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LAND ADJACENT TO PEARSON HOUSE, EDINBURGH GATE, HARLOW, ESSEX

Environmental Archaeological Assessment Report

NGR: TL 44908 11265

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1. NON-TECHNICAL SUMMARY

A programme of environmental archaeological assessment was undertaken at the Pearson House site, as recommended in the previous geoarchaeological monitoring and deposit model report (Young, 2018). As reported in Young (2018) the results of the deposit modelling indicate that the site lies towards the edge of the floodplain and the edge of a former channel, the main axis of which probably traverses the north-western area of the site. Overlying the bedrock is a sequence of probably Late Devensian Gravel, Holocene alluvium and modern Made Ground. The alluvial sequence consists of a tripartite sequence of sandy Lower Alluvium, Organic Clay, and the clay-rich Upper Alluvium. Significantly, the organic unit at the site is indicative of a transition towards semi-terrestrial (marshy) conditions, perhaps supporting the growth of sedge fen/reed swamp and/or woodland communities across the floodplain. It is generally present at elevations between *ca*. 38.5 and 35.5m OD, in thicknesses of between 2.6 and 0.18m.

Radiocarbon dating of the base of the Organic Clay in borehole WS16 has provided a Late Roman/Early Medieval age for the onset of organic accumulation. The results of the pollen assessment are consistent with this age for the sequence; an open environment dominated by herbaceous taxa is indicated, with limited trees and shrubs and indications of human activity in the form of disturbance and/or cultivation indicators, including cereals. The floodplain environment is likely to have been relatively damp, dominated by sedge fen or reed swamp type vegetation. The pollen assemblage is relatively consistent throughout the Organic Clay and is poorly preserved. In addition, no identifiable macrofossil remains were found within the organic unit in WS16. On this basis, no further palaeoenvironmental analysis of the sequence is recommended. As stated in Young (2018), from an archaeological perspective, the site's location towards the margins of the floodplain (and potentially a former channel) suggest that the archaeological potential is considered to be limited to where the Gravel surface lies above *ca*. 37m OD.

2. INTRODUCTION

2.1 Site context

This report summarises the findings arising out of the environmental archaeological assessment undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development of Land Adjacent to Pearson House, Edinburgh Gate, Harlow, Essex (National Grid Reference (NGR); TL 44908 11265 Figures 1 & 2). Quaternary Scientific were commissioned by CgMs Heritage to undertake the geoarchaeological investigations. The area of investigation lies in the valley of the River Stort, a tributary of the River Lea that rises in the village of Langley and drains in to the River Lea at Hoddesdon. The site lies approximately 100m to the south of the modern waterfront, where the British Geological Survey (BGS) maps the superficial geology across the majority of the site as Alluvium – described as 'Clay, Silt, Sand and Gravel', overlying London Clay bedrock (http://mapapps.bgs.ac.uk/geologyofbritain/home.html). Towards the southeastern margin of the site the superficial geology is shown as Quaternary Head deposits – also described as 'Clay, Silt, Sand and Gravel'.

Two geotechnical boreholes were put down within the eastern area of the site in 1991 (BH1 and BH2; see CgMs, 2018). In these boreholes a unit of gravel was recorded at the base of the alluvial sequence, the surface of which was identified at between 36.05 (BH1) and 37.6m OD (above Ordnance Datum) (BH2). Silty clay alluvium was recorded in both boreholes, to a level of 38m OD in BH1 and 38.65m OD in BH2; in BH1 the alluvium included bands of peat and frequent organic material at between 37.1 and 36.35m OD. The sequence was capped by variable thicknesses of Made Ground associated with ground raising in the area of the former velodrome, with 3.7m recorded in BH1, and 5.35m recorded in BH2, although it is understood that much of this Made Ground was removed during subsequent development of the site (CgMs, 2018). A number of BGS archive boreholes are present in the area of the site, recording variable thicknesses of alluvium (generally between *ca.* 1 and 2m); one of these (borehole TL41SW351) records 0.84m of peat within the alluvium, at a depth of 0.53m below ground level (no elevation data is available for this borehole).

A programme of geoarchaeological monitoring and subsequent deposit modelling was recently undertaken at the site (Young, 2018a), the results from which indicate that the site lies towards the edge of the floodplain and the edge of a former channel, the main axis of which probably traverses the north-western area of the site. The results confirmed that the bedrock at the site is overlain by a sequence of Gravel (thought to be of Late Devensian age), Holocene alluvium, and modern Made Ground. The Holocene alluvial sequence consisted of a tripartite sequence of general sandy Lower Alluvium, Organic Clay, and the clay-rich Upper Alluvium. Significantly, the organic unit at the site is indicative of a transition towards semi-terrestrial (marshy) conditions, perhaps supporting the growth of sedge fen/reed swamp and/or woodland communities across the floodplain. It was generally present at between *ca.* 38.5 and 35.5m OD across the site, in thicknesses of between 2.6 and 0.18m.

2.2 Geoarchaeological, palaeoenvironmental and archaeological significance

On the basis of the palaeoenvironmental potential of the sequence at the site, a limited programme of environmental archaeological assessment was recommended on the retained sequence from the site (WS16) in the geoarchaeological deposit model report (Young, 2018a). As outlined in this report and the Written Scheme of Investigation (WSI) for the site (Young, 2018b), the available records indicate some variation in the height of the underlying gravel, and the type, thickness and age of the subsequent Holocene alluvial deposits. 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 former channels and bars; (2) the presence of peat represents former terrestrial or semi-terrestrial land-surfaces, and (3) the alluvium represents periods of channel activity or changing hydrological conditions. Thus by studying the sub-surface stratigraphy across the site and wider area in more detail, it will be possible to build our understanding of the former landscapes and environmental changes that took place across space and time.

Organic-rich sediments (in particular peat) also have high potential to provide a detailed reconstruction of past environments on both the wetland and dryland. In particular, they provide the potential to increase knowledge and understanding of the interactions between hydrology, human activity, vegetation succession and climate. Significant vegetation changes include the Mesolithic/Neolithic decline of elm woodland, the Neolithic colonisation and decline of yew woodland; the Late Neolithic/Early Bronze Age growth of elm on Peat, and the general decline of wetland and dryland woodland during the Bronze Age.

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).

2.3 Aims and objectives

A limited programme of environmental archaeological assessment was recommended on the retained sequence from the site (WS16) in the geoarchaeological deposit model report (Young, 2018a) in order to investigate the sedimentary and vegetation history of the site in more detail, and to identify and evidence for human activity. Five significant research aims relevant to the geoarchaeological investigations were proposed within the WSI for the site (Young, 2018):

1. To clarify the nature of the sub-surface stratigraphy;
2. To clarify the nature, depth, extent and possible date of any alluvium and organic/peat deposits;
3. To investigate whether the sequences contain any artefact or ecofact evidence for prehistoric or historic human activity;
4. To investigate whether the sequences contain any evidence for natural and/or anthropogenic changes to the landscape (wetland and dryland);

5. To integrate the new geoarchaeological record with other recent work in the local area for publication (if appropriate, pending the results of the investigations).

The first two of these aims were addressed within the geoarchaeological deposit model report (Young, 2018a). The environmental archaeological assessment presented here is being undertaken to address aims three and four, and to make recommendations for any further analysis and the potential for achieving aim five.

