SILVERTOWN TUNNEL

Preliminary Environmental Information Report: Appendix 8.B

Geoarchaeological Deposit Modelling

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A REPORT ON THE GEOARCHAEOLOGICAL DEPOSIT MODELLING ON LAND ASSOCIATED WITH THE SILVERTOWN TUNNEL, LONDON BOROUGHS OF GREENWICH AND NEWHAM

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INTRODUCTION

This report summarises the findings arising out of the deposit modelling undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development associated with the Silvertown Tunnel, London Boroughs of Greenwich and Newham (National Grid Reference *centred on*: TQ 39720 80100; Figure 1). The site is approximately 1.5km in length, incorporating the route of the proposed tunnel, the tunnel construction worksites and associated highway work. The overall Extent of Works is shown in Figure 2.

The southwestern area of investigation lies to the south of the River Thames on Greenwich Peninsula, formed and bounded by a meander of the Thames to the west, east and north of the site, and opposite the confluence of the River Lea. The northeastern area of investigation lies to the north of the Thames and in the lower valley of the River Lea. The western boundary of the site lies within 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 immediately to the west. The ground across both areas originally formed part of the natural floodplain of the Thames (and in the northern area of investigation, the Lea) 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 in places, Peat. To the south of Greenwich Peninsula Alluvium is mapped 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, and in the northern area of investigation, to the Lea Valley Gravel of similar age. The bedrock beneath both areas is the Paleocene London Clay.

Previous geoarchaeological investigations on the Greenwich Peninsula at plots MO115, MO117 (Young & Batchelor, 2013a, b), the Millennium Festival Site (BWP97; Bowsher & Corcoran, unknown date), the Cable Car South Station (CAB11; Batchelor *et al*., 2012), Greenwich Millennium Village (Miller & Halsey, 2011) and at the Victoria Deep Water Terminal and across Greenwich Peninsula as a whole (TUA02; Corcoran, 2002) have also revealed a sequence of Shepperton Gravel, overlain by Alluvium and Made Ground. At these sites, and at others nearby to the Greenwich Peninsula area (e.g. Silvertown; Wilkinson *et al*., 2000), a horizon of peat within the Alluvium is frequently recorded and has been radiocarbon dated as accumulating between approximately 6000 and 3000 cal BP, equating to the Neolithic and Bronze Age cultural periods.

The northern area of investigation has been investigated in the Lea Valley Mapping Project (Corcoran *et al.,* 2011). In this project the Lea Valley has been divided into Landscape Zones characterised by their Holocene landscape history based largely on sedimentary evidence derived from borehole records. The majority of the site lies within Landscape Zone LZ1.1b., which '…represents the deepest part of the floodplain of the Lea at its southernmost extent...'. Corcoran *et al.,* (2011 p.48) describe the deposit characteristics of Landscape Zone LZ1.1 in the following terms:

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

In discussing the archaeological and palaeoenvironmental potential of Landscape Zone LZ1.1, Corcoran *et al.* (2011 p.49) note that although borehole data are 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, e.g. at Dock Road (GLHER/ELO7446), where 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 north, where peat horizons radiocarbon dated to the Late Neolithic through to Late Bronze Age; and at Fords Park Road (GLHER/ELO10265) *ca*. 0.6km to the northeast where evidence of Mesolithic and Bronze age occupation was identified on an upstanding 'island' of sandy sediment. It should also be recognised that although the examination of the borehole evidence by Corcoran *et al.* (2011) appears to have been thoroughly comprehensive (in total over 2000 BGS borehole records were incorporated into the Lea Valley Mapping Project database), the distribution of these boreholes is very uneven (see Corcoran *et al.* 2011 Figure 15) relative to the scale of the variability that characterises the Holocene alluvial sequence and the surface of the Lea Valley and Shepperton Gravels on which it rests.

The different stratigraphic units recorded are significant as they represent different environmental conditions that would have existed in a given location. For example, soil and Peat represent former terrestrial or semi-terrestrial land-surfaces, whilst 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, it is possible to build an understanding of the former landscapes and environmental changes that took place over space and time. Furthermore, any soils or peat horizons represent potential areas that might have been utilised or even occupied by prehistoric people. Similarly, upstanding areas of Shepperton Gravel may also have been utilised as they remained elevated above the floodwater during periods of inundation. Evidence for such utilisation of the floodplain landscape has, for example, been recorded at two sites close to the present area of investigation, on Bellot Street (GLB05 / BSG93; Branch *et al*., 2005; McLean, 1993; Philp, 1993) and Atlas Wharf (AWF98; Lakin, 1998) where Bronze Age trackways were found within the peat.

The aim of this report is to produce a model of the sub-surface stratigraphy of the area of the site using a combination of existing geoarchaeological, geotechnical and BGS borehole records resulting from previous investigations. Specifically, this area includes the Extent of Works outlined in Figure 2, and a 250m ‘buffer zone’ surrounding it; in practice, the model has been extended to include the majority of Greenwich Peninsula and a wider area of Silvertown. This model will be used to provide a reconstruction of the site’s former landscape and its evolution through time, as well as its potential utilisation by prehistoric people. In addition, this landscape will be placed in context with other investigations on the Greenwich Peninsula and in Silvertown.


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Royal Victoria Dock
Silvertown
Millwall
Isle of Dogs
Cubitt Town
New Charlton
Bugsby's Reach
Canary Wharf
West India Dock
Beckton District Park
Exhibition Centre

Figure 1: Location of (1) Silvertown Tunnel (red outline) and other geoarchaeological and archaeological sites nearby: (2) Plot MO117 (JHW13; Young & Batchelor, 2013a); (3) Plot MO115 (Young & Batchelor, 2013b) (4) Tunnel Avenue (GPF12; Batchelor, 2013); (5) Greenwich Millennium Village (Miller & Halsey, 2011); (6) Atlas Wharf (AWF98; Lakin, 1998); (7) Mast House Terrace (MHT95; Bowsher & Wilkinson, 1995); (8) Victoria Deep Water Terminal (TUA02; Corcoran, 2002); (9) Greenwich Peninsula (Corcoran, 2002); (10) Canning Town (Stafford, 2012); (11) Lower Lea Valley Mapping Project (Corcoran *et al*., 2011); (12) Bellot Street (GLB05; Branch *et al*., 2005); (13) 72-88 Bellot Street (BSG93; McLean, 1993; Philp, 1993); (14) Canning Town Regeneration Area 7 & 1C (CTR12; Green & Young, 2012); (15) the Cable Car route (CAB11; Green *et al*., 2011) (A) North Station; (B) North Intermediate Tower; (C) North Tower; (D) South Tower; (E) South Station) (Batchelor *et al*., 2012); (16) Silvertown (BWC96; Wilkinson *et al*., 2000); (17) Fort Street (HW-FO94; Wessex Archaeology, 2000); (18) Greenwich Industrial Estate (GIE02; Morley, 2003); (19) Royal Docks Community School (PRG97; Holder, 1998); (20) Preston Road (PPP06; Branch *et al*., 2007); (21) East India Docks (Pepys, 1665); (22) Plot MO401 (Batchelor, 2014). (23) 105-107 Tarling Road (Batchelor & Young, 2014); (24) St Luke's Square (LUC07; Weale, 2008; Wicks, 2008); (25) Caxton Works (Young, 2014); (26) 118 Victoria Dock Road (Barnett *et al*., 2010); (27) Tidal Basin Road (Young & Batchelor, 2013) and (28) Enderby Wharf (Young, 2013c). ***Contains Ordnance Survey data © Crown copyright and database right [2012]***

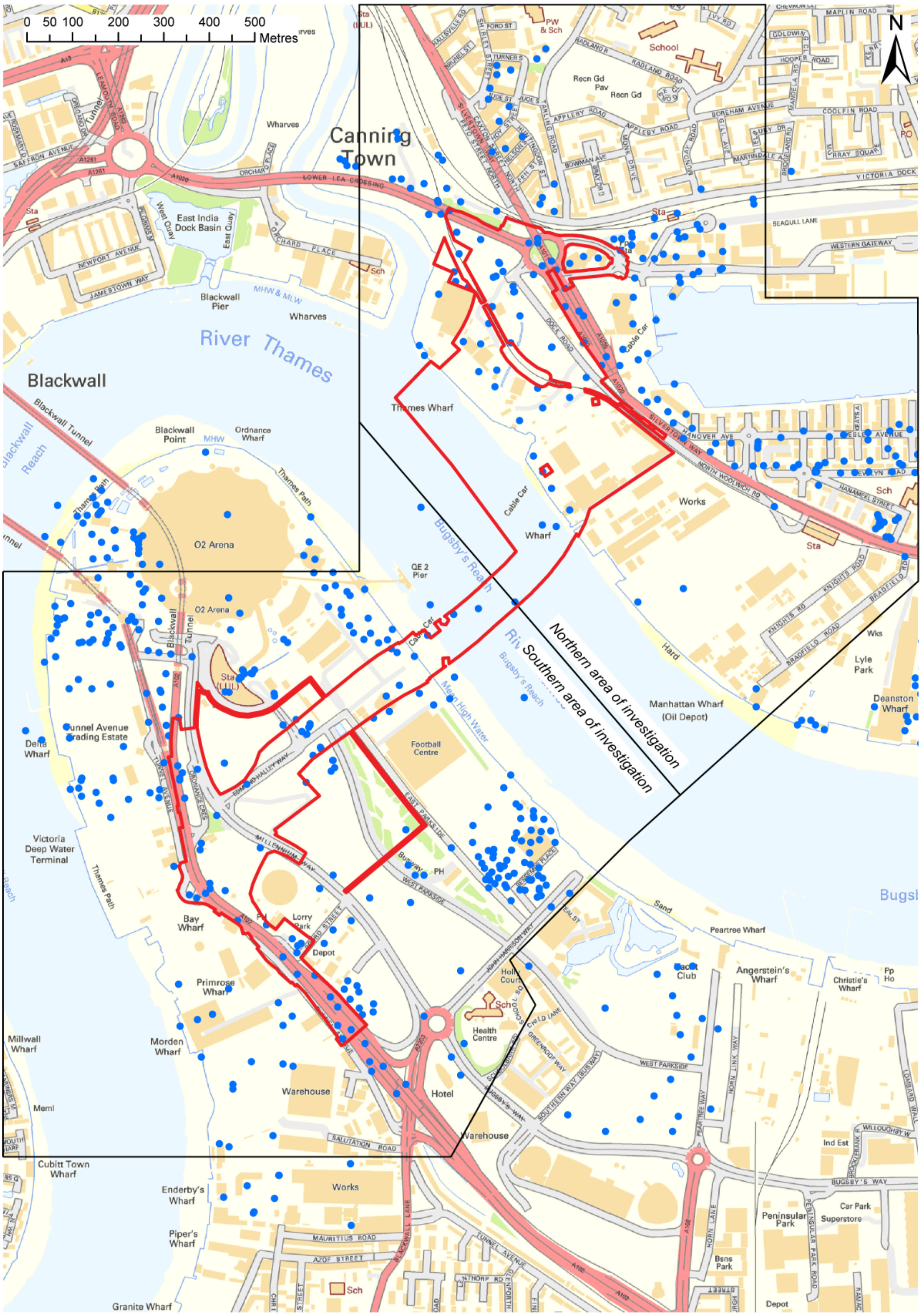

Figure 2: Extent of Works associated with the Silvertown Tunnel (red outline) and all geotechnical and geoarchaeological boreholes included in the deposit model (includes BGS borehole records from www.bgs.ac.uk/opengeoscience). *Contains Ordnance Survey data © Crown copyright and database right [2014]*

METHODS

Deposit modelling

The reconstruction of the sedimentary architecture beneath the site and its immediate surroundings was undertaken using records from a total of 499 boreholes. These records include all available BGS archive boreholes within the area shown in Figure 2 (black outline), and all existing geoarchaeological and geotechnical borehole data currently available within the Quaternary Scientific database and made available by the Greater London Archaeology Advisory Service (see Figure 1). 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. Within the model, six stratigraphic units were recognised: (1) Shepperton Gravel; (2) Sand; (3) Lower Alluvium; (4) Peat; (5) Upper Alluvium and (6) 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. The larger the chosen distance, the less reliable the overall portrayal. In the present case the distance chosen for each data point within the model has been set to a radius of 50m. Because the boreholes are not uniformly distributed over the area of investigation, the reliability of the models is variable. In general, the distribution of boreholes in the northern area of investigation is good, except in the southeast of this area where no boreholes are available (see Figure 2). Gaps in the borehole coverage are also present towards the centre of the southern area of investigation (see Figure 2). 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 AND INTERPRETATION OF THE DEPOSIT MODELLING

The results of the deposit modelling are displayed in Figures 3 to 16; Figures 3 to 8 provide surface elevation and thickness models for each of the main stratigraphic units, whilst Figure 9 shows the location of the two-dimensional stratigraphic profiles shown in Figures 10 to 13. The results of the deposit modelling indicate that the number and spread of boreholes put down across the area of investigation and within its immediate vicinity is sufficient to permit modelling across the majority of the site. However, within both the northern (Silvertown) and southern (Greenwich Peninsula) areas of investigation gaps in the borehole records do exist; particularly in the southern area of investigation, where Edmund Halley Way meets Millennium Way, and in the northern area of investigation towards Bell Lane and on the eastern half of the Thames (see Figures 2 and as demonstrated in Figures 3 to 8).

