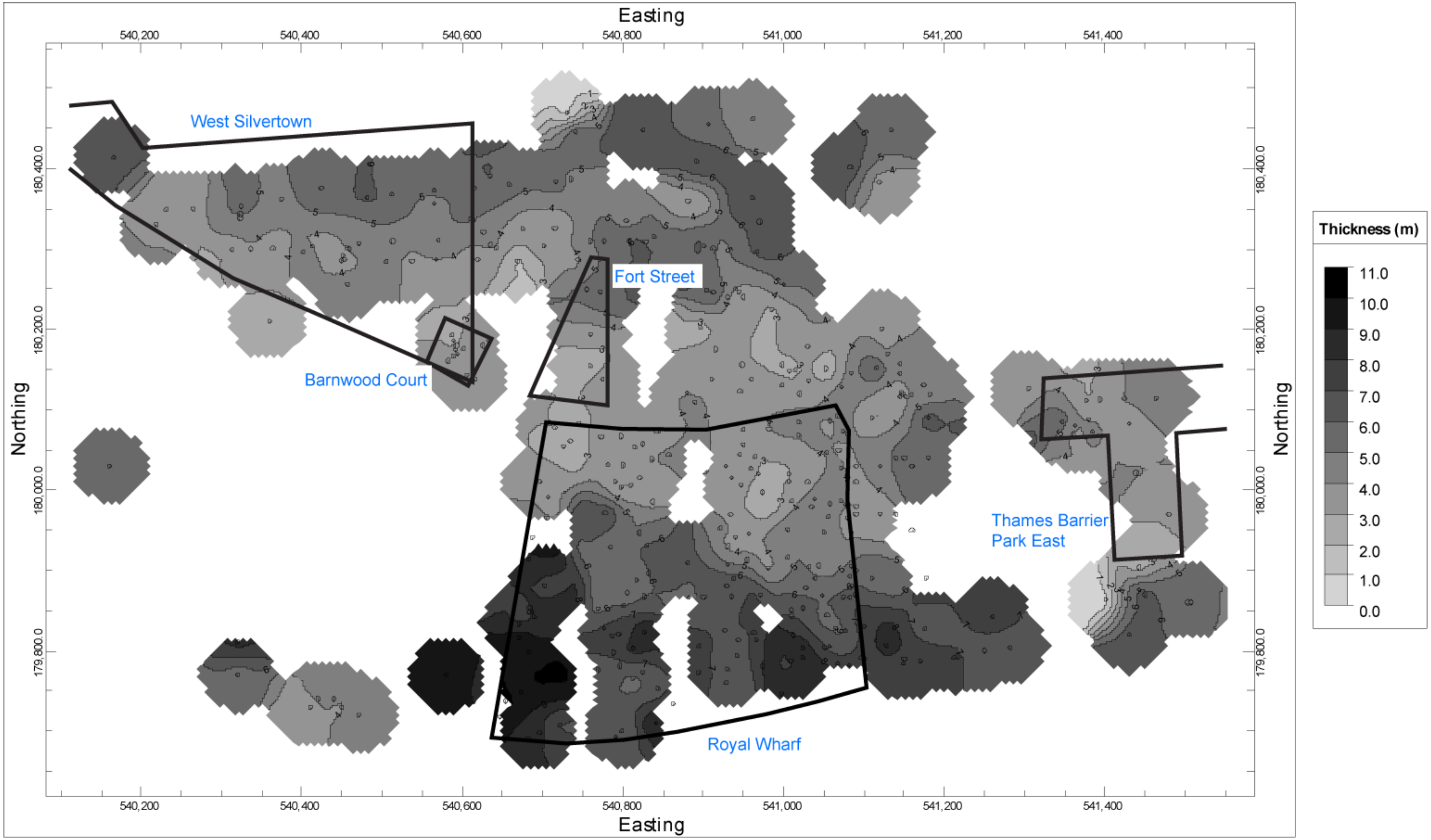

Figure 8: Modelled thickness of the Total Alluvium (metres)