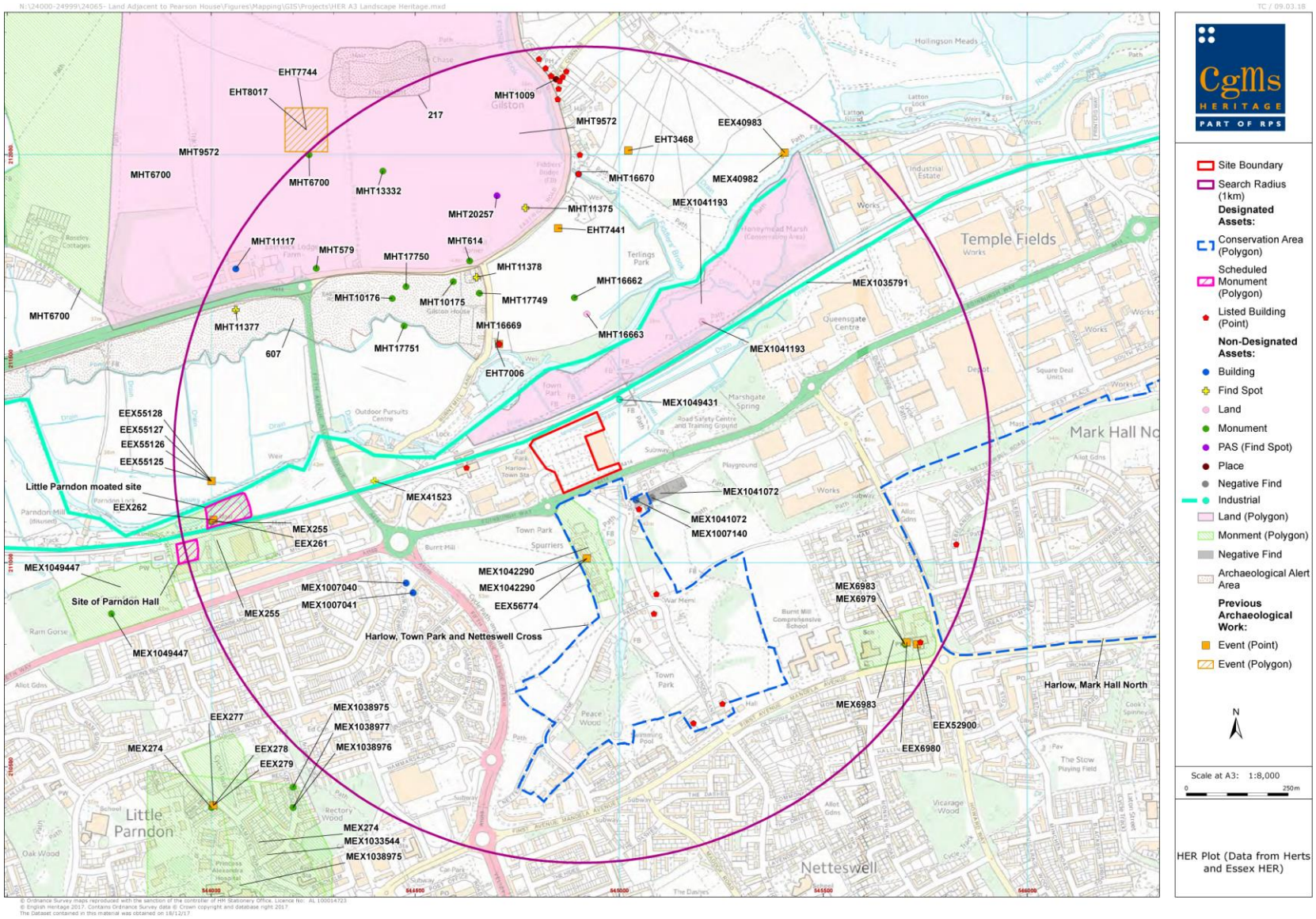

Figure 1: Location of the site at Pearson House, Edinburgh Gate, Harlow, Essex, showing Herts and Essex HER data. Figure provided by CgMs (2018).

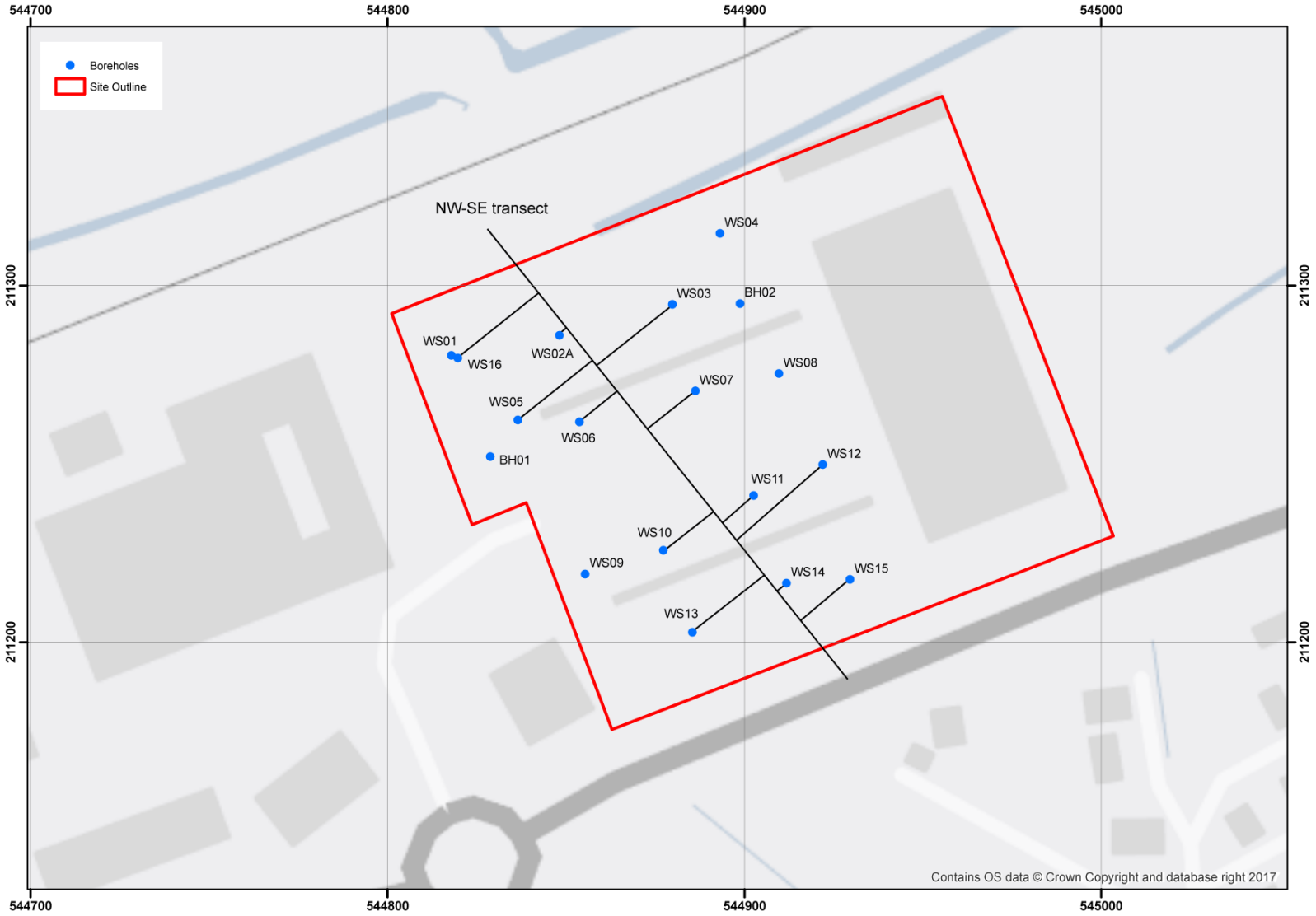

Figure 2: Location of the boreholes on Land Adjacent to Pearson House, Edinburgh Gate, Harlow, Essex. Alignment of the northwest-southeast transect (Figure 10) also shown. Borehole WS16 was retained for further environmental archaeological assessment.

3. METHODS

3.1 Field investigations

A total of 17 geotechnical boreholes (BH01 to BH02 and WS01 to WS15) were put down at the site by Stansted Environmental Services Ltd in March 2018 (see Table 1 and Figure 2) using a rotary auger (BH01/BH02) and a windowless sampler (WS01-WS15). Of these, two were monitored and described in the field by Quaternary Scientific, with a subsequent borehole (WS16) retained for laboratory-based description and further assessment (where necessary). The location of WS16 was determined following the results of the geoarchaeological monitoring and upon examination of the remaining geotechnical logs; on the basis that the organic sediments appeared to be thickest in the area of WS01, this location was selected for sampling using a windowless sampler. This coring technique provides 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 by Stansted Environmental Services Ltd (Table 1).

Table 1: Spatial data for the boreholes used in the deposit model on Land Adjacent to Pearson House, Edinburgh Gate, Harlow, Essex.

Name	Easting	Northing	Elevation (m OD)
Geotechnical boreholes			
WS01	544817.89	211280.35	38.60
WS02A	544848.25	211285.96	38.60
WS03	544879.88	211294.63	38.60
WS04	544893.15	211314.52	38.80
WS05	544836.51	211262.23	38.95
WS06	544853.86	211261.72	38.90
WS07	544886.26	211270.40	39.00
WS08	544909.73	211275.25	39.10
WS09	544855.39	211219.12	39.30
WS10	544877.33	211225.75	39.25
WS11	544902.59	211241.06	39.25
WS12	544921.97	211249.73	39.25
WS13	544885.49	211202.79	39.60
WS14	544911.77	211216.57	39.80
WS15	544929.63	211217.59	39.70
BH01	544828.86	211252.03	39.00
BH02	544898.76	211294.89	39.20
Geoarchaeological borehole			
WS16	544819.74	211279.65	38.60

3.2 Lithostratigraphic description

Field-based lithostratigraphic description of BH02 and WS13, and laboratory-based description of WS16, 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 to 4.