The Shepperton/Lea Valley Gravel

The lowermost unit recorded is the sand and gravel of the Shepperton Gravel, and in the northern area of investigation the Lea Valley Gravel (Figure 3). These sediments were deposited during the Late Devensian (Marine Isotope Stage 2, *ca*. 16,000-11,500 cal BP), within a high energy braided river system.

Silvertown

In the northern area of investigation, the surface of the Lea Valley Gravel generally lies between -4 and -2m OD. Higher gravel surfaces are recorded towards the south of this area in boreholes 37NE28 (1.29m OD) and TQ38SE407 (1.52m OD); however, these surfaces are considered most likely to represent an error in description or interpretation. Elsewhere the model demonstrates that the gravel surface falls towards the south (see Figure 12/Transect C) to below -4m OD in boreholes NTBH02, TQ38SE1012 and TQ38SE1011 (on the margins of the Thames). A linear depression is apparent, following a line just beyond the northern edge of the site. Eastward this depression curves round towards the south with a slightly sinuous course, so that it lies approximately 200m from the site's eastern edge (see Figures 3 and 13/Transect D). Within this depression the gravel surface falls below -4m OD, recorded in boreholes TQ38SE1290 (-4.89m OD), at Victoria Dock Road Trenches 1 and 2 (-4.95m OD; Barnett *et al*., 2010), TQ48SW1839 (-4.53m OD), NSBH01A (-4.78m OD) and TQ48SW2070 (-4.94m OD). It is possible that this feature represents a palaeochannel, perhaps a former meander or subsidiary channel of the River Lea.

Greenwich Peninsula

In the southern area of investigation the Shepperton Gravel surface generally lies at between

-1.5 and -3m OD. The highest points on the gravel surface are recorded towards the centre of this area, in boreholes TQ37NE1689 (-1.57m OD), TQ37NE1691 (-1.65m OD) and TQ37NE1694 (-0.94m OD) (See Figures 3 and 10/Transect A). Elsewhere, the Gravel surface is recorded fairly consistently between -2 and -3m OD, except where it falls towards the Thames in borehole TQ37NE28 (-5.0m OD; see Figure 11/Transect B) and in one borehole towards the south of this area (TQ38SE710; -4.76m OD). However, it is of note that as stated above, relatively few borehole records are available for the eastern part of this area, resulting in significant gaps in the modelled surface of the gravel.

Holocene Alluvium

On the basis of the borehole records, it is possible to recognise four sediment types in the Holocene alluvial sequence, forming Units 2, 3, 4 and 5 of the present account:

(Unit 6) - Made Ground

(Unit 5) - Upper Alluvium

(Unit 4) - Peat

(Unit 3) - Lower Alluvium

(Unit 2) - Sand

(Unit 1) - Shepperton/Lea Valley Gravel

As outlined in the introduction, the different alluvial units recorded are significant as they show that environmental conditions varied over space and time. For example, the Peat (Unit 4) represents former semi-terrestrial conditions supporting fen or swamp vegetation, whilst the Sand, Lower and Upper Alluvium represent periods of inundation/flooding by estuarine or fluvial waters. The overall thickness of the Holocene Alluvium (Figure 7) is controlled quite closely by the topography of the surface of the underlying Shepperton Gravel (Figure 3), but there are local variations in the development of the four units forming the sequence.

The Sand (Unit 2) is the lowest unit in the Holocene alluvial sequence and where present, it rests directly on the surface of the underlying Shepperton Gravel. This unit is recorded in only two boreholes in the northern area of investigation, towards the northwest of this area (in thicknesses of up to 0.9m; TQ38SE1290); and in occasional records within the southern area of investigation in thicknesses up to 3.8m (see Figures 4 and 10/Transect A). In general the surface of this unit lies below -2m OD. Whilst the Sand has been recognised as a separate unit in other nearby deposit models (e.g. the Millennium Festival site), it should be noted that such separation can rarely be carried out confidently during the course of geotechnical investigations, due to the nature of the coring method and less precise method of description. Where it is identified, it can be interpreted as being deposited under low to moderate energy fluvial conditions, perhaps within former channels.

The Lower Alluvium (Unit 3) is present in fewer than half the boreholes, resting directly on the surface of the Shepperton Gravel or on the Sand. It is often sandy, especially in its lower part and is interpreted (Corcoran, 2002) as having accumulated during the Early to Middle Holocene (Mesolithic cultural period), within a fluvial or estuarine environment. It is generally less than 2.0m in thickness, but there are isolated areas where greater thicknesses are present. This Unit is present more frequently in the south of the southern area of investigation (e.g. boreholes TQ37NE710/TQ37NE38; see Figure 10/Transect A), and in the north of the northern area of investigation (see Figure 12/Transect C).

In the majority of boreholes in the southern area of investigation, a bed of Peat (Unit 3) was recorded either overlying the Lower Alluvium or resting directly on the Shepperton Gravel (see Figures 5, 10 and 11). The Peat here is present in thicknesses of up to 2.0m and its surface generally lies at elevations between 0.0 and -3.0m OD; it is entirely absent in only three boreholes in the central part of the site (TQ37NE2108, TQ37NE1689 and TQ37NE1695). In contrast, peat was recorded in only three boreholes within the northern area of investigation (Silvertown; TQ38SE1499, TQ38SE3704 and TQ38SE407), in thicknesses of up to 1.5m and generally present with a surface at levels between -2.0 and -3.5m OD. Notably, the model of the peat thickness (Figure 5) indicates that greater thicknesses of peat are present more frequently within the linear depression identified in the gravel surface (see above). In both areas, the accumulation of peat represents a transition to semi-terrestrial conditions, supporting the growth of wetland vegetation and forming a land surface which might have been utilised by prehistoric people.

The silty clay Upper Alluvium (Unit 4) overlies the Peat where it is present, and the gravel or Sand/Lower Alluvium elsewhere. It indicates deposition from standing or slow moving floodwater. The surface of the Upper Alluvium across the area of investigation is generally recorded at between 1.0 and 0.0m OD (Figure 6). In some boreholes a horizon of peat is recorded within the Upper Alluvium, generally up to 0.5m thick and fairly consistently present at elevations between *ca*. -0.5 and 0.3m OD (e.g. TQ38SE748, SEBH28, TQ37NE2109 and TQ37NE1472; see Figure 6), indicative of a second, later transition to semi-terrestrial conditions. The total thickness of the Holocene Alluvium (incorporating Units 2 to 5) is shown in Figure 7. In the southern area of investigation thicknesses of between 2 and 4m are recorded, whilst in the northern area between 3 and 8m are recorded.

A horizon of Made Ground (Unit 6) caps the site, generally present in thicknesses of between

1 and 4m and in places up to 6m (Figure 8).

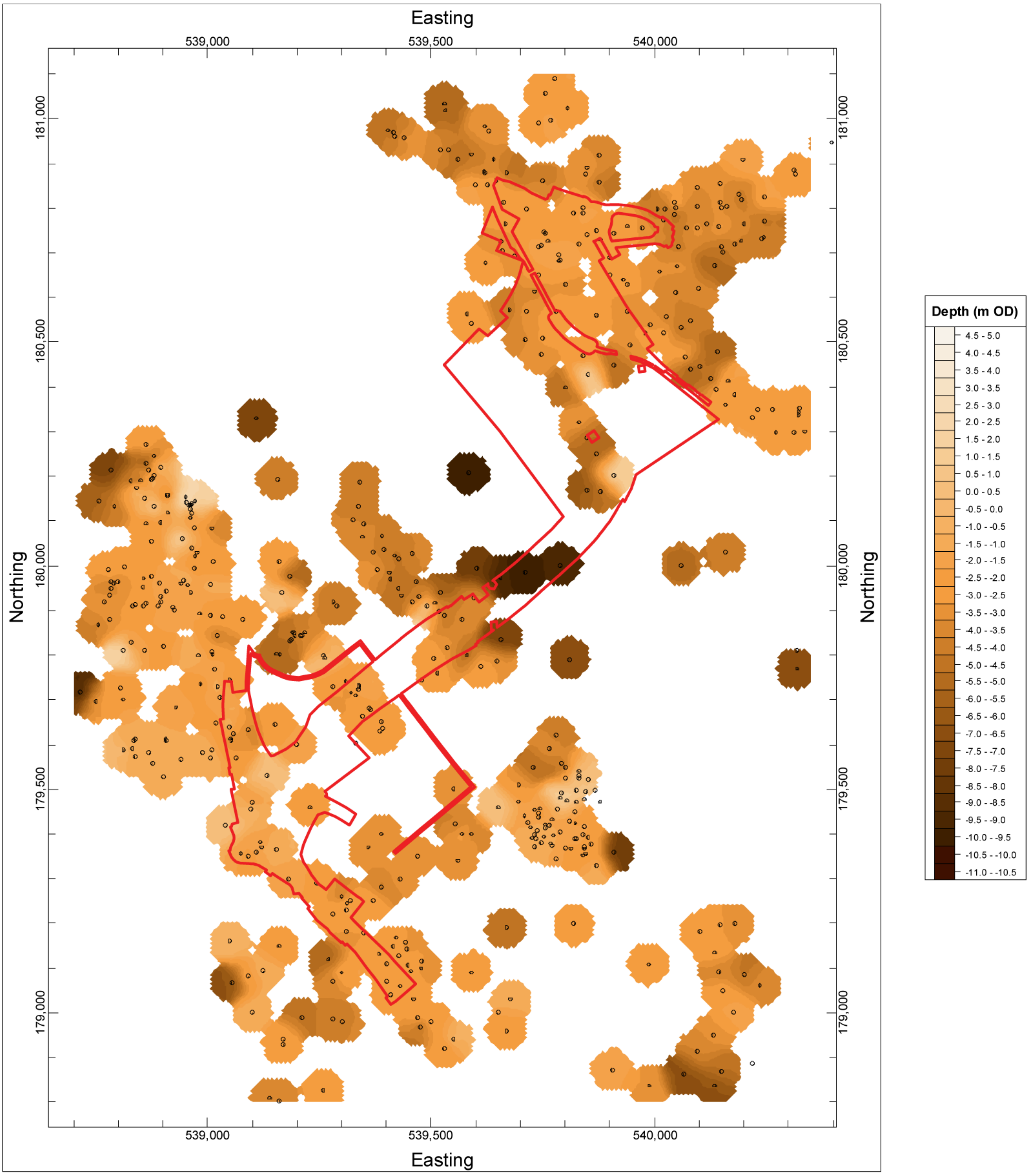

Figure 3: Modelled surface of the Shepperton Gravel (metres OD)