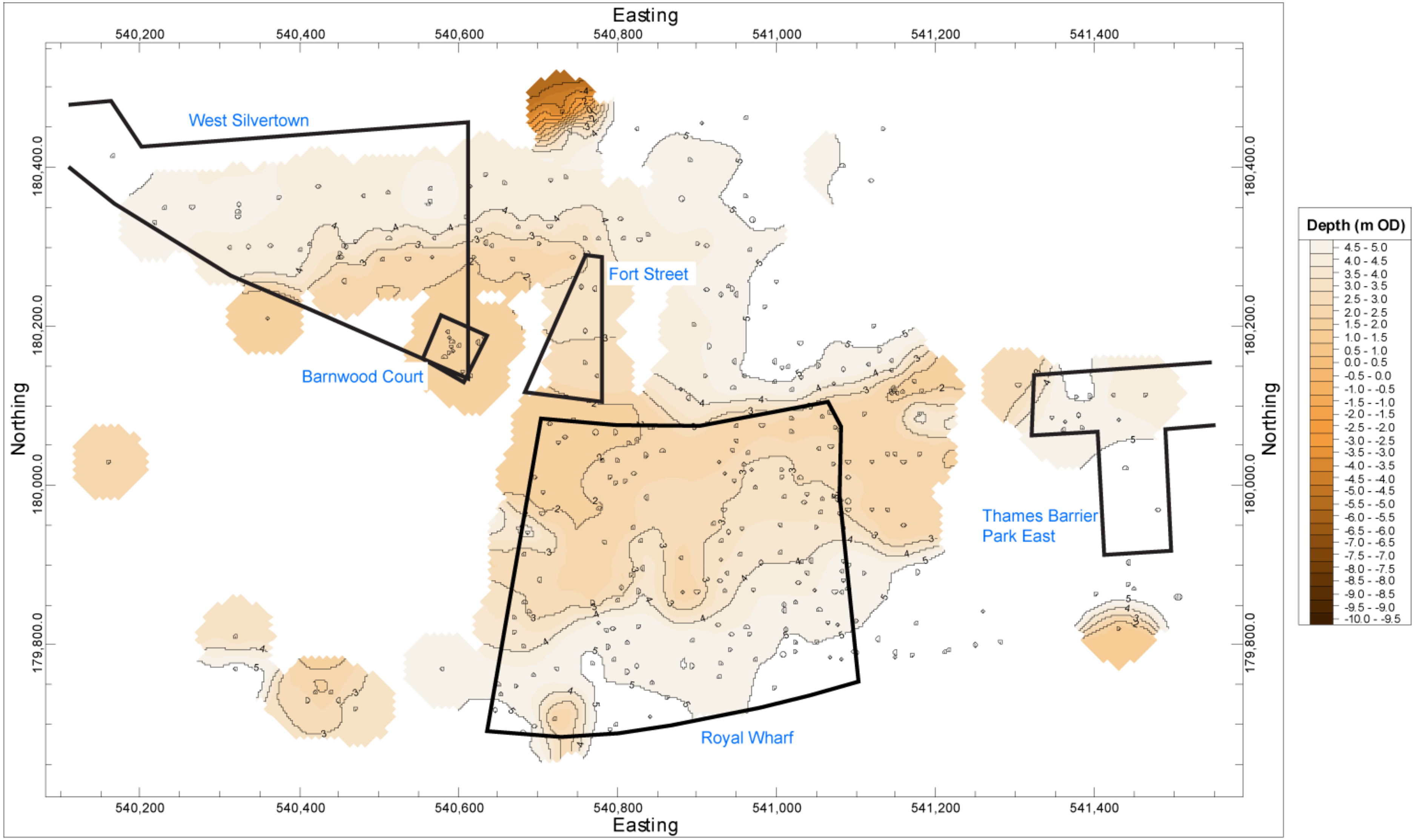

Figure 9: Modelled surface of the Made Ground (m OD)