3.3 Deposit modelling

The deposit model for the site was based on a review of the 18 new borehole records (see Figure 2), following the general guidelines of Carey *et al.* (2018). Sedimentary units from the boreholes were classified into six groups: (1) Bedrock, (2) Gravel, (3) Lower Alluvium. (4) Organic alluvium, (5) Upper Alluvium and (6) Made Ground. The classified data for groups 1-6 were then input into a database within the RockWorks 16 geological utilities software, the output from which was displayed using ArcMAP 10. A north-west to south-east borehole transect is displayed in Figure 3. Models of surface height were generated for the Gravel, Lower Alluvium, Organic Alluvium and Upper Alluvium using an Inverse Distance Weighted algorithm (Figures 3 to 5 and 7). Thickness of the Organic Alluvium (Figure 6), total Holocene alluvium (incorporating the Lower Alluvium, Organic Alluvium and Upper Alluvium; Figure 8) and Made Ground (Figure 9) were also modelled (also using an Inverse Distance Weighted algorithm). A northwest-southeast transect of selected boreholes across the site is displayed in Figure 10.

Because the boreholes are not uniformly distributed over the area of investigation, the reliability of the models generated using RockWorks is variable. In general, reliability improves from outlying areas where the models are largely supported by scattered archival records towards the core area of commissioned boreholes. Because of the 'smoothing' effect of the modelling procedure, the modelled levels of stratigraphic contacts may differ slightly from the levels recorded in borehole logs and section drawings. As a consequence of this the modelling procedure has been manually adjusted so that only those areas for which sufficient stratigraphic data is present will be modelled. In order to achieve this, a maximum distance cut-off filter equivalent to a 50m radius around each record is applied to all deposit models from the site.

3.4 Pollen assessment

Eight subsamples from borehole WS16 were extracted for an assessment of pollen content. The pollen was extracted as follows: (1) sampling a standard volume of sediment (1ml); (2) adding two tablets of the exotic clubmoss *Lycopodium clavatum* to provide a measure of pollen concentration in each sample; (3) deflocculation of the sample in 1% Sodium pyrophosphate; (4) sieving of the sample to remove coarse mineral and organic fractions (>125µ); (5) acetolysis; (6) removal of finer minerogenic fraction using Sodium polytungstate (specific gravity of 2.0g/cm^3); (7) mounting of the sample in glycerol jelly. Each stage of the procedure was preceded and followed by thorough sample cleaning in filtered distilled water. Quality control is maintained by periodic checking of residues, and assembling sample batches from various depths to test for systematic laboratory effects. Pollen grains and spores were identified using the University of Reading pollen type collection and the following sources of keys and photographs: Moore *et al.* (1991); Reille (1992). The assessment procedure consisted of scanning the prepared slides, and recording the

concentration and preservation of pollen grains and spores, and the principal taxa on four transects (10% of the slide) (Table 5).

3.5 Radiocarbon dating

Following the results of an initial macrofossil assessment of three samples from the organic unit in borehole WS16, no macrofossil remains suitable for dating (e.g. terrestrial seeds/twig wood) were identified. A bulk sample of organic sediment was therefore extracted from the base of this unit (36.60 to 36.62m OD) for radiocarbon dating. The sample was submitted to the BETA Analytic radiocarbon dating facility, Miami, Florida for AMS radiocarbon dating of the humins (alkali and acid insoluble organic detritus) and humic acids (alkali soluble and acid insoluble matter) fractions of the bulk sample. The results have been calibrated using OxCal v4.2 Bronk Ramsey (1995, 2001) and the IntCal13 atmospheric curve (Reimer *et al.*, 2013). The results are displayed in Figure 10 and Table 4.

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

The results of the geoarchaeological investigations at the site were reported in Young (2018a). The results of this deposit modelling are displayed in Figures 3 to 10. Figures 3 to 9 are surface elevation and thickness models for each of the main stratigraphic units across the site, whilst Figure 10 is a two-dimensional northwest-southeast transect of selected boreholes across the site. The results of the deposit modelling indicate that the number and spread of the logs is sufficient to permit modelling with a high level of certainty across the majority of the site

The full sequence of sediments recorded in the boreholes comprises:

Made Ground
Upper Alluvium – widely present
Organic Clay – widely present, thicker towards the southeast
Lower Alluvium – present towards the northwest
Gravel – widely present; rises to the southeast

4.1 Gravel

A horizon of sandy gravel was recorded at the base of the sequence in all 17 boreholes. This unit is considered likely to have been deposited during the Devensian Late Glacial (15,000 to 10,000 years before present) and comprises the sands and gravels of a high-energy braided river system which, while it was active would have been characterised by longitudinal gravel bars and intervening low-water channels in which finer-grained sediments might have been deposited. Such a relief pattern would have been present on the valley floor at the beginning of the Holocene when a lower-energy fluvial regime was being established.

The deposit modelling exercise indicates that the surface of the Gravel rises towards the southeast (see Figures 3 and 10), where it is recorded at between 37.15 (WS10/WS11) and 38.3m OD (WS15); in the north-western half of the site it lies at between 35.78 (WS16) and 36.8m OD (BH02). The topography of the gravel surface thus indicates that the site lies close to the edge of the floodplain and the edge of a former channel, the main axis of which probably traverses the north-western area of the site.

4.2 Lower Alluvium

Recorded within this channel towards the northwest of the site is a unit of generally silty, sandy clay alluvium, described here as the Lower Alluvium. This unit rests directly on the Gravel, and is generally only recorded below *ca.* 37m OD, its surface falling towards the northwest (see Figure 4). The Lower Alluvium was absent towards the southeast, where the Gravel surface rises above *ca.* 37m OD.

This unit is similar to that recorded elsewhere in the Lower Thames Valley and its tributaries, and is likely to represent a similar depositional environment. Here, the deposits of the Lower Alluvium are described as a predominantly silty or clayey tending to become increasingly sandy downward, and often containing detrital organic material and Mollusca. The sediments of the Lower Alluvium are indicative of deposition during the Early to Mid-Holocene, when the main course of the river was probably confined to a single meandering channel. During this period, the surface of the 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 Gravel.

4.3 Organic Clay

A unit of organic clay was frequently recorded overlying the Lower Alluvium towards the northwest, and the Gravel towards the southeast. This organic unit is indicative of a transition towards semi-terrestrial (marshy) conditions, perhaps supporting the growth of sedge fen/reed swamp and/or woodland communities across the floodplain. However, this unit is relatively mineral-rich, and is therefore indicative of frequent (perhaps seasonal) flood events during its accumulation. In the absence of suitable macrofossil material for radiocarbon dating, two radiocarbon dates have been obtained from a bulk sediment sample at the base of the organic unit: one for the humins (alkali and acid insoluble organic detritus), and one for the humic acids (alkali soluble and acid insoluble matter) fractions of the bulk sample. These returned radiocarbon ages of 395 to 540 cal AD (1555 to 1410 cal BP) and 385 to 535 cal AD (1565 to 1415 cal BP) respectively. On the basis that these dates are statistically consistent (T'=0.2; T'(5%)=3.8, v=1; Ward & Wilson, 1978), taking a weighted mean of the two determinations provides a best estimate for the onset of organic accumulation at the site of 390–540 cal AD (2σ; Late Roman/Early Medieval) (Peter Marshall, pers. comm.).

The surface of this organic unit is uneven, lying at between 36.4 (WS02A) and 38.6 OD (WS14/WS15) (Figure 5). However, it should be noted that it was not always possible to identify this unit and its exact elevation in the geotechnical logs, leading to some uncertainty as to its extent across the site. Where recorded, this unit measures between *ca*. 2.6 (BH01) and 0.18m in thickness (WS16) (Figure 6). Significantly, this unit was considered to be thinner in the borehole described in the laboratory (WS16) than the neighbouring geotechnical borehole (WS01), indicative of either significant variability in the thickness of this unit across the floodplain, or the different descriptive terminology used in the geotechnical and geoarchaeological logs. In general this unit increases in thickness towards the southeast, despite the gravel surface rising in this direction (see Figures 6 and 10); the lower surface of this unit towards the northwest may be indicative of subsequent erosion of the organic alluvium by fluvial activity in this area. However, it should be noted that the organic clay described in the geotechnical log for WS13 was interpreted as the Upper Alluvium in the geoarchaeological description, with no organic material noted. The actual extent/thickness of organic material in this area of the site is therefore unclear.

4.4 Upper Alluvium

The Upper Alluvium rests variously on the Organic Clay, Lower Alluvium or Gravel, and was recorded in the majority of records across the site, although it was absent in some records towards the southeast (although there is some uncertainty as to the differentiation between this unit and the Organic Clay here; see above). The sediments of the Upper Alluvium are indicative of deposition within low energy fluvial and/or semi-aquatic conditions on the floodplain 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, with occasional organic lenses and gravel clasts. The surface of this unit is recorded at between 37.4 (WS16) and 38.6m OD (WS09), generally rising toward the southeast (Figure 7).