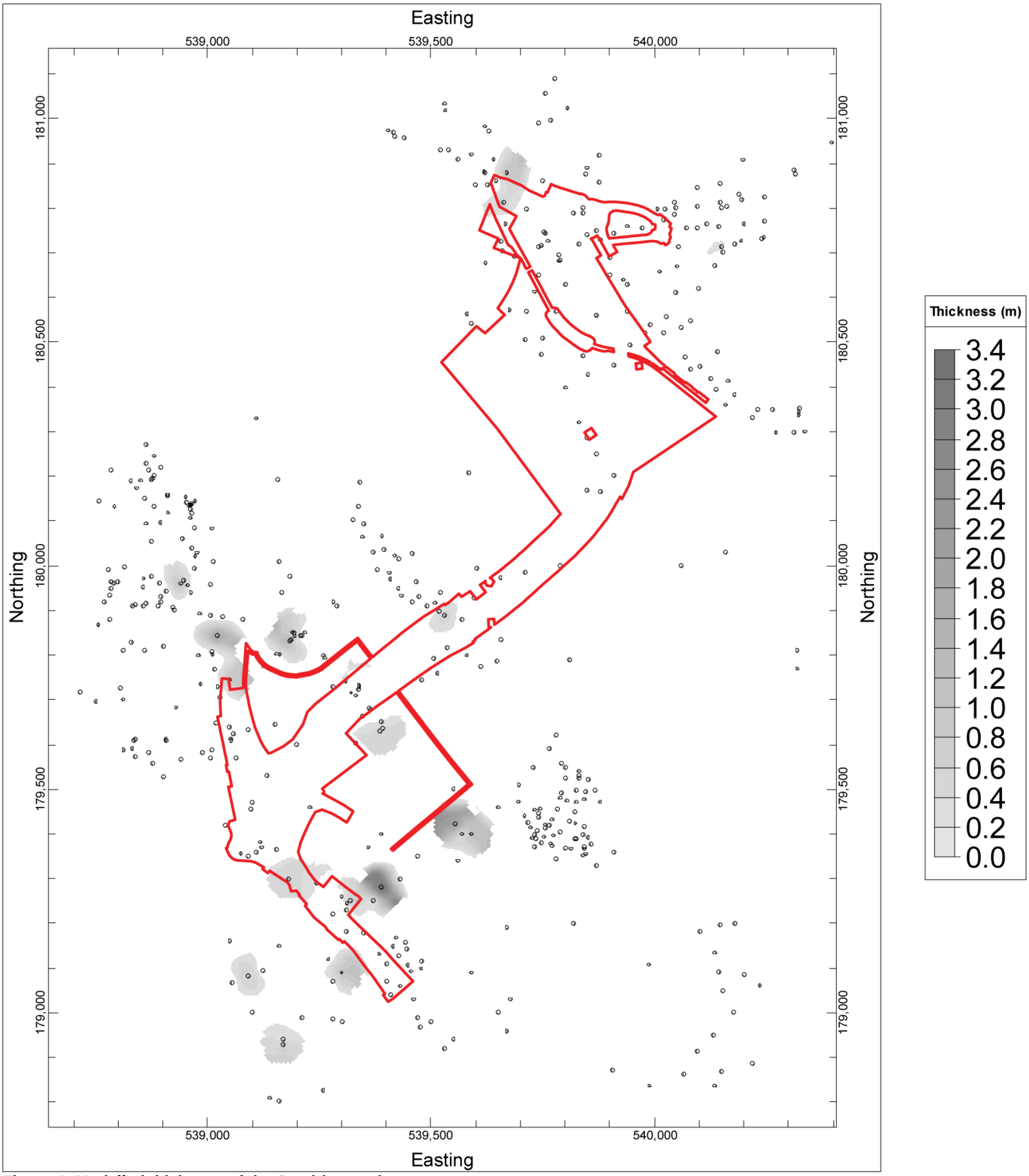

Figure 4: Modelled thickness of the Sand (metres)

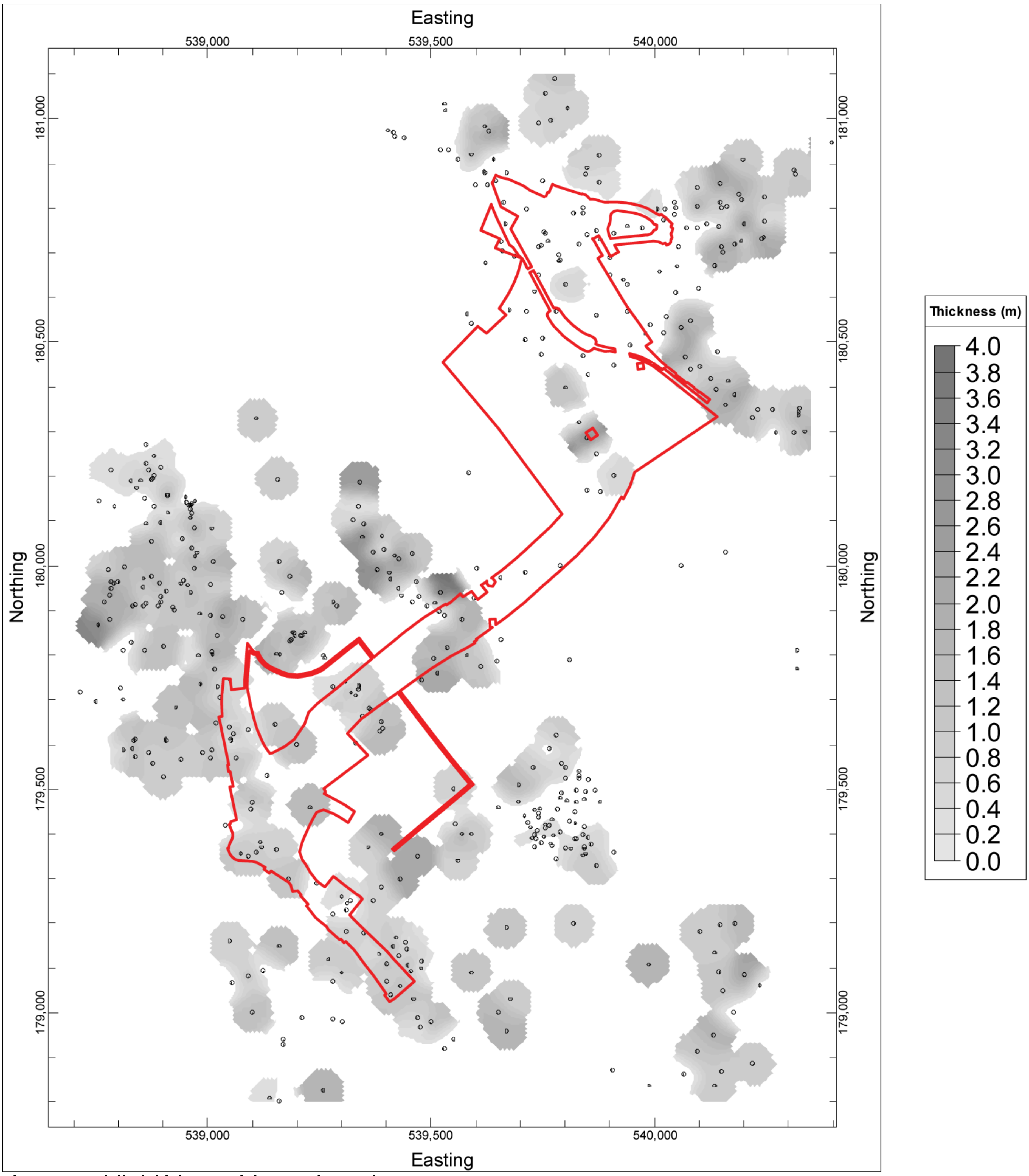

Figure 5: Modelled thickness of the Peat (metres)

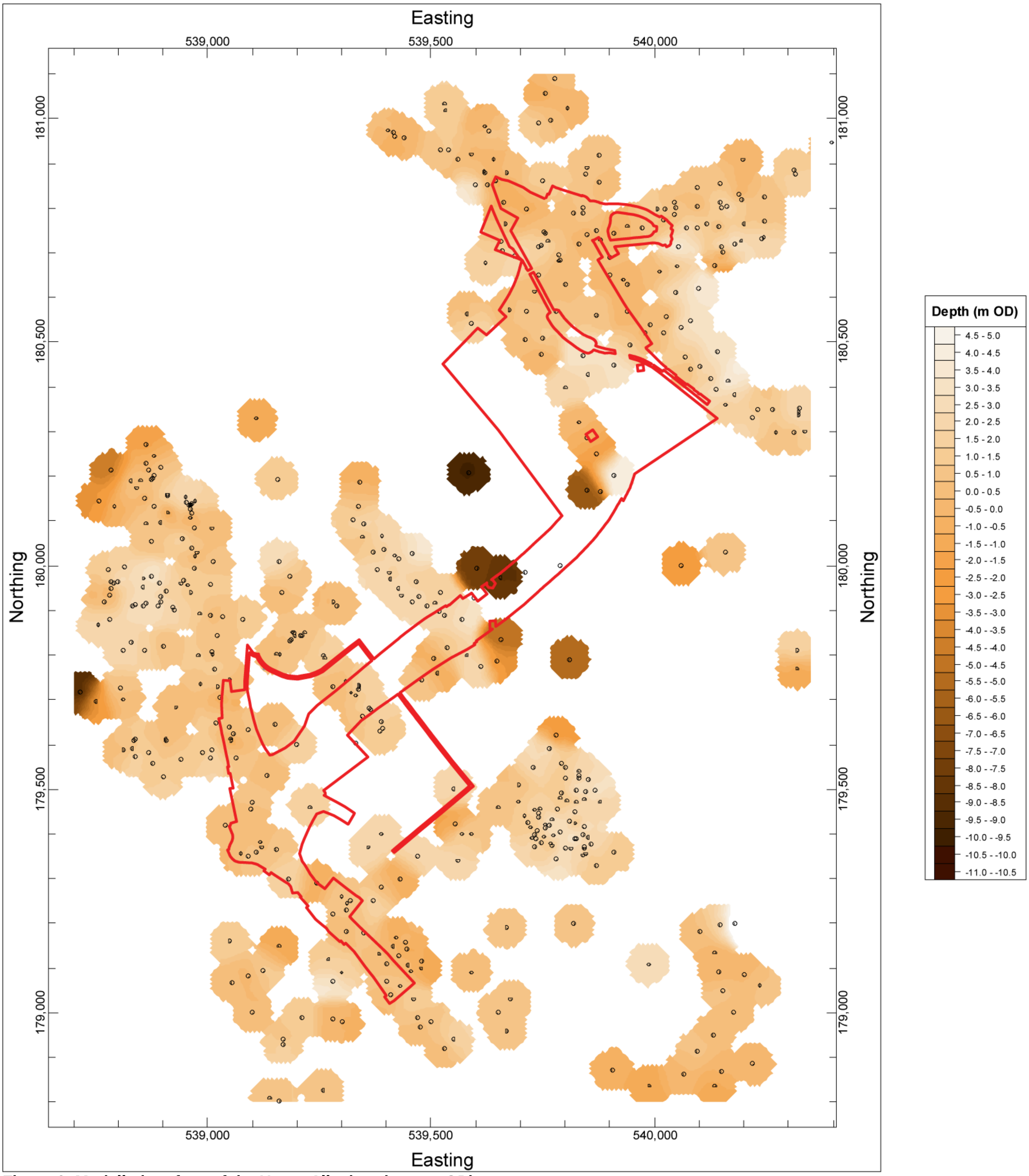

Figure 6: Modelled surface of the Upper Alluvium (metres OD)