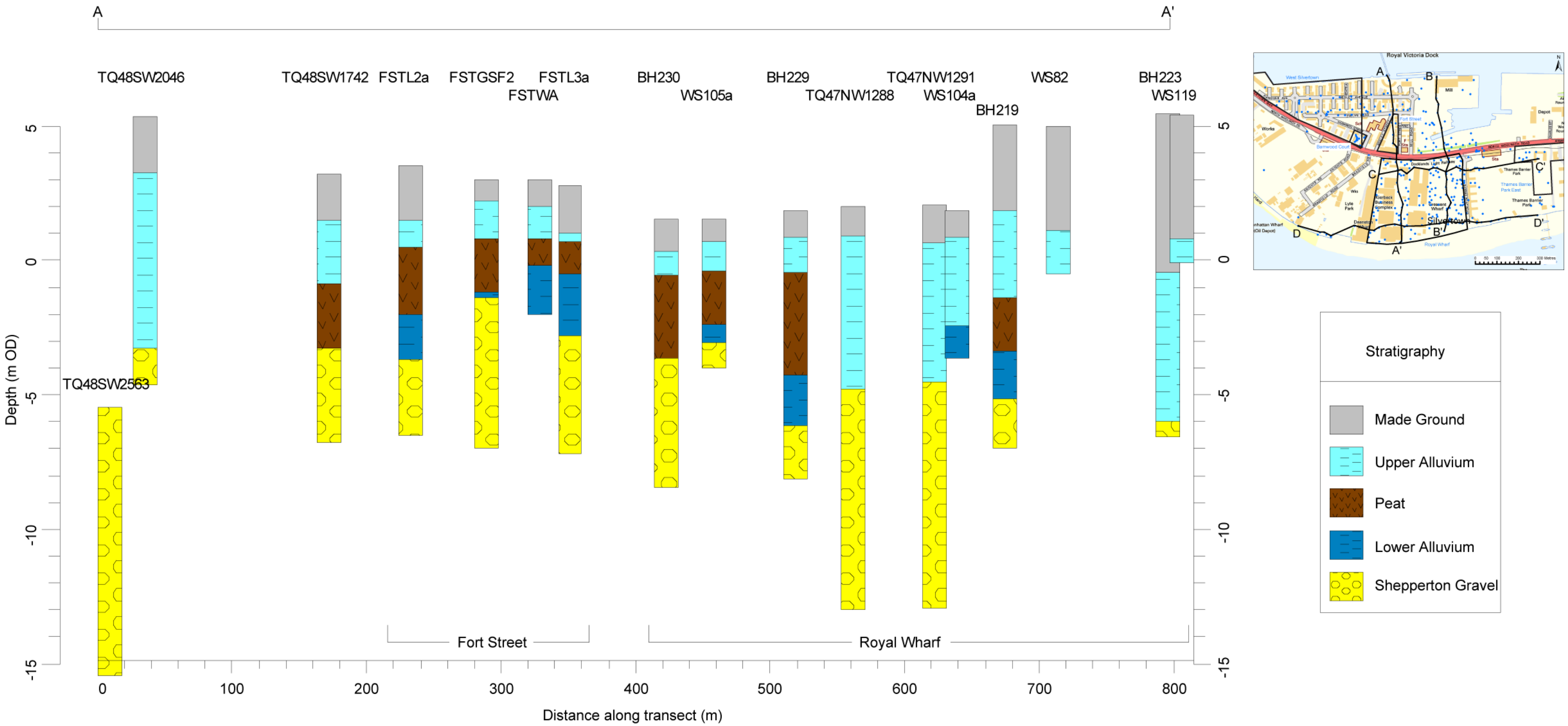

Figure 10: North to south transect A-A’