The Total Alluvium thickness (incorporating the Lower Alluvium, Organic Clay and Upper Alluvium) is displayed in Figure 8. The thickness of the alluvial sequence tends to reflect the topography of the Gravel surface, with greater thicknesses recorded in areas of lower Gravel topography towards the northwest (see Figure 8), including within the possible former channel identified here.

4.5 Made Ground

Between 0.4 (WS03) and 1.2m (WS02A/WS06/WS11/WS14/WS16) of Made Ground caps the alluvial sequence across the site (Figure 9). The Made Ground appears to be thickest in a line across the centre of the site, perhaps related to a phase of previous development at the site or the infilling of a linear depression.

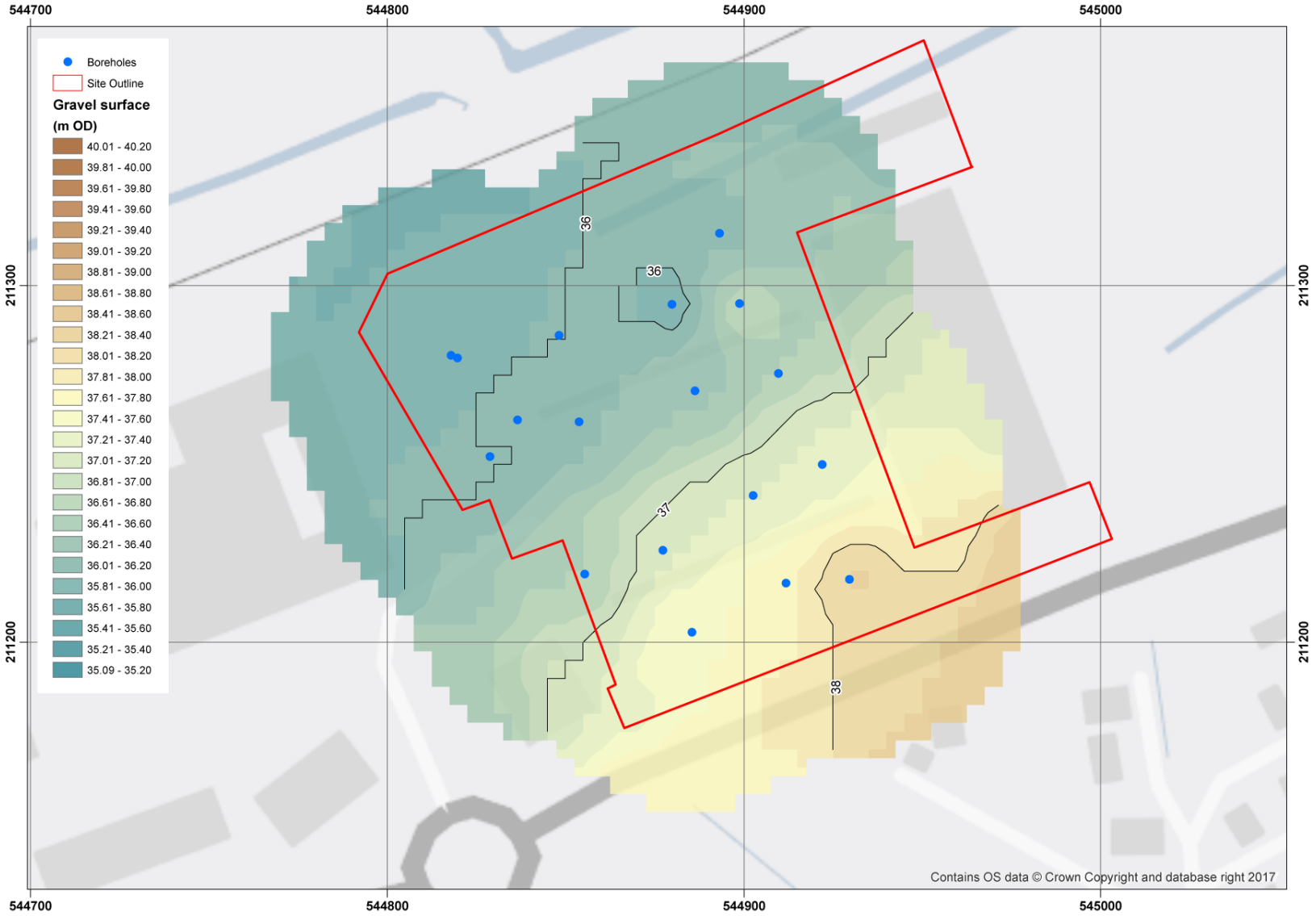

Figure 3: Top of the Gravel (m OD)

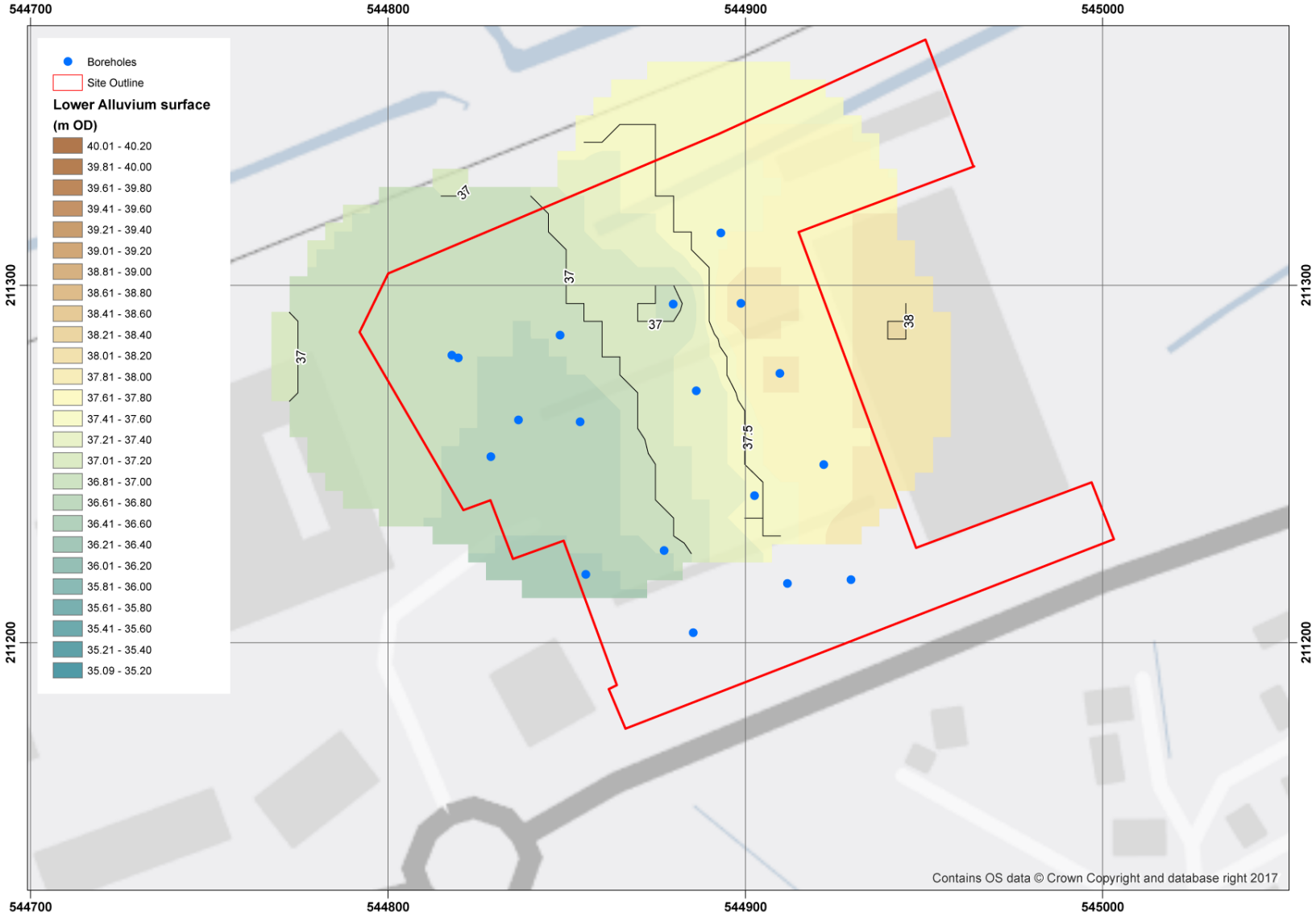

Figure 4: Top of the Lower Alluvium (m OD)