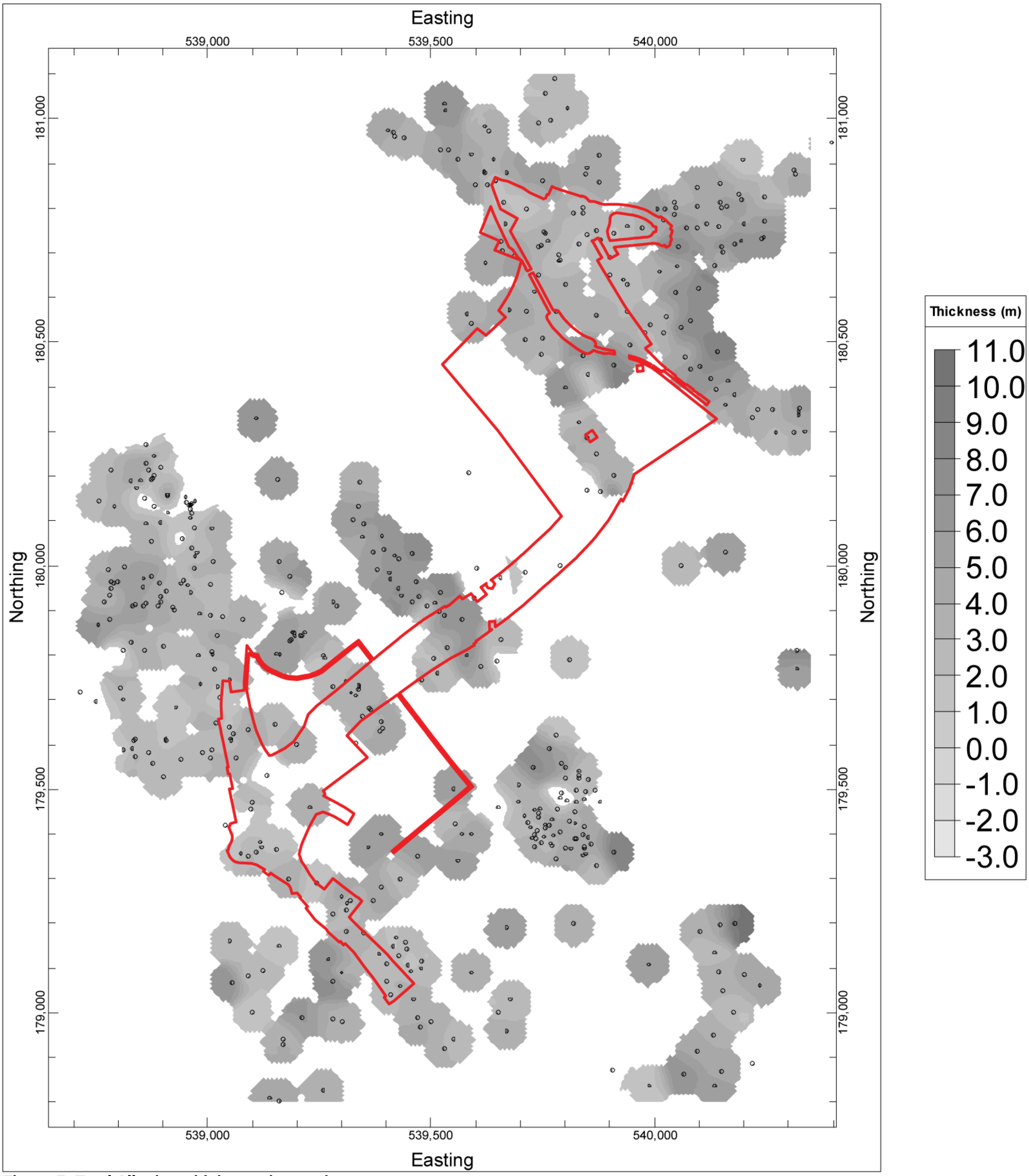

Figure 7: Total Alluvium thickness (metres)

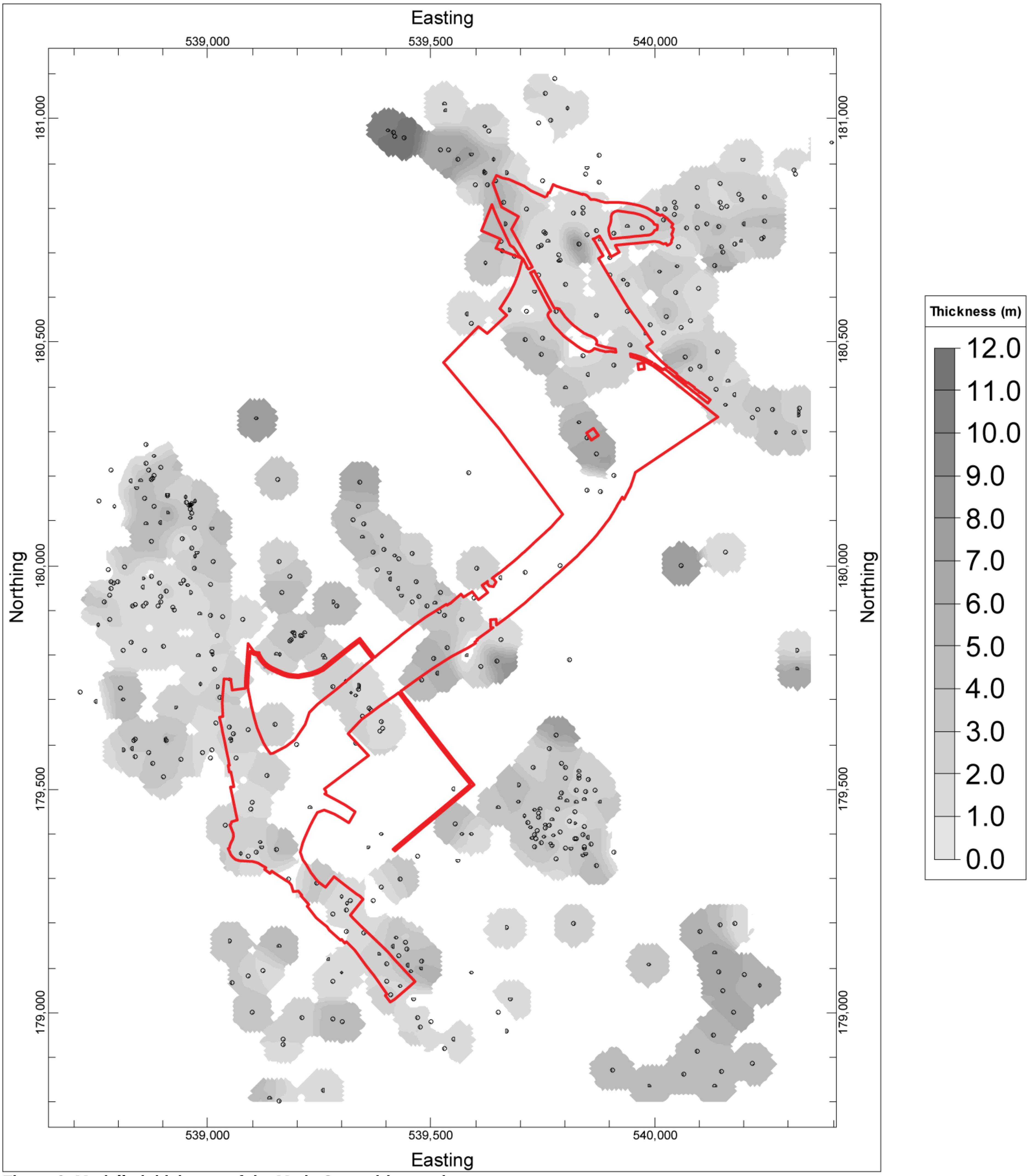

Figure 8: Modelled thickness of the Made Ground (metres)