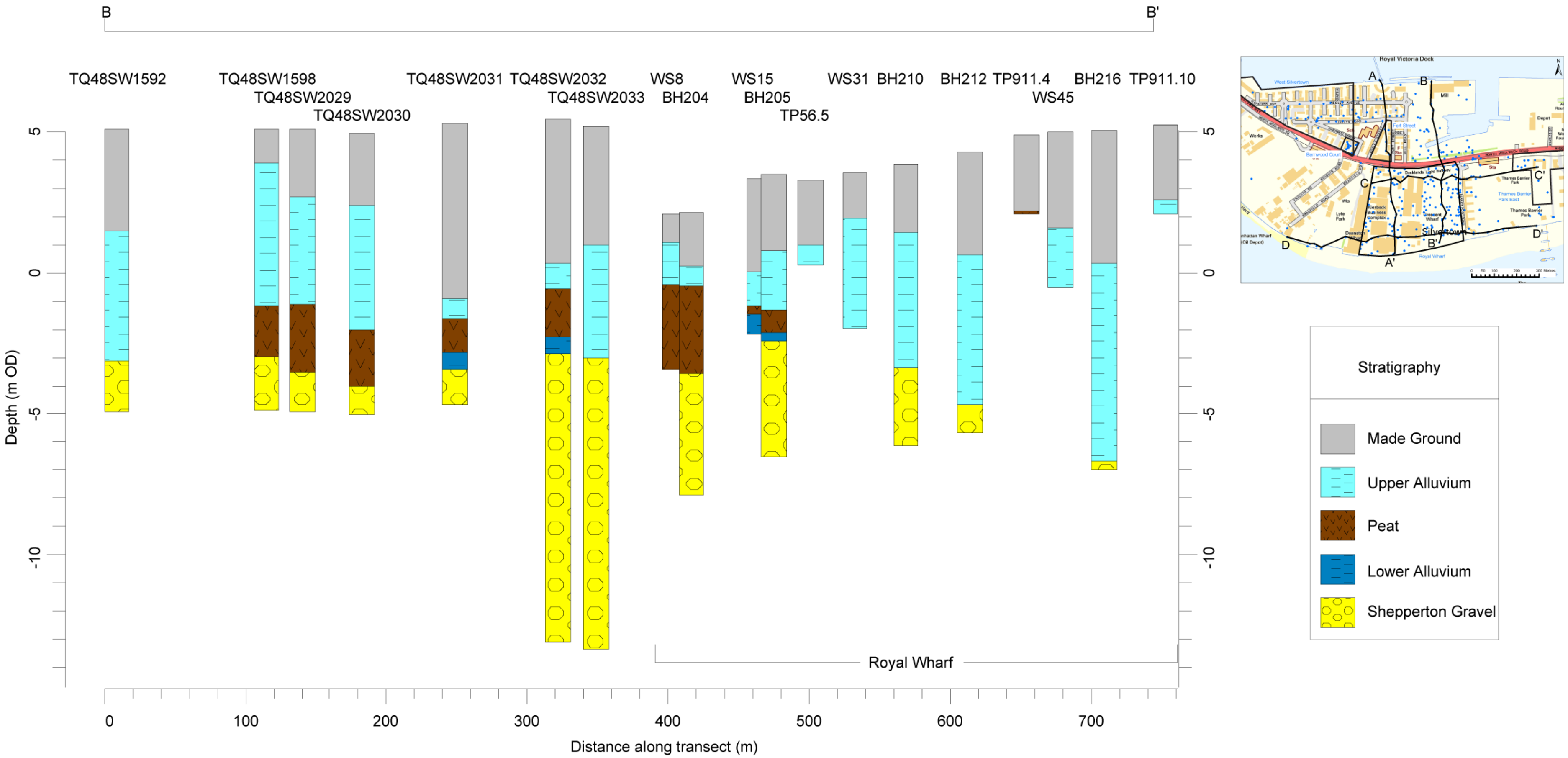

Figure 11: North to south transect B-B'