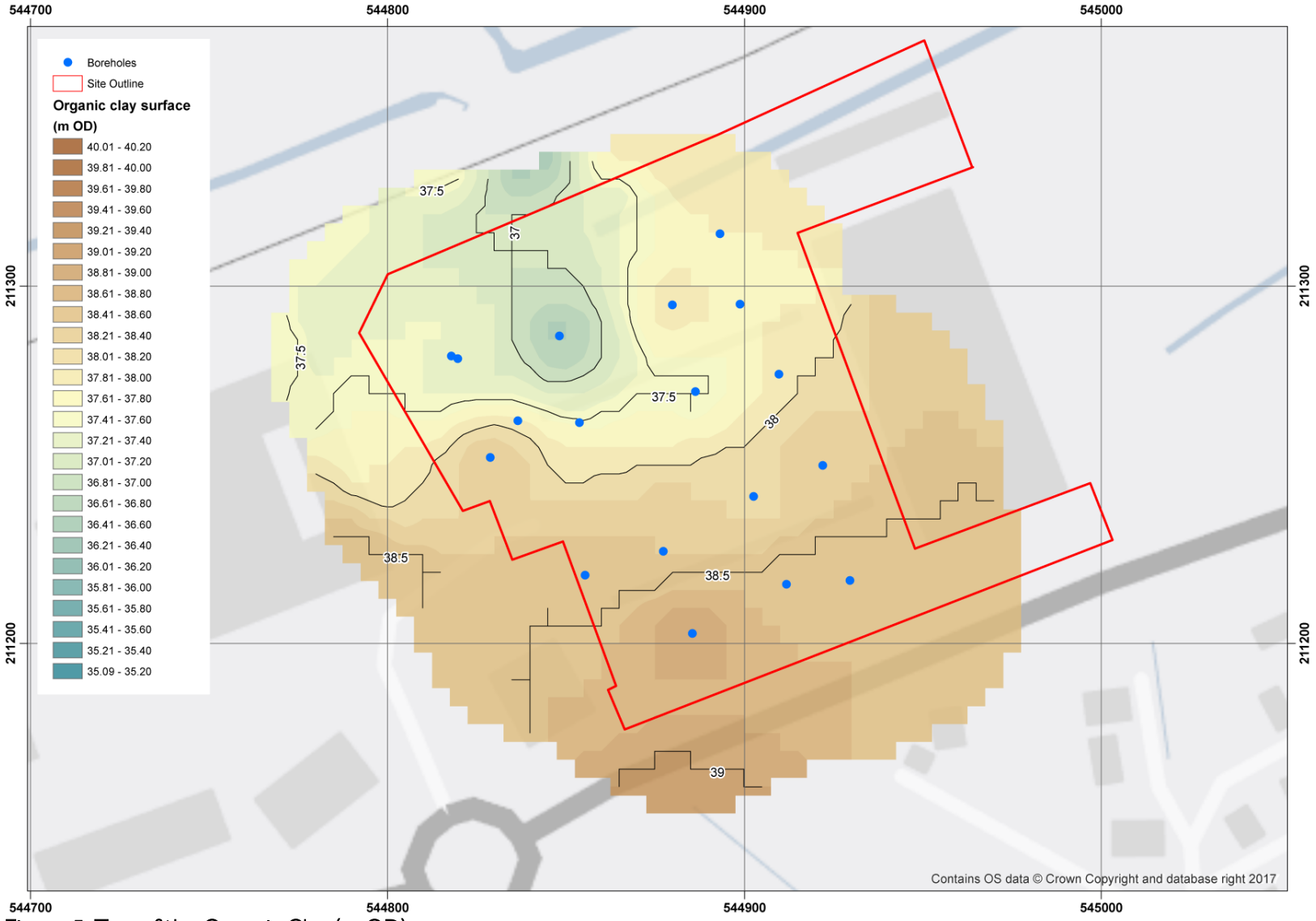

Figure 5: Top of the Organic Clay (m OD)

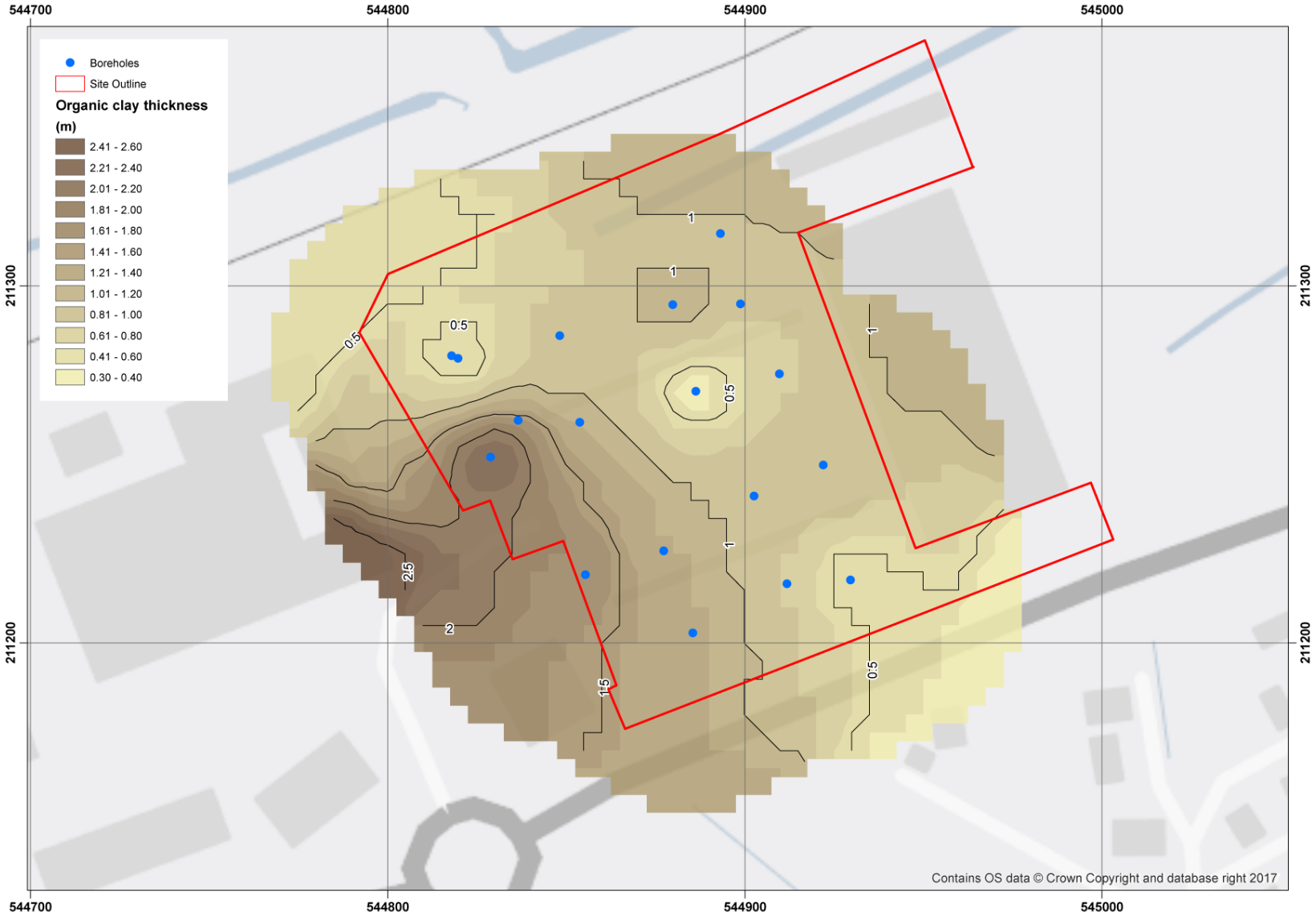

Figure 6: Thickness of the Organic Clay (m)