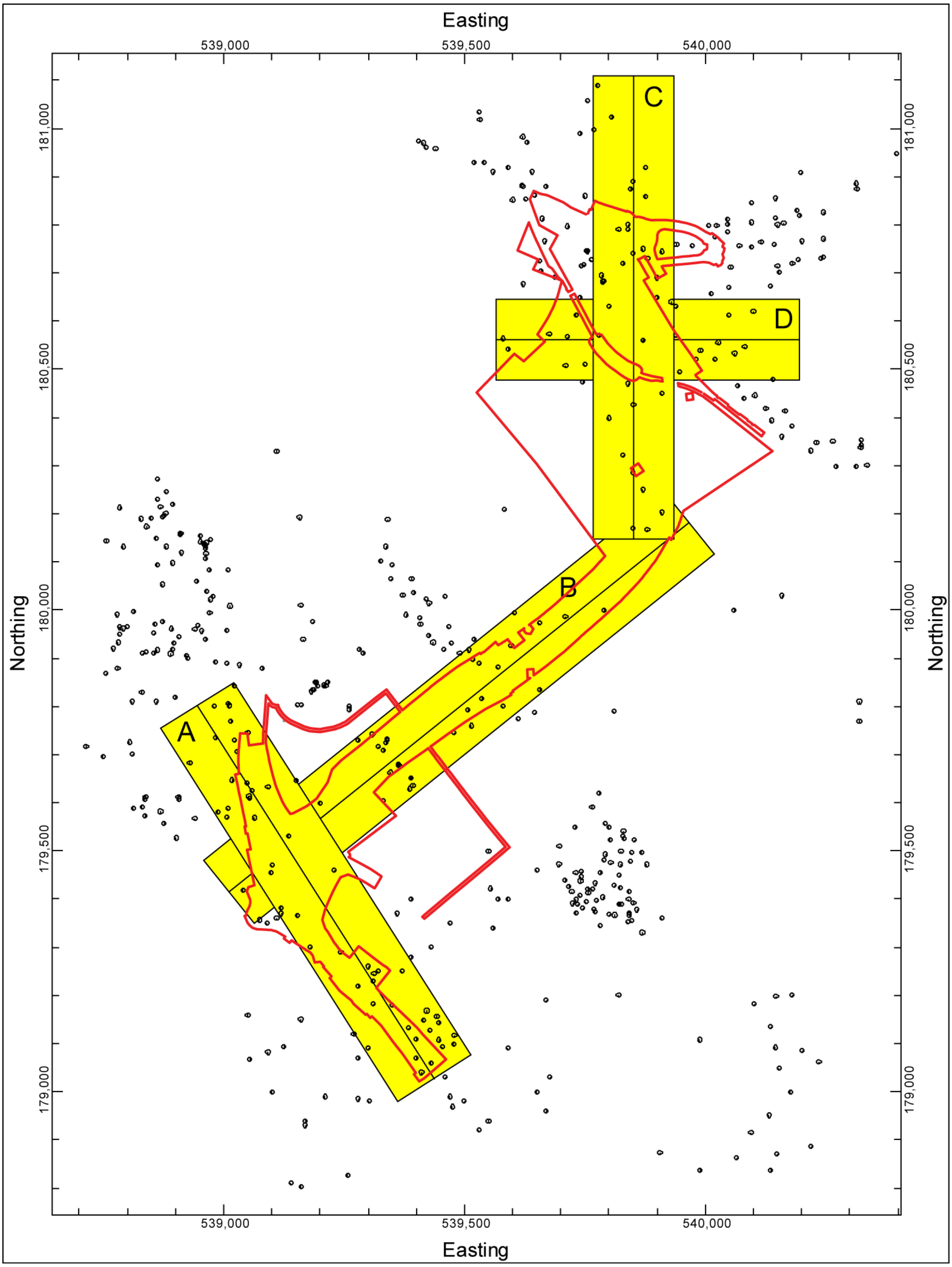

Figure 9: Map showing the location of Transects A to D

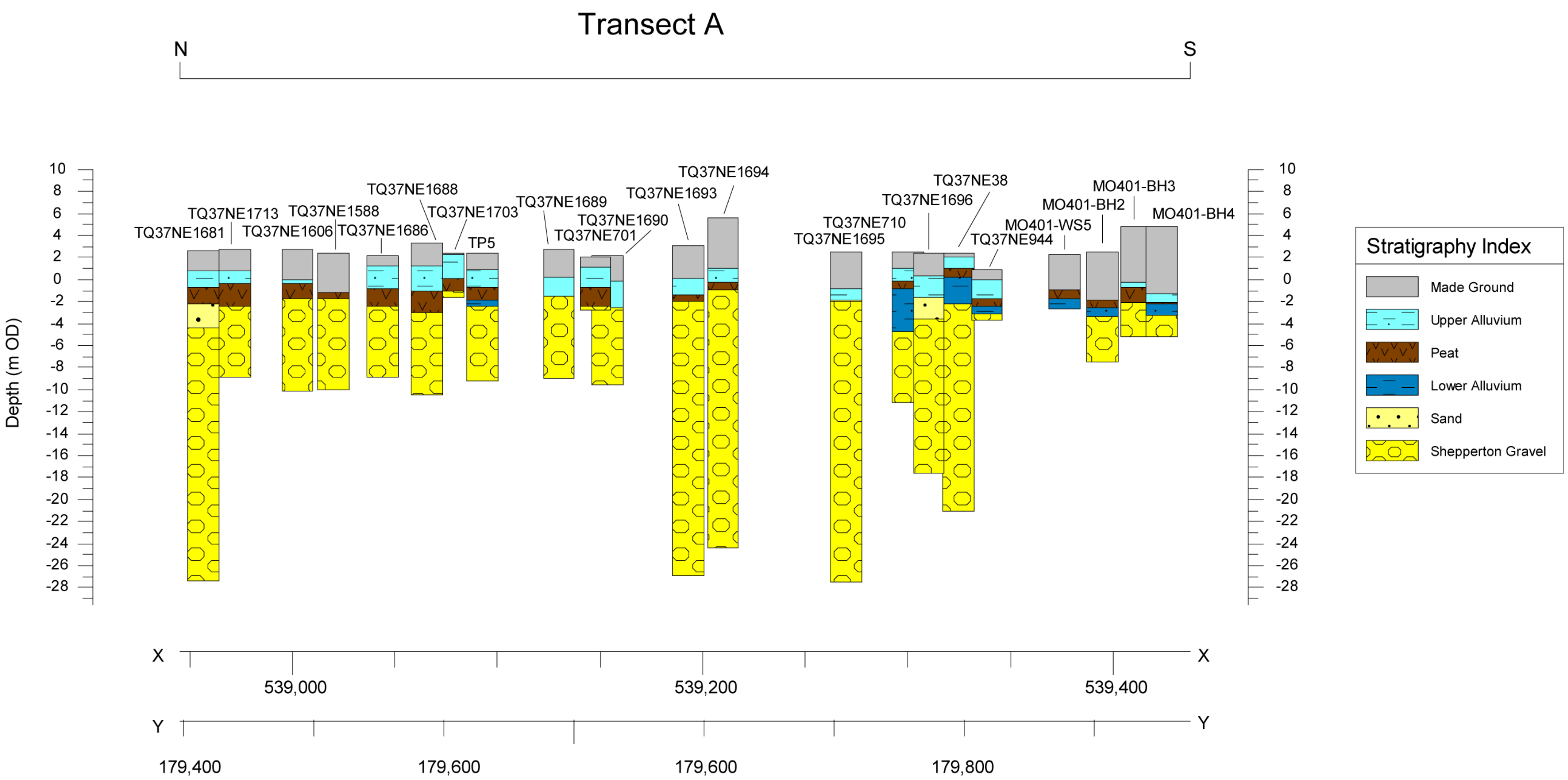

Figure 10: Transect A

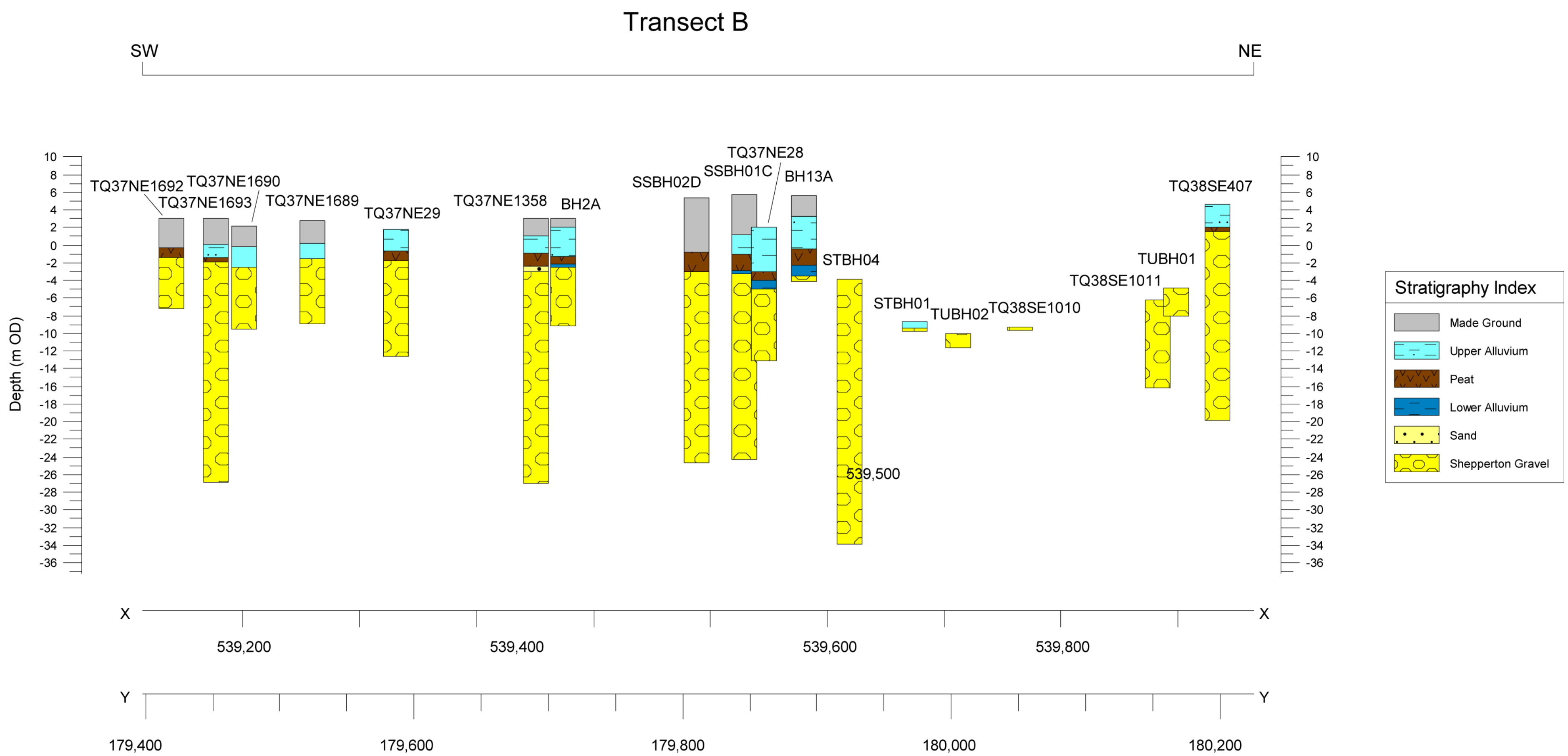

Figure 11: Transect B

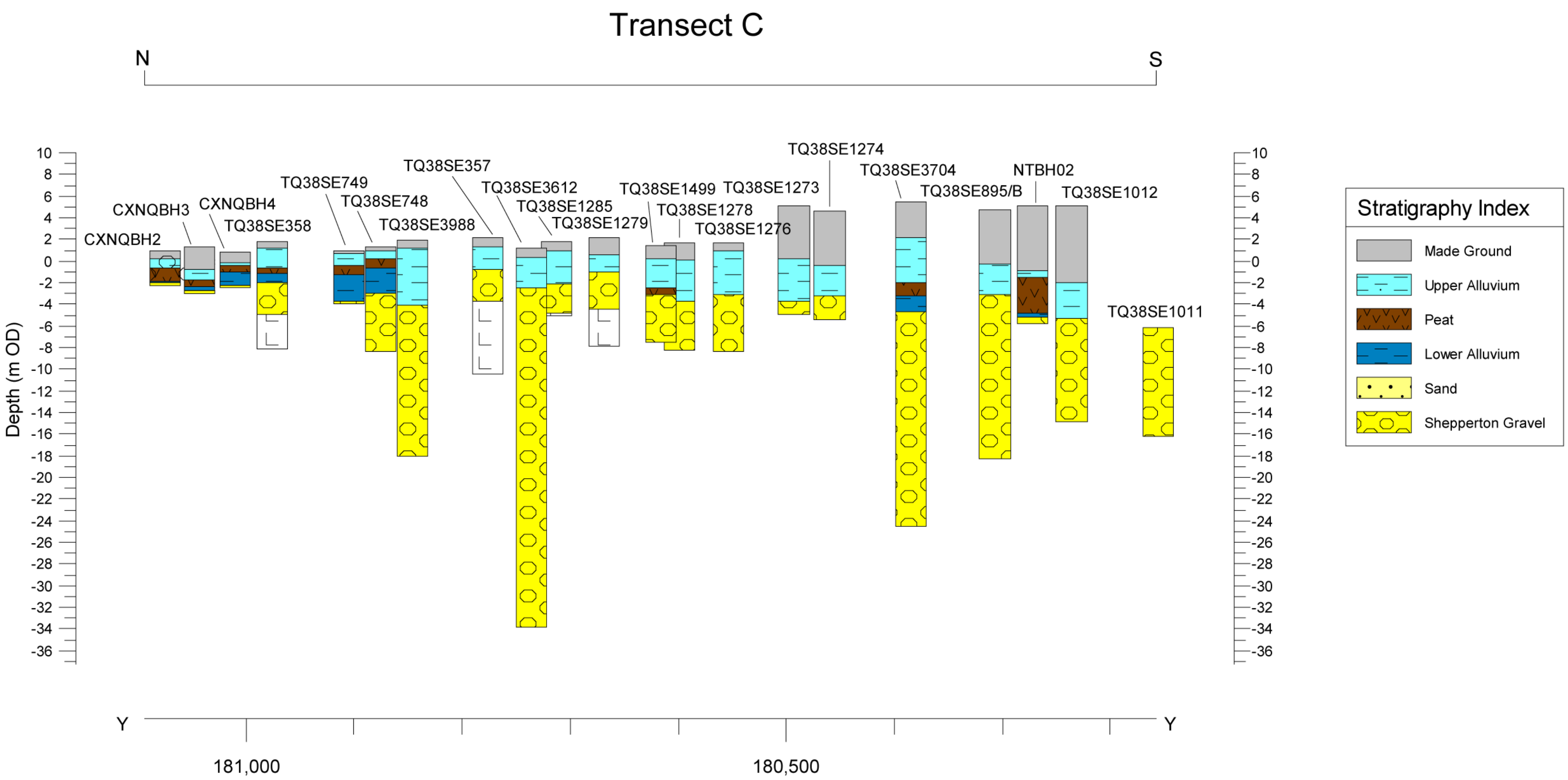

Figure 12: Transect C

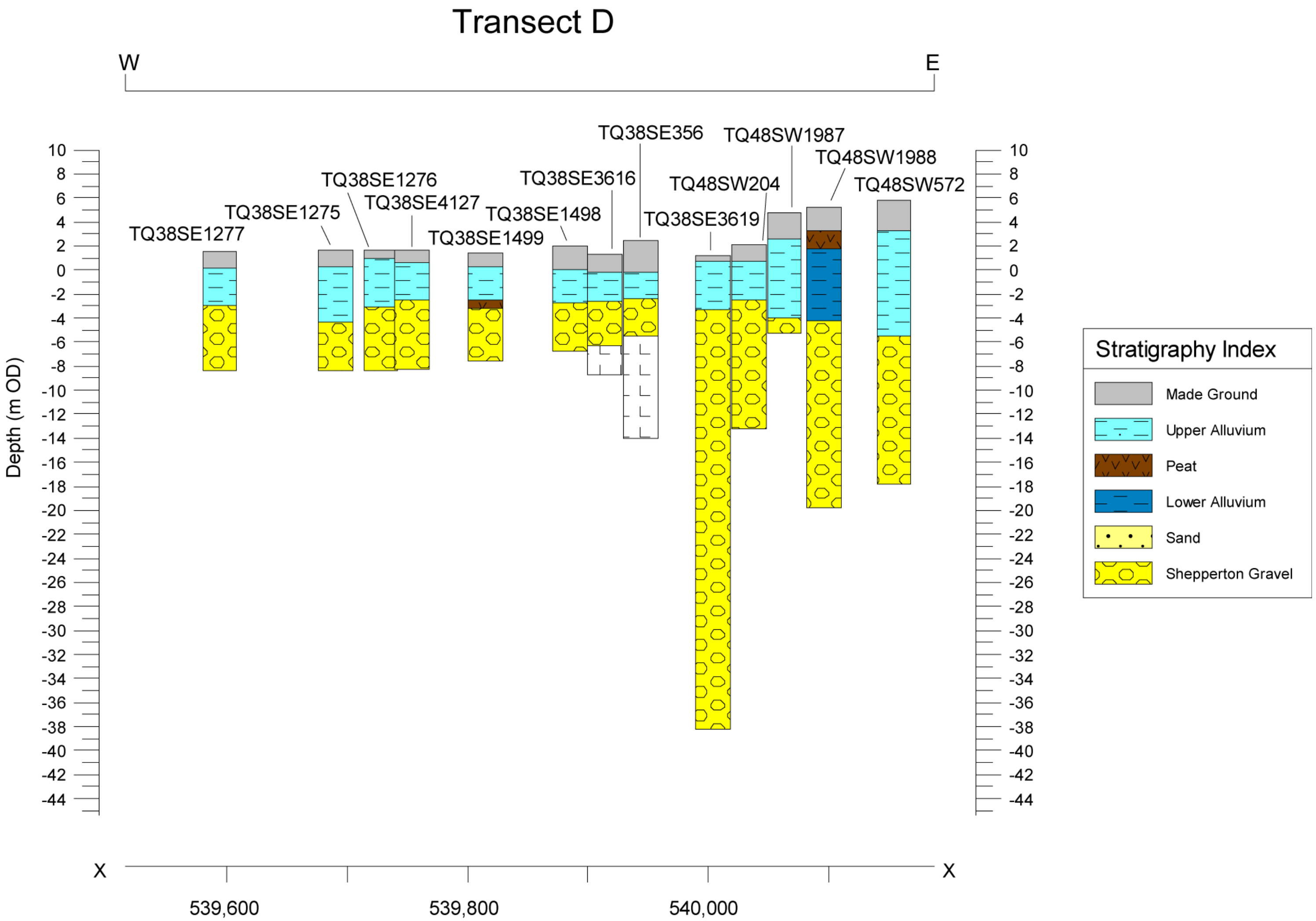

Figure 13: Transect D

DISCUSSION

The results of the deposit modelling indicate that the sediments recorded across the area of investigation are similar to those recorded elsewhere in the Lower Thames Valley, with a sequence of Late Devensian (Marine Isotope Stage 2, *ca*. 16,000-11,500 cal BP) Shepperton Gravel, and in the northern area of investigation, Lea Valley Gravel of equivalent age, overlain by Holocene Alluvium and capped by Made Ground.

Northern area of investigation (Silvertown)

The northern area of investigation was underlain by Lea Valley Gravel with an upper surface lying at between -2.0 and -4.0m OD, with an indication in the models that the Gravel surface falls below -4m OD towards the south, near the margins of the Thames. Peat was not widely present, being recorded in only three boreholes within the area of the site (TQ38SE1499, TQ38SE3704 and TQ38SE407, generally present between -2.0 and -3.5m OD). The results of the modelling are therefore broadly consistent with the findings of Corcoran *et al.* (2011) in the Lower Lea valley and with their inclusion of the area around the site in their Landscape Zone 1.1, where the surface of the gravel is described as undulating between *ca*. -3 and -5m OD and the Holocene Alluvium is described as ‘commonly clayey and generally *ca*. 4m thick, with some silts and sands within the alluvium but with only very occasional evidence of peat’. Beyond the margins of the site a linear depression in the gravel surface (<4m OD) is apparent, following a line just beyond its northern edge. Eastward the depression curves round towards the south so that it lies approximately 200m from the site's eastern edge. This feature is interpreted as a possible palaeochannel associated with the River Lea, perhaps a former meander or subsidiary channel. The deposit model shows that peat is more frequently recorded within this depression.

The recorded levels of the gravel surface are generally consistent with those levels recorded *ca*. 200m to the north at Caxton Works (-1.80 to -2.78m OD; Young, 2014), St Luke’s Square (-1.75 to -2.03m OD; Weale, 2008) and Tarling Road (-2.29 to -2.86m OD; Batchelor & Young, 2014). At Caxton Works (as shown in Figure 5) Peat was recorded, generally at between *ca*. -0.2 and -1.9m OD and consistent with peat horizons recorded at the nearby St Luke’s Square (Wicks, 2008; -2.03 to -0.61m OD) and Tarling Road sites (Batchelor & Young, 2014; -1.5 to -2.0m OD). At St Luke’s Square the Peat was radiocarbon dated to between 5660–5580 (middle Neolithic) and 3570-3440 cal BP (middle Bronze Age) (Wicks, 2008). Significantly, the pollen record from this site contains evidence for the well-documented Neolithic lime decline (e.g. Thomas & Rackham, 1996; Sidell *et al*., 2000). Peat of very similar age and elevation was identified at the Tarling Road site, where it was recorded at between *ca*. -1.5 and -2.0m OD and radiocarbon dated to between 5730-5600 cal BP and

3630-3460 cal BP (Batchelor & Young, 2014). Here, possible evidence of human activity was recorded in conjunction with a possible decline in elm populations towards the base of the Peat (possible evidence of the early Neolithic elm decline), whilst a decline in lime was recorded towards the middle of the Peat, with persuasive evidence of human activity. A saline influence recorded towards the top of the Peat.

No peat horizons were recorded during geoarchaeological investigations at the Tidal Basin Road site (immediately to the east of the present area of investigation; Young & Batchelor, 2013a), where the Lea Valley Gravel surface lay at between *ca*. -2.5 and -3.5m OD. However, variable thicknesses and generally localised areas of peat were recorded in BGS borehole records to the north and north east of this site, and at Victoria Dock Road (*ca*. 50m to the north; Barnett *et al*., 2010), where peat horizons radiocarbon dated to the Early Neolithic (5440-5650; 5300-4980 cal BP) and Middle Bronze Age (3350-3080 cal BP) were recorded. Around 800m to the north of the present site, no peat horizons were recorded at Canning Town Regeneration Area 7/1C (Green & Young, 2011), where the gravel surface fell northwards from -0.5 to -2.81m OD and was overlain by a single unit of inorganic Alluvium. However, immediately to the north of this site at Rathbone Market (Young *et al*., 2013) a depression in the gravel surface (-3.81m OD) was recorded to the west of the site, and was thought likely to represent the palaeochannel recorded by Stafford (2012) along the Ironbridge-Canning Town section of the A13 and containing peat horizons up to 3m in thickness.