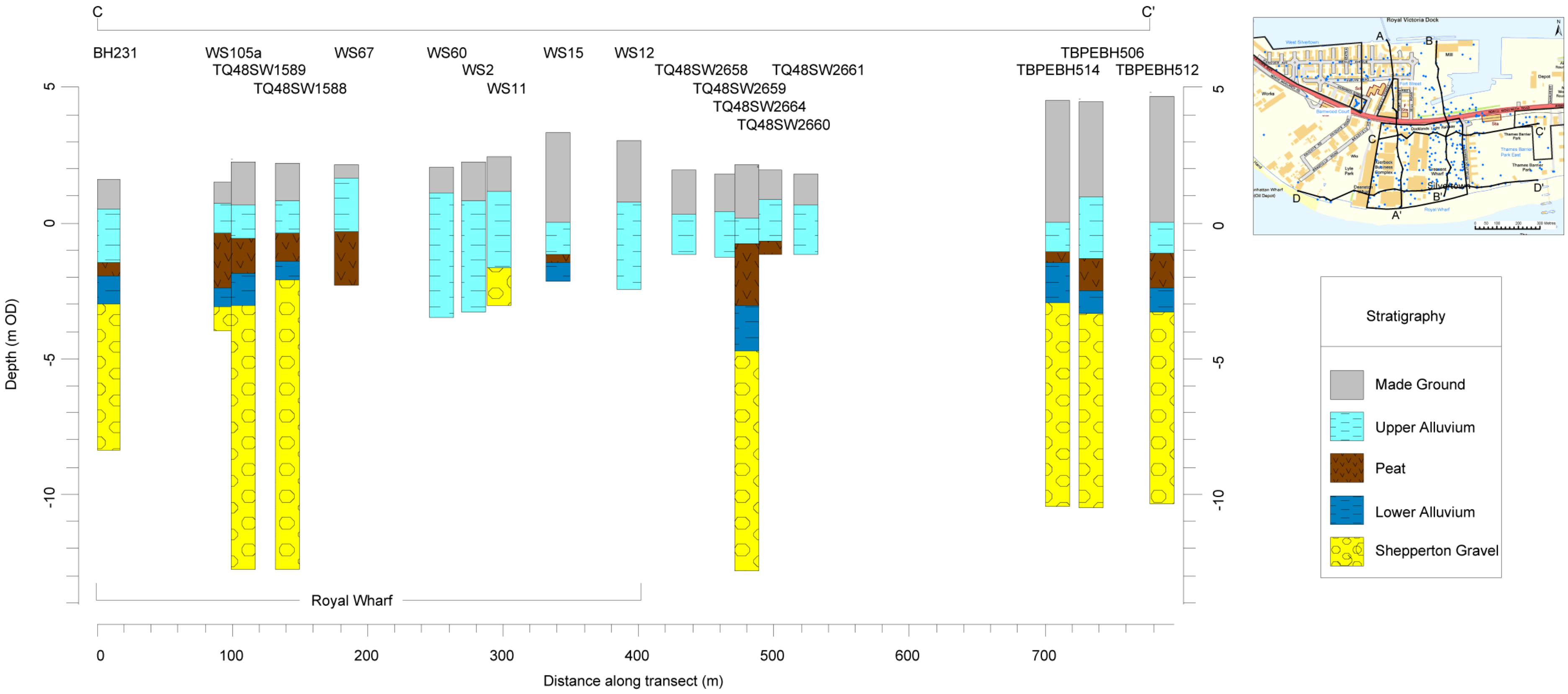

Figure 12: East to west transect C-C'