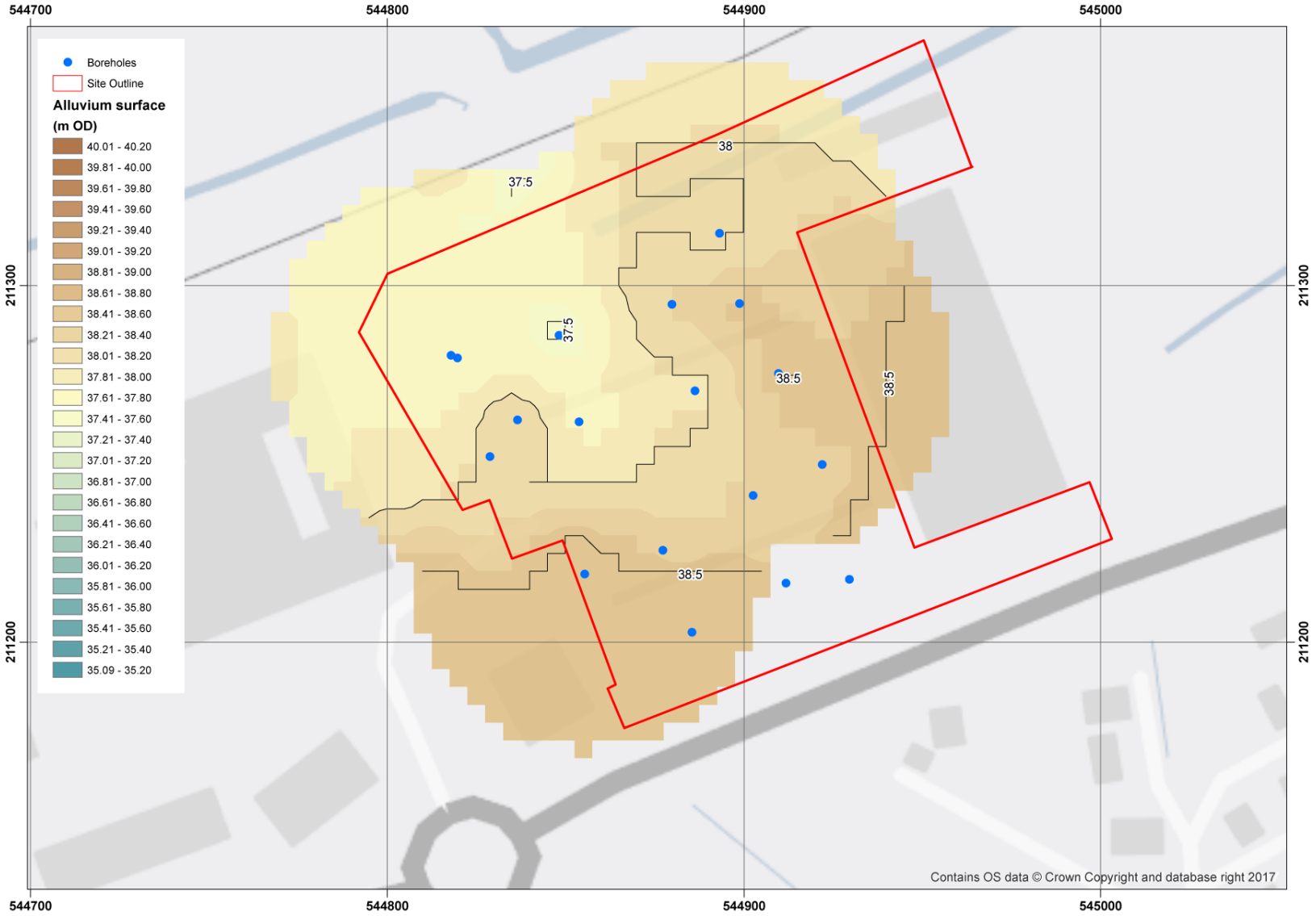

Figure 7: Top of the Upper Alluvium (m OD)

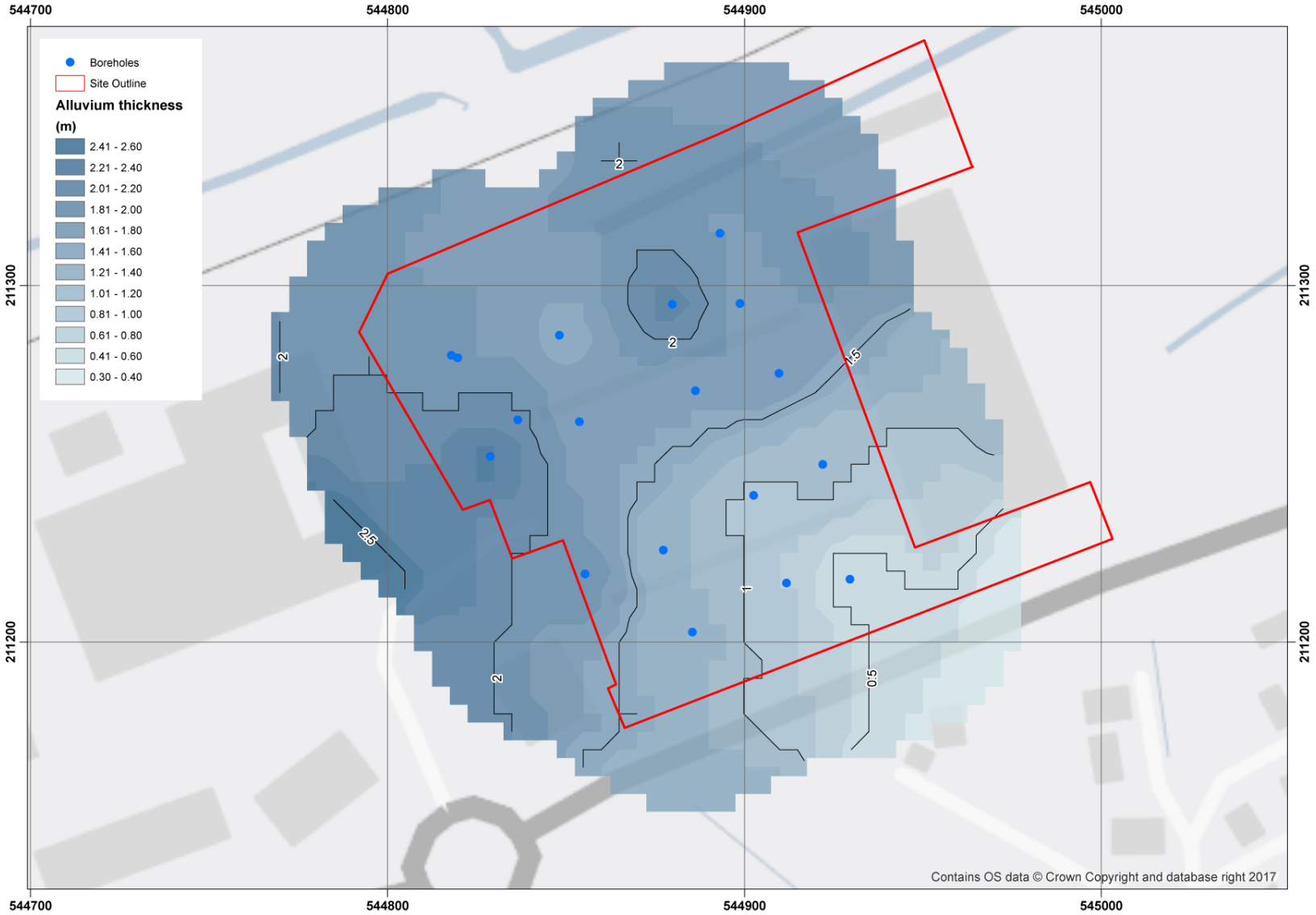

Figure 8: Thickness of the Total Alluvium (Lower Alluvium, Organic Clay and Upper Alluvium) (m)