Southern area of investigation (Greenwich Peninsula)

In the southern area of investigation the surface of the Shepperton Gravel was recorded at between *ca*. -1.5 and -3m OD, with lower surfaces recorded in only two boreholes (where the gravel falls towards the Thames, in borehole TQ37NE28 (-5.0m OD) and in one borehole towards the south, TQ38SE710 (-4.76m OD). The results of the modelling exercise for Greenwich Peninsula enhance the results of a similar investigation carried out by MoLAS (Corcoran, 2002). In their investigation, four landscape zones were identified as follows: Landscape Zones A and B represented areas of high (LZ-A = >-2m OD) and moderately high (LZ-B = -2 to -4m OD) gravel surface, and surfaces below -4m OD adjacent to the River (Landscape Zone C) and cut off from the river (Landscape Zone D). The majority of the present area of investigation lies within Corcoran’s (2002) Landscape Zones A and B; the new model for the gravel surface is thus consistent with the existing model.

At the MO401 site (Batchelor, 2014), immediately to the southeast of the present site the gravel surface was recorded at between -2 and -3.5m OD, whilst at the MO115 site (Young and Batchelor, 2013a), Tunnel Avenue (Batchelor, 2013) and Victoria Deep Water Terminal (Corcoran, 2002) sites it was recorded at between -1 and -1.7m OD. Towards the north-east of the Tunnel Avenue site however, the Shepperton Gravel surface drops to below -4m OD. It does the same towards the west of the Cable Car South Station site (Green *et al*., 2011), south-west and south-east of MO115, and in the far south-eastern corner of the modelled area at Greenwich Millennium Village (Miller & Halsey, 2011).

Peat was recorded within the Holocene Alluvium across the southern area of investigation, present in thicknesses of up to 2.0m and generally lying at elevations between 0.0 and -3.0m OD. It was absent entirely in the area of only three boreholes in the central part of the site: TQ37NE2108, TQ37NE1689 and TQ37NE1695 (see Figure 5). Where the Peat is recorded it is representative of a transition to a semi-terrestrial environment, supporting the growth of wetland vegetation. 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 (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). A similar range of ages might be expected for the Peat horizons within the southern area of investigation.

CONCLUSIONS AND RECOMMENDATIONS

The aim of this report was to produce a model of the sub-surface stratigraphy of the site: (1) to provide a reconstruction of the site's former landscape and its evolution through time, as well as its potential for exploitation by prehistoric people; and (2) to provide recommendations on the need for further geoarchaeological investigations at the site. The results of the deposit modelling have revealed a sequence of Shepperton Gravel/Lea Valley Gravel overlain by Holocene Alluvium, in places containing Peat, and Made Ground. In the northern area of investigation (Silvertown) the existing boreholes are well distributed, so that a model of the Lea Valley Gravel surface for the majority of this area can be produced; in addition, peat is only rarely recorded in this area and appears to be confined to localised parts of the site. There is therefore no case for further geoarchaeological investigation of this part of the site.

However, in the southern area of investigation (Greenwich Peninsula) significant gaps are present in the distribution of the borehole records (e.g. between Edmund Halley Way and Millennium Way), meaning that the surface of the gravel and thickness and surfaces of the Holocene alluvial units cannot be modelled. Furthermore, peat is recorded in all but three of the existing borehole records for this area of the site. Where peat is recorded it represents a transition to semi-terrestrial conditions and a land surface which might have been utilised (or even permanently occupied) by prehistoric people. In addition, peat may contain evidence for such human activity and for environmental changes that took place here during the Holocene period.

It is therefore recommended that additional geoarchaeological investigations are undertaken within the southern area of the site (Greenwich Peninsula), in order (1) to understand the depth and thickness of the major stratigraphic units in areas where few boreholes are currently available; and (2) to investigate the environmental record and any evidence of human occupation preserved in the Peat horizons that are recorded within this area of the site.