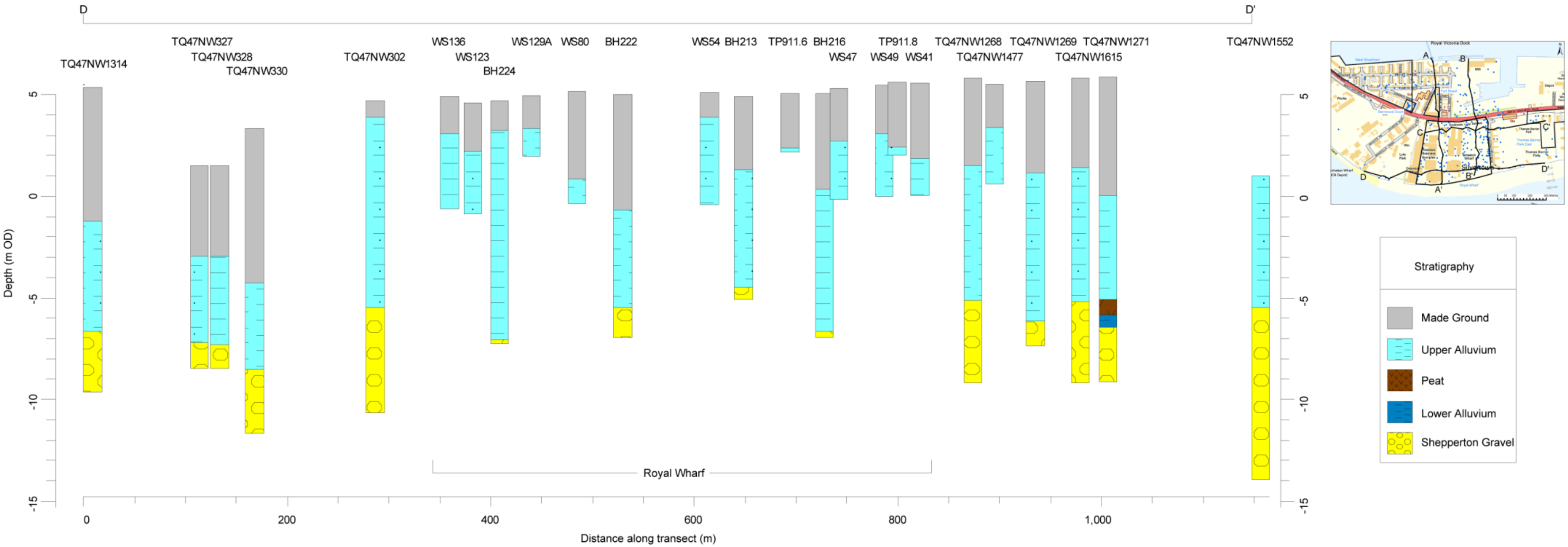

Figure 13: East to west transect D-D’

REFERENCES

Barnett, C., Allen, M.J., Evans, G., Grimm, J.M., Scaife, R., Stevens, C.J. & Wyles, S.F. (2011) A Submerged Forest with Evidence of Early Neolithic Burning Activity and the Tilbury Alluvial Sequence at Canning Town, East London. *Transactions of the London and Middlesex Archaeological Society*, **61**, 1-15.

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. (2013) *A report on the geoarchaeological borehole investigations and deposit modelling on land at Greenwich Peninsula, Tunnel Avenue, London Borough of Greenwich (Site Code: GPF12)*. Quaternary Scientific (QUEST) Unpublished Report February 2013; Project Number 079/12.

Batchelor, C.R. & Young, D.S. (2013) *105-107 Tarling Road, London Borough of Newham (Site Code: TAR13): Geoarchaeological Assessment Report*. Quaternary Scientific (QUEST) Unpublished Report October 2013; Project Number 206/13.

Branch, N.P., Green, C.P., Vaughan-Williams, A., Elias, S., Swindle, G., & Batchelor, C.R. (2005) *Bellot Street, Maze Hill, London Borough of Greenwich (site code: GBL05): environmental archaeological assessment*. ArchaeoScape Unpublished Report.

Batchelor, R., Green, C., Young, D., Austin, P., Cameron, N. and Elias, S. (in press) Prehistoric Landscapes beneath the London Cable Car. *London Archaeologist.*

Branch, N.P., Batchelor, C.R., Elias, S., Green., C.P. & Swindle, G.E. (2007) *Preston Road, Poplar High Street, Poplar, London Borough of Hamlets (site code: PPP06): environmental archaeological analysis*. ArchaeoScape Unpublished Report.

Carew, T., Meddens, F., Batchelor, R., Branch, N., Elias, S., Goodburn, D., Vaughan Williams, A., Webster, L. & Yeomans, L. (2009) Human–environment interactions at the wetland edge in East London: Trackways, platforms and Bronze Age responses to environmental change. *London and Middlesex Archaeological Society* **60**: 1–34.

Corcoran, J. (2002) *Greenwich Peninsula SE10: a geoarchaeological report*. MoLAS unpublished report.

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.

Crockett, A.D., Allen, M.J., Scaife, R.G., Boismier, W.A., Mepham, L., Gale, R. (2002) A Neolithic trackway within peat deposits at Silvertown, London. *Proceedings of the Prehistoric Society* **68**, 185-213.

Divers, D. (1995) *Archaeological Evaluation at Ferndale Street, Cyprus, London E6*. Newham Museum Service Unpublished Report.