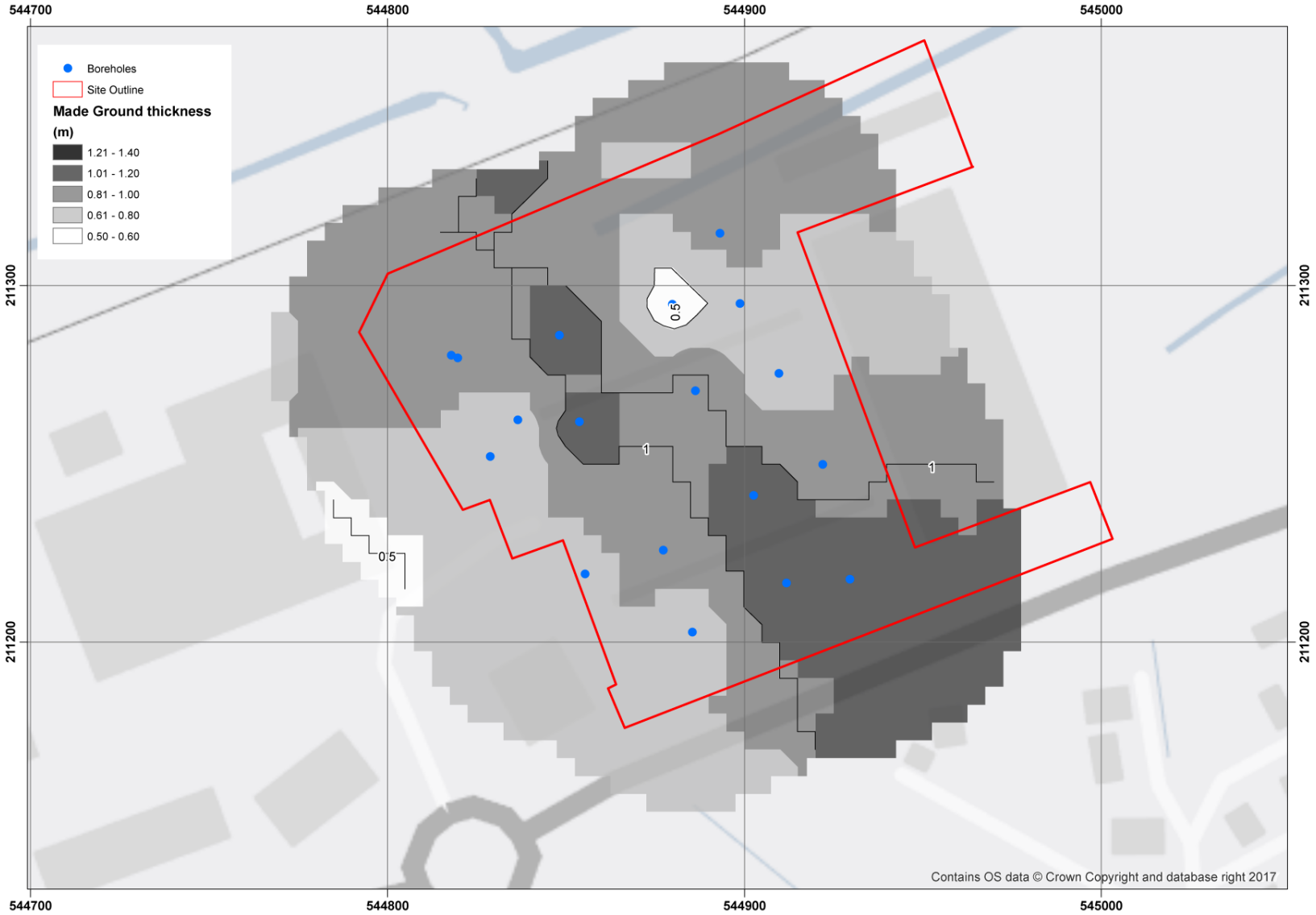

Figure 9: Thickness of Made Ground (m)

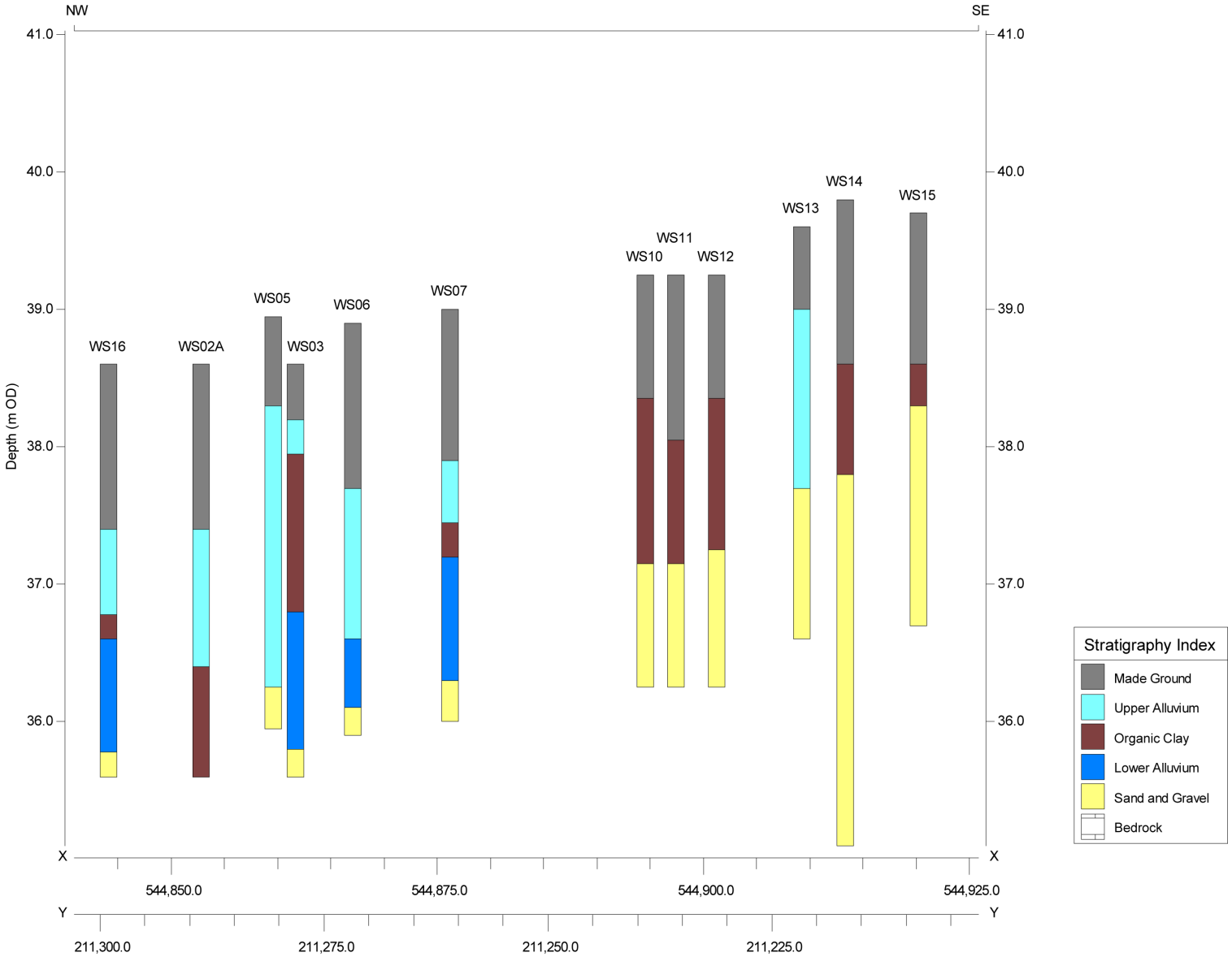

Figure 10: Northwest-southeast transect of boreholes across the Pearson House site (see Figure 2 for alignment).

Table 2: Field-based lithostratigraphic description of borehole BH02, Land Adjacent to Pearson House, Edinburgh Gate, Harlow, Essex.

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
39.20 to 38.50	0.00 to 0.70	Made Ground of brick paving over concrete, sand and gravel.	MADE GROUND
38.50 to 38.00	0.70 to 1.20	Made Ground of disturbed/redeposited dark grey clay with some Mollusca fragments.	
38.00 to 36.80	1.20 to 2.40	As3 Ag1 Sh+; dark grey silty clay with some organic lenses. Diffuse contact in to:	UPPER ALLUVIUM
36.80 to 36.50	2.40 to 2.70	As3 Ag1; grey silty clay with some Mollusca fragments. Sharp contact in to:	LOWER ALLUVIUM
36.50 to 36.20	2.70 to 3.00	Gley2 4/10G; Gg3 Ga1; dark greenish grey sandy gravel. Gravel clasts are flint, up to 40mm in diameter, sub-angular to well-rounded.	SAND AND GRAVEL

Table 3: Field-based lithostratigraphic description of borehole WS13, Land Adjacent to Pearson House, Edinburgh Gate, Harlow, Essex.

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
39.60 to 38.90	0.00 to 0.70	Made Ground of brick cobbles over sand and gravel.	MADE GROUND
38.90 to 38.65	0.70 to 0.95	As3 Ag1 Gg+; grey silty clay with occasional gravel clasts. Diffuse contact in to:	UPPER ALLUVIUM
38.65 to 37.70	0.95 to 1.90	As2 Ag2 Ga+ Gg+; grey silty clay with occasional gravel clasts and a trace of sand. Diffuse contact in to:	
37.70 to 37.60	1.90 to 2.00	As2 Ag1 Gg1 Gg+; grey clay, silt and gravel with a trace of sand. Clasts are flint, angular to well-rounded, up to 30mm in diameter. Diffuse contact in to:	
37.60 to 36.60	2.00 to 3.00	Gg2 Ga2; orange sand and gravel. Clasts are flint, angular to well-rounded, up to 30mm in diameter.	SAND AND GRAVEL

Table 3: Laboratory-based lithostratigraphic description of borehole WS16, Land Adjacent to Pearson House, Edinburgh Gate, Harlow, Essex.