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APPENDIX

Table A1: Boreholes used in the deposit model for the Silvertown Tunnel.

Name	Easting	Northing	Elevation (m OD)
Site specific georchaeological/geotechnical boreholes			
AH1 Tr2	539532	181019	2.75
AH2 Tr1	539530	181034	2.75
BH10-2011	538830.63	179591.7	4.61
BH11-2011	538837.02	179573.32	4.49
BH13-2011	538812.26	179588.74	1.66
BH13A	539569	179881	5.64
BH1A-2011	538812.94	179997.36	5.65
BH205.1A	539337.37	180132.09	5.62
BH205.2	539347.72	180064.9	5.64
BH205.3	539394.93	180036.95	5.76
BH205.4	539390.28	180065.76	5.62
BH205.5	539325.45	180102.57	5.55
BH206.1	539426.81	180014.36	5.69
BH206.2	539408.57	179971.32	5.72
BH206.3	539435.05	179932.88	5.61
BH207.1	539472.13	179931.5	5.3
BH207.2	539509.17	179917.51	6.14
BH207.3	539530.61	179889.73	6.15
BH2A	539339	179729	2.98
BH2C-2011	538971.08	179994.61	4.87
BH3A-2011	538790.76	179961.93	4.99
BH4A	539364	179678	3.04
BH6A	539390	179652	3.1
BH7-2011	538755.27	179868.66	2.8
BH802	538873.93	179976.86	4.106
BH803	538906.71	179944.1	4.092
BH804	538831.75	179910.64	4.078
BH805	538862.19	179917.21	4.615
BH806	538892.06	179961.53	5.113
BH807	538954.6	179956.83	3.419
BH808	538894.02	179919.26	4.172
BH809	538921.9	179905.98	4.162
CABSSDS04	539478.67	179745.07	5.05
CH56R	539415	180970	11
CH57R	539440	180958	11
CH61R	539420	180960	11
CH85R	539405	180974	10.5
CRB242	539876	180919	1
CRB276	540397	180947	2
CRCH22	540199	180908	1.5
CRCH23	540315	180875	2

CRWS26	540313	180886	2.5
CXNQBH2	539776.6	181089.5	1
CXNQBH3	539754.8	181057	1.3
CXNQBH4	539805.6	181023.8	0.8
CXNQBH5	539768.7	180997.4	1.3
EWBH1	539161	178803	2.25
EWBH2	539258	178827	1.9
GMVBH3/1	540102	179182	5.8
GMVBH3/10	540153	179049	6.7
GMVBH3/11	540177	179000	6.5
GMVBH3/2	540147	179198	6.5
GMVBH3/4	540136	179135	6.3
GMVBH3/7	540145	179092	6
GMVBH3/8	540201	179085	5.8
GMVBH4/10	540065	178863	3.9
GMVBH4/11	540136	178837	3.4
GMVBH4/2	540132	178951	5.5
GMVBH4/4	540095	178915	5.2
GMVBH4/7	540149	178870	3.9
GMVBH4/8	539906	178873	3.6
GMVBH4/9	539989	178837	3.4
GMVBH5/2	540236	179062	5.7
GMVBH5/5	540220	178886	4.3
MO114BH001A	539709.3	179440.2	5.05
MO114BH002	539731	179454.2	5.37
MO114WS001B	539696.5	179472.3	5.38
MO114WS003	539716.6	179426.3	5.01
MO115BH1	539746	179381	5.2
MO115BH2	539741	179438	5.41
MO115BH3	539768	179379	5.58
MO115BH4	539753	179394	5.32
MO115BH5	539735	179389	5.2
MO115BH6	539723	179415	4.86
MO115BH7	539756	179421	5.63
MO115BH713	539739	179407	5.7
MO115BH714	539771	179373	5.89
MO115QBH1	539732.01	179398.95	4.4
MO115QBH2	539757.1	179413.97	4.63
MO115QBH3	539741.82	179446.1	4.62
MO117BH1	539858	179378	6.15
MO117BH2	539843	179371	6.3
MO117BH3	539812	179367	6.3
MO117BH4A	539839	179352	6.2
MO117BH5	539843	179367	6.2
MO117BH6	539851	179393	6.25
MO117BH719	539826	179390	6.85
MO117BH720	539847	179355	5.23

MO117BH7A	539825	179389	6.3
MO117BH8	539841	179399	6.3
MO401-BH1	539414.5	179149.5	2.93
MO401-BH2	539446.9	179143.5	2.56
MO401-BH3	539447.6	179107.7	4.75
MO401-BH4	539477.8	179099.3	4.75
MO401-WS1	539442.7	179157	2.45
MO401-WS2	539479.1	179116.7	4.73
MO401-WS3	539453.9	179093	4.82
MO401-WS4	539427.5	179127.4	3.66
MO401-WS5	539421.7	179168.2	2.3
NSBH01A	540152.83	180702.12	4.87
NSBH02	540135.76	180672.33	-5.52
NTBH02	539850.35	180286.36	5.16
PQBH01	538804.18	179725.77	5.272
PQBH02	538810.7	179701	4.92
SEBH10A	539321	179716	3.05
SEBH13A	539569	179881	5.64
SEBH1A	539309	179742	2.93
SEBH28	539420	180023	5
SEBH2A	539339	179733	2.99
SEBH3A	539332	179710	2.93
SEBH4A	539362	179681	3.04
SEBH5A	539346	179663	2.98
SEBH6A	539389	179652	3.15
SEBH7A	539393	179636	3.35
SSBH01C	539535.75	179817.14	5.72
SSBH02D	539513.84	179759.81	5.31
SSBH03	539507.18	179793.44	5.34
SSDS04	539478.67	179745.07	5.05
STBH01	539655.23	179973.19	-8.72
STBH02	539603.46	179994.39	-5.88
STBH03	539656.99	179834.86	-4.08
STBH04	539597.2	179927.28	-3.88
SVTBH6	540323.07	180343.71	4.5
SVTBH7	540165.7	180414.01	6
SVTBH8	540068.13	180466.46	8
SVY02 BH28	540061	180533	4.5
SVY02 BH30	540163	180803	5
TBH10	539009	179588	2.52
TBH11	538901	179527	4.55
TBH12	538876	179558	4.67
TBH1a	538836	179608	4.75
TBH2	538838	179613	4.73
TBH5	538906	179613	4.51
TBH6	538907	179608	4.48
TBH7	538869	179582	4.27

TBH8	538940	179567	4.27
TBH9	538988	179581	2.68
TBRQBH1	539909.99	180744.63	1.11
TBRQBH2	539940.41	180760.12	1.83
TBRQBH3	539972.34	180756.23	3.13
TP4-2011	538799.25	179965.29	5.48
TP5	539007	179570	2.42
TP802	538857.34	179971.77	4.124
TP804	538838.17	179912.53	3.889
TP805	538854.88	179911.24	4.893
TP806	538889.9	179909.41	4.377
TP808	538895.81	179932.12	4.096
TP809	538924.49	179900.88	3.608
TUBH01	539879.91	180166.61	-4.89
TUBH02	539709.58	179986.13	-10.04
VDRTR1/TR2	539876	180859	1.1
WS1-2011	538778.21	179990.86	1.2
WS205.1	539349.85	180094	5.47
WS205.3	539371.9	180031.66	5.86
WS206.2	539407.99	179983.96	5.86
WS206.4	539467.11	179965.17	5.49
WS206.5A	539426.49	179948.32	5.67
WS207.1B	539457.74	179917.97	5.31
WS207.2A	539518.02	179897.56	5.88
WS2-2011	538783.48	179964.69	1.33
WS3-2011	538783.17	179949.72	-0.96
WS4-2011	538781.31	179932.99	0.84
WS820	538854.81	179951.99	3.826
BGS archive boreholes			
TQ37NE1295	539611	179774	5.26
TQ37NE1299	539185	179976	4.84
TQ37NE1309/A	539820	179200	3.76
TQ37NE1358	539386	179629	3.05
TQ37NE1369	539013.3	180008.6	4.42
TQ37NE1467	539050	179160	5
TQ37NE1468	539160	179150	3.55
TQ37NE1469	539320	179250	2.45
TQ37NE1470	539390	179280	1.1
TQ37NE1471	539430	179300	2.1
TQ37NE1472	539590	179400	2.35
TQ37NE1473	539650	179460	4.3
TQ37NE1474	539830	179530	4.3
TQ37NE1475	539780	179620	4.7
TQ37NE1476	539810	179790	-5.3
TQ37NE1477	539730	179550	4.57
TQ37NE1478	539800	179550	4.57
TQ37NE1498	538830	179830	4.09

TQ37NE1584	538714.4	179717.3	-9.23
TQ37NE1585	538749.5	179696.8	-3.01
TQ37NE1587	538984	179736	2.22
TQ37NE1588	539028.26	179706.61	2.336
TQ37NE1589	539153.14	179803.14	3.224
TQ37NE1590	539183	179831	3.8
TQ37NE1591	539186	179834	3.79
TQ37NE1592	539194.77	179842.51	3.943
TQ37NE1593	539192.92	179849.25	3.964
TQ37NE1594	539190.97	179851.37	3.95
TQ37NE1595	539188	179835	3.79
TQ37NE1596	539161.55	179802.51	3.34
TQ37NE1597	539217.01	179851.21	5.025
TQ37NE1598	539290.01	179911.28	4.69
TQ37NE1599	539212.02	179842.64	5.005
TQ37NE1600	539209.3	179843.9	5.01
TQ37NE1601	539165.01	179939.42	4.925
TQ37NE1602	539261.15	179794.15	2.971
TQ37NE1603	539336.72	179724.75	3.143
TQ37NE1604	539281.71	179918.57	5.031
TQ37NE1605	539379.47	179990.44	5.024
TQ37NE1606	538929.59	179683.16	2.719
TQ37NE1679	538983	179893.3	2.15
TQ37NE1680	539007.1	179889.4	2.48
TQ37NE1681	539022.2	179842.9	2.64
TQ37NE1683	539014.7	179769.3	2.91
TQ37NE1684	539050	179746	2.98
TQ37NE1685	539023	179729.5	3.05
TQ37NE1686	539017.9	179647.3	2.21
TQ37NE1687	539049	179640.1	2.32
TQ37NE1688	539063.9	179568.9	2.37
TQ37NE1689	539134.1	179531.3	2.73
TQ37NE1690	539097.8	179455.5	2.16
TQ37NE1691	539040.5	179419	2.55
TQ37NE1692	539074.2	179356.7	3.04
TQ37NE1693	539119	179382	3.06
TQ37NE1694	539153	179366	5.66
TQ37NE1695	539243.5	179290.5	2.47
TQ37NE1696	539312	179245	2.38
TQ37NE1700	539092	179633	2.87
TQ37NE1701	539006.2	179958.1	4.19
TQ37NE1702	539033.6	179886	3.09
TQ37NE1703	539058.5	179625.1	3.35
TQ37NE1705	538947.1	179968.2	2.57
TQ37NE1706	538962.8	179939.8	2.06
TQ37NE1713	539011.1	179802	2.79
TQ37NE1714	539009.5	179806.6	2.79