Eastbury, E. Ruddy, M. & Jones, S. (2009) MoLA 2009. *Canning Town Sites, London E16, London Borough of Newham: Post-Excavation Assessment and updated project design*. MoLA Unpublished Report.

Farid, S. (1997) *An archaeological evaluation at Barnwood Court, North Woolwich Road, London Borough of Newham, E16*. Pre-Construct Archaeology Unpublished Report.

Green, C.P., Batchelor, C.R., Austin, P., Brown, A., Cameron, N., Young, D.S. (in press) Holocene Alluvial Environments At Barking, Lower Thames Valley (London, UK). *Proceedings of the Geologists Association*.

Green, C.P., Wilkinson, K., Branch, N.P. & Swindle, G.E. (2006) *Thames Barrier Park East, Silvertown, London Borough of Newham (site code: TBP06): Geoarchaeology and radiocarbon dating*. ArchaeoScape Unpublished Report 2006.

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

McLean. G. (1993) *An outline report on an archaeological evaluation at the land at the rear of 72-88 Bellot Street Greenwich London SE10*. SELAU Unpublished Report.

Miller, P. & Halsey, C. (2011) *Greenwich Millennium Village Phase 3-5, Greenwich SE10: A geoarchaeological and historic environment assessment*. Museum of London Archaeology Unpublished Report 2011.

Morley, M. (2003) *Greenwich Industrial Estate, Bugsby's Way, Charlton, London SE7, a Geoarchaeological Investigation*. MoLAS Unpublished Report.

Philp, B. (1993) *An Outline Report on an Archaeological Evaluation Excavation at the Land at the Rear of 72-88 Bellot Street, Greenwich, London SE10*. SELAU Unpublished Report.

Pepys, S. (1665). *Samuel Pepys Diary September 1665*. Available at http://www.pepysdiary.com/diary/1665/09/accessed on 15th May 2014.

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

Sidell, E.J. (2003) *Relative sea-level change and archaeology in the inner Thames estuary during the Holocene.* University College, London, Unpublished PhD Thesis.

Spurr, G., Scaife, R., Cameron, N. & Corcoran, J. (2001) *145-155 Albert Road, E16 London Borough of Newham: a geoarchaeological evaluation report*. MoLAS Unpublished Report.

Stafford, E. (2012) *Landscape and Prehistory of the East London Wetlands*. Oxford Archaeology Monograph no. 17.

Weale, A. (2008) St Luke’s Square, Canning Town, London Borough of Newham. An Archaeological Evaluation. *Thames Valley Archaeological Services Ltd Unpublished Report, March 2008.*

Wessex Archaeology (2000) *Fort Street (West) Silvertown, London, E16, Archaeological excavation assessment report*. Wessex Archaeology: Unpublished Report.

Wicks, K. (2010) St Luke’s Square, Canning Town, London Borough of Newham (Site Code: LUC07): Palynological Assessment. *AFESS, University of Reading Unpublished Report, 2010.*

Wilkinson, K.N., Scaife, R.J. & Sidell, E.J. (2000) Environmental and sea-level changes in London from 10,500 BP to the present: a case study from Silvertown. *Proceedings of the Geologists' Association,* **111**, 41-54.

Young, D.S. & Batchelor, C.R. (2013a) *A report on the geoarchaeological borehole* *investigations and deposit modelling on land at Tidal Basin Road, London Borough of Newham (NGR: TQ 39950 80750)*. Quaternary Scientific (QUEST) Unpublished Report August 2013; Project Number 156/13.

Young, D.S. & Batchelor, C.R. (2013-b) *A report on the geoarchaeological borehole investigations and deposit modelling on land at Plot MO115, Greenwich Peninsula, London Borough of Greenwich (site code: CHB13)*. Quaternary Scientific (QUEST) Unpublished Report February 2013; Project Number 224/12.

Young, D.S. & Batchelor, C.R. (2013-c) *A report on the geoarchaeological borehole investigations and deposit modelling on land at Plot MO117, Greenwich Peninsula, London Borough of Greenwich (site code: JHW13)*. Quaternary Scientific (QUEST) Unpublished Report February 2013; Project Number 210/12.