TQ37NE1715	539052.6	179613.5	2.16
TQ37NE1716	539053	179609	2.16
TQ37NE1998	539140	178810	5.2
TQ37NE2098	539170	178940	3.66
TQ37NE2099	539210	178990	3.87
TQ37NE2100	539280	179070	4.97
TQ37NE2101	539100	179000	3.66
TQ37NE2108	539331	179604	3.35
TQ37NE2109	539280	179730	2.82
TQ37NE2151	539670	179190	2.43
TQ37NE2152	538780	179880	4.8
TQ37NE2153	538770	179920	4.65
TQ37NE2154	538900	179820	2.15
TQ37NE2155	538860	179810	2.9
TQ37NE2156	538810	179810	3.15
TQ37NE23	538940	179960	2.76
TQ37NE24	538980	179800	2.1
TQ37NE25	539260	179800	2.1
TQ37NE2641	539490	179910.5	5.08
TQ37NE2642	539151	179646.5	2.75
TQ37NE2643	539555	179422	3.17
TQ37NE2644	539869.5	179330.5	5.56
TQ37NE2645	539678	179030	2.19
TQ37NE2646	539988	179108	6.47
TQ37NE2648	539646.5	179787.5	5.3
TQ37NE27	539520	179940	1.83
TQ37NE28	539580	179800	2.1
TQ37NE29	539200	179600	1.83
TQ37NE30	539230	179460	1.83
TQ37NE31	539090	179350	1.52
TQ37NE32	539360	179370	2.1
TQ37NE33	539390	179400	2.1
TQ37NE34	539470	179350	2.1
TQ37NE35	539550	179500	2.1
TQ37NE36	539570	179400	2.1
TQ37NE37	539560	179340	2.1
TQ37NE3713	539765	179592	5.65
TQ37NE3714	539697	179509	5.1
TQ37NE3715	539830.34	179541.33	5.4
TQ37NE3716	539789	179481	4.42
TQ37NE3718	539823.42	179424.03	5.28
TQ37NE3719	539725	179391	4.85
TQ37NE3720	539766	179420	5.03
TQ37NE3721	539775	179397	4.99
TQ37NE3722	539811	179428	5.47
TQ37NE3723	539788	179404	5.09
TQ37NE3724	539772	179433	5.06

TQ37NE3725	539782	179455	4.76
TQ37NE3726	539743	179457	4.59
TQ37NE3727	539793	179493	4.6
TQ37NE3728	539804	179475	4.88
TQ37NE3729	539822	179449	5.11
TQ37NE3730	539842	179416	5.06
TQ37NE3731	539821	179390	5.14
TQ37NE3732	539801	179368	5.04
TQ37NE3733	539781	179344	5.02
TQ37NE3735	539732	179372	4.85
TQ37NE3736	539802	179524	5.01
TQ37NE3737	539831	179526	5.3
TQ37NE3738	539853	179523	5.32
TQ37NE3739	539825	179499	5.05
TQ37NE3740	539847	179496	5.35
TQ37NE3741	539868	179497	5.6
TQ37NE3742	539824	179472	5.12
TQ37NE3743	539844	179478	5.1
TQ37NE3744	539878	179472	5.57
TQ37NE3758	539792	179557	5.4
TQ37NE38	539370	179250	2.4
TQ37NE39	539910	179360	1.22
TQ37NE41	539270	179120	1.5
TQ37NE602	539280	178985	4.27
TQ37NE603	539302	178980	4.27
TQ37NE696	539312	179245	2.38
TQ37NE697	539384	179132	2.79
TQ37NE698	539475	178969	2.29
TQ37NE701	539100	179470	2.04
TQ37NE702	539110	179360	2.71
TQ37NE703	539180	179300	2.38
TQ37NE705	539080	179880	2.1
TQ37NE706	539120	179370	2.41
TQ37NE710	539300	179260	2.56
TQ37NE711	539310	179230	1.54
TQ37NE712	539280	179220	1.84
TQ37NE714	539350	179180	2.42
TQ37NE717	539400	179110	2.33
TQ37NE718	539400	179070	2.5
TQ37NE719	539430	179060	2.36
TQ37NE720	539460	179030	2.04
TQ37NE721	539470	178990	2.31
TQ37NE722	539500	178980	1.41
TQ37NE724	539530	178920	1.05
TQ37NE725	539550	178940	3.3
TQ37NE728	539590	179090	1
TQ37NE730	539650	179000	1.09

TQ37NE731	539670	178960	0.87
TQ37NE777	539300	179090	2.74
TQ37NE779	539170	178930	2.74
TQ37NE925	539054	179068	0.24
TQ37NE926	539092	179082	2.74
TQ37NE927	539125	179094	2.59
TQ37NE944	539311	179182	0.88
TQ37NE945	539411	179040	2.59
TQ37SE1243	539583.2	180209.1	-9.69
TQ38SE1010	539790	180000	-9.3
TQ38SE1011	539850	180170	-6.2
TQ38SE1012	539870	180250	5.15
TQ38SE1013	539910	180450	5.55
TQ38SE114	538964	180040	2.83
TQ38SE1273	539710	180507	5.05
TQ38SE1274	539746	180474	4.63
TQ38SE1275	539676	180573	1.62
TQ38SE1276	539714	180568	1.68
TQ38SE1277	539580	180564	1.58
TQ38SE1278	539732	180613	1.74
TQ38SE1279	539789	180683	2.17
TQ38SE1280	539785	180695	1.73
TQ38SE1281	539659	180705	4.8
TQ38SE1283	539787	180682	2.02
TQ38SE1284	539742	180714	2.19
TQ38SE1285	539763	180727	1.76
TQ38SE1286	539754	180747	1.47
TQ38SE1287	539756	180745	1.52
TQ38SE1288	539714	180797	1.63
TQ38SE1289	539662	180813	4.45
TQ38SE1290	539670	180880	1.61
TQ38SE1291	539630	180972	2.22
TQ38SE1292	539621	180983	2.29
TQ38SE1316	539687	180692	4.68
TQ38SE1317	539622	180677	5.28
TQ38SE1318	539656	180726	5.23
TQ38SE1357	538862.9	180271.3	-2.03
TQ38SE1358	538880.5	180245.7	0.15
TQ38SE1359	538827.6	180189.6	0.31
TQ38SE1360	538880.6	180131.9	5.49
TQ38SE1361	538911.5	180119.1	5.33
TQ38SE1362	538893.9	180097.9	5.18
TQ38SE1364	538970.5	180083.6	2.59
TQ38SE1365	538944.1	180060.6	2.9
TQ38SE1366	538972	180022	2.48
TQ38SE1370	539008.6	180083.3	4.56
TQ38SE1371	538868.9	180214	5.3

TQ38SE1372	538849.2	180191.3	5.36
TQ38SE1401	538784.7	180213	-4.41
TQ38SE1402	538756.6	180144.2	-3.24
TQ38SE1403	538861.9	180229.8	-0.86
TQ38SE1404	538791.3	180131.8	-0.7
TQ38SE1405	538840.2	180173.7	5.37
TQ38SE1408	538879.9	180200.9	4.77
TQ38SE1409	538876.6	180196.7	4.47
TQ38SE1410	538873.7	180192.7	4.59
TQ38SE1411	538859.8	180149.8	4.1
TQ38SE1413	538909.1	180157.8	4.25
TQ38SE1414	538910.8	180158.6	4.38
TQ38SE1415	538862.4	180095	5.35
TQ38SE1416	538873	180053.4	5.06
TQ38SE1417	538977.6	180029.1	4.1
TQ38SE1421	538894.3	180220.1	5.36
TQ38SE144	539591	180542	2.03
TQ38SE1440	538961.9	180134.3	5.38
TQ38SE1441	538961.9	180136.6	5.41
TQ38SE1442	538963.6	180139.9	5.58
TQ38SE1443	538962.2	180127.2	2.94
TQ38SE1444	538971.9	180145.7	5.62
TQ38SE1445	538950.9	180154.3	5.3
TQ38SE1446	538962.2	180107.2	2.85
TQ38SE1448	538959.6	180136.1	5.47
TQ38SE1450	538952.1	180142.2	5.49
TQ38SE1451	538963.4	180117.1	2.95
TQ38SE1452	538960.4	180137.5	5.46
TQ38SE1497	539946	180494	3.72
TQ38SE1498	539871	180561	1.99
TQ38SE1499	539801	180630	1.46
TQ38SE1500	539748	180717	4.72
TQ38SE1501	539667	180766	4.99
TQ38SE1502	539600	180852	5.57
TQ38SE1581	539627	180853	4.43
TQ38SE1582	539646	180861	4.58
TQ38SE1583	539621	180879	4.38
TQ38SE1584	539619	180883	4.41
TQ38SE2283	539110	180330	5.85
TQ38SE2557	539830	180720	5.34
TQ38SE3298	539157.5	180192.5	5.01
TQ38SE3299	539340.5	180187.5	6.12
TQ38SE356	539930	180640	2.44
TQ38SE357	539840	180790	2.21
TQ38SE358	539740	180990	1.84
TQ38SE3610	539840	180800	2.06
TQ38SE3611	539820	180790	1.73

TQ38SE3612	539870	180750	1.18
TQ38SE3613	539850	180740	1.37
TQ38SE3614	539880	180730	0.81
TQ38SE3615	539900	180690	0.71
TQ38SE3616	539900	180650	1.25
TQ38SE3617	539940	180630	1.22
TQ38SE3618	539940	180570	1.28
TQ38SE3619	539990	180540	1.18
TQ38SE3620	539980	180520	1.35
TQ38SE3704	539800	180399	5.47
TQ38SE3705	539851	180427	5.49
TQ38SE3822	539520	180930	7.17
TQ38SE3988	539750	180860	1.95
TQ38SE3989	539640	180910	4.8
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TQ38SE3991	539540	180930	7.55
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TQ38SE4126	539560	180910	7.7
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TQ38SE4129	539750	180510	3.7
TQ38SE4130	539870	180560	2.5
TQ38SE4131	539840	180470	4.35
TQ38SE748	539845	180875	1.37
TQ38SE749	539850	180890	1.37
TQ38SE850	539160	180010	4.84
TQ38SE854	539459	180028	5.83
TQ38SE895/B	539830	180321	4.72
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TQ47NW856	540180	179200	8.08
TQ48SW161	540150	180714	5.94
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TQ48SW163	540241	180731	5.64
TQ48SW1708	540024	180799	2.88
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TQ48SW1713	540116	180765	4.84
TQ48SW1732	540138	180394	4.94
TQ48SW1733	540219	180331	4.66
TQ48SW1734	540272	180299	4.31
TQ48SW1735	540336	180300	4.2
TQ48SW1831	540246	180826	2.65
TQ48SW1833	540196	180820	2.83
TQ48SW1834	540146	180855	2.62
TQ48SW1835	540146	180814	2.92
TQ48SW1836	540096	180845	2.74

TQ48SW1837	540096	180805	2.82
TQ48SW1838	540046	180812	2.82
TQ48SW1839	540007	180798	2.87
TQ48SW1868	540053	180713	4.79
TQ48SW1976	540246	180771	5.35
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TQ48SW1978	540200	180766	5.4
TQ48SW1981	540194	180727	5.38
TQ48SW1982	540144	180759	5.29
TQ48SW1983	540096	180755	5.02
TQ48SW1984	540024	180799	2.88
TQ48SW1986	540012	180658	4.4
TQ48SW1987	540049	180612	4.71
TQ48SW1988	540082	180547	5.23
TQ48SW1989	540027	180556	4.67
TQ48SW1990	540021	180774	3.99
TQ48SW1991	540047	180802	2.74
TQ48SW1992	540046	180785	4.27
TQ48SW204	540020	180520	2.08
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TQ48SW2064	540324	180353	4.43
TQ48SW2065	540313	180299	4.29
TQ48SW2066	540265	180350	4.5
TQ48SW2067	540231	180349	4.81
TQ48SW2068	540179	180382	5.03
TQ48SW2069	540126	180419	4.68
TQ48SW2070	540103	180446	5.96
TQ48SW2079	540323	180338	5.16
TQ48SW2617	540160	180360	4.43
TQ48SW334/B	540160	180030	2.225
TQ48SW3678	540190	180830	2.52
TQ48SW383/A	540060	180000	5.34
TQ48SW450	540050	180670	4.65
TQ48SW451	540150	180800	2.8
TQ48SW571	540100	180620	5.03
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