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
38.60 to 37.40	0.00 to 1.20	Made Ground of brick paving over concrete, sand and gravel.	MADE GROUND
37.40 to 37.24	1.20 to 1.36	10YR 4/1; Ag1 As1 Dh1 Sh1 Ga+; dark grey organic silt, clay and detrital herbaceous material. Diffuse contact in to:	UPPER ALLUVIUM
37.24 to 36.78	1.36 to 1.82	Gley2 5/10G; Ag2 As2; greenish clay silt and clay. Some iron staining/mottling. Diffuse contact in to:	
36,78 to 36.60	1.82 to 2.00	10YR 3/1; Sh2 As1 Ag1 Th+ Tl+; humo. 3; very dark grey, well humified very organic silt and clay with traces of woody and herbaceous material. Diffuse contact in to:	ORGANIC CLAY
36.60 to 36.39	2.00 to 2.21	10YR 4/1; As2 Ag2 Sh+; dark grey silt and clay with a trace of organic matter. Diffuse contact in to:	LOWER ALLUVIUM

Depth (m OD)	Depth (m bgl)	Description	Stratigraphic group
36.39 to 36.31	2.21 to 2.29	10YR 4/1; Ag3 As1 Ga+; dark grey silt and clay with a trace of sand and frequent Mollusca fragments. Diffuse contact in to:	
36.31 to 36.22	2.29 to 2.38	10YR 2/1; Ag3 As1 Sh+; black clayey silt with a trace of organic matter. Diffuse contact in to:	
36.22 to 35.78	2.38 to 2.82	Gley2 4/10G; Ag2 As1 Ga1 Dh+; dark greenish grey sandy clayey silt with a trace of detrital herbaceous material. Sharp contact in to:	
35.78 to 35.60	2.82 to 3.00	Gley2 4/10G; Gg3 Ga1; dark greenish grey sandy gravel. Gravel clasts are flint, up to 40mm in diameter, sub-angular to well-rounded.	SAND AND GRAVEL

Table 4: Results of the radiocarbon dating of samples from borehole WS16, Land Adjacent to Pearson House, Edinburgh Gate, Harlow, Essex.

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 498335 AMS	Alkali Soluble Organics (humic); base of peat	36.62 to 36.60	1620 ± 30	385 to 535 cal AD (1565 to 1415 cal BP)	-27.8
BETA 498334 AMS	Alkali Insoluble Organics (humin); base of peat	36.62 to 36.60	1600 ± 30	395 to 540 cal AD (1555 to 1410 cal BP)	-28.6

5. RESULTS & INTEPRETATION OF THE POLLEN ASSESSMENT

Samples were prepared for pollen assessment from the Lower Alluvium, Organic Clay and Upper Alluvium in borehole WS16. The results indicate a high concentration of remains in poor to moderate state of preservation in the majority of samples assessed (see Table 5).

The sequence is characterised by high values of herbaceous pollen: Cyperaceae (sedges), Poaceae (grasses) and Lactuceae (dandelions) dominate, with Asteraceae (daisies), Artemisia (mugwort), *Chenopodium* type (e.g. fat hen), Apiaceae (carrot family), *Centaurea nigra* (black knapweed), *Filipendula* type (meadowsweet) and sporadic occurrences of *Cereale* type (e.g. wheat), *Sinapis* type (e.g. charlock) and *Valeriana* type (marsh valerian). Tree and shrub pollen is limited to isolated grains of *Quercus* (oak), *Pinus* (pine) and *Corylus* type (e.g. hazel). Aquatic and fern taxa include sporadic occurrences of *Typha latifolia* (bulrush), *Sparganium* type (bur-reed), *Filicales* (ferns) and *Polypodium vulgare* (polypody). Microcharcoal is recorded no more than occasionally.

The results of the assessment indicate an open environment dominated by herbaceous taxa. The limited number of trees and shrubs is strongly suggestive of a late prehistoric or historic date for the sequence; it is therefore consistent with the Late Roman/Early Medieval date for the beginning of organic sediment accumulation at this location (see Discussion). The floodplain environment appears to be relatively damp, dominated by sedge fen or reed swamp type vegetation with marsh valerian, bulrush and bur-reed. Evidence for human activity (excluding the limited woodland cover) includes disturbance and/or cultivation indicators such as fat hen, charlock, knapweed and cereal taxa.

Table 5: Results of the pollen assessment of samples from borehole WS16, Land Adjacent to Pearson House, Edinburgh Gate, Harlow, Essex.

	Depth (m OD)	37.00	36.92	36.84	36.76	36.68	36.60	36.52	36.44
Latin name	Common name								
Trees									
Quercus	oak			3	1				
Pinus	pine	1							1
Shrubs									
Corylus type	e.g. hazel			1			3	1	1
Herbs									
Cyperaceae	sedge family	8	6	17	17	2	5	17	
Poaceae	grass family	3	6	11	4		12		1
Cereale type	e.g. wheat				1				
Asteraceae	daisy family	3				1	2		
Artemisia type	mugwort		1	1					
Lactuceae	dandelion family	21	6	5	3	6	7	13	6
Plantago type	plantain		1						
Chenopodium type	goosefoot family				1	1			
Apiaceae	carrot family			1	1		3		
Rumex acetosa / acetosella	sorrel			1					
Cirsium type	thistle			1					1
Galium type	bedstraw		1						
Valeriana type	marsh valerian				3				
Centaurea nigra	black knapweed				2			2	2
Filipendula type	meadowsweet				1		1		
Rosaceae	rose family						1		
Sinapis type	e.g. charlock						1		
Aquatics									
Typha latifolia	bulrush				2				
Sparganium type	bur-reed				1				
Spores									
Pteridium aquilinum	bracken			1					1
Filicales	ferns				1				
Polypodium vulgare	polypody	1							1
Total Land Pollen (grains counted)		35	21	41	34	10	35	33	12
Concentration*		5	4	5	5	2	5	5	2
Preservation**		2	2	2	3	3	3	2-3	2-3
Microcharcoal Concentration***		1	1	2	2	2	2	1	1

	Depth (m OD)	37.00	36.92	36.84	36.76	36.68	36.60	36.52	36.44
Latin name	Common name								
Suitable for further analysis		YES	YES	YES	YES	NO	YES	YES	NO

*Key: *Concentration: 0 = 0 grains; 1 =1-75 grains, 2 = 76-150 grains, 3 =151-225 grains, 4 = 226-300, 5 =300+ grains per slide; **Preservation: 0 = absent; 1 = very poor; 2 = poor; 3 = moderate; 4 = good; 5 = excellent; ***Microcharcoal Concentration: 0 = none, 1= negligible, 2 = occasional, 3 = moderate, 4 = frequent, 5 = abundant*

6. DISCUSSION, CONCLUSION & RECOMMENDATIONS

A programme of environmental archaeological assessment was undertaken on borehole WS16 from the Pearson House site, as recommended in the previous geoarchaeological monitoring and deposit model report (Young, 2018). The assessment was undertaken (1) to investigate whether the sequences contain any artefact or ecofact evidence for prehistoric or historic human activity; and (2) to investigate whether the sequences contain any evidence for natural and/or anthropogenic changes to the landscape (wetland and dryland). In order to achieve this aim, a single radiocarbon date from the base of the organic unit was obtained, in order to ascertain the age of peat accumulation, and an assessment of the palaeobotanical remains (pollen, waterlogged wood and seeds) undertaken to provide a provisional reconstruction of the vegetation history.

As reported in Young (2018) the results of the deposit modelling indicate that the site lies towards the edge of the floodplain and the edge of a former channel, the main axis of which probably traverses the north-western area of the site. Overlying the bedrock is a sequence of Gravel (thought to be of Late Devensian age), Holocene alluvium and modern Made Ground. The Holocene alluvial sequence consists of a tripartite sequence of generally sandy Lower Alluvium, Organic Clay, and the clay-rich Upper Alluvium. Significantly, the organic unit at the site is indicative of a transition towards semi-terrestrial (marshy) conditions, perhaps supporting the growth of sedge fen/reed swamp and/or woodland communities across the floodplain. It is generally present at elevations between *ca*. 38.5 and 35.5m OD, in thicknesses of between 2.6 and 0.18m. However, there is some uncertainty as to the exact thickness and extent of this unit due to discrepancies between the geoarchaeological and geotechnical descriptions (see above).

Radiocarbon dating of the base of the Organic Clay in borehole WS16 has provided a Late Roman/Early Medieval age for the onset of organic accumulation (weighted mean 390–540 cal AD). The results of the pollen assessment are consistent with this age for the sequence; an open environment dominated by herbaceous taxa is indicated, with limited trees and shrubs and indications of human activity in the form of disturbance and/or cultivation indicators, such as fat hen, charlock, knapweed and cereal taxa. The floodplain environment is likely to have been relatively damp, dominated by sedge fen or reed swamp type vegetation.

The pollen assemblage is relatively consistent throughout the Organic Clay, and is poorly preserved. In addition, no identifiable macrofossil remains were found within the organic unit in WS16. On this basis, no further palaeoenvironmental analysis of the sequence is recommended. As stated in Young (2018), from an archaeological perspective, the site's location towards the margins of the floodplain (and potentially a former channel) suggest that the archaeological potential is considered to be limited to where the Gravel surface lies above *ca*. 37m OD (see Figure 11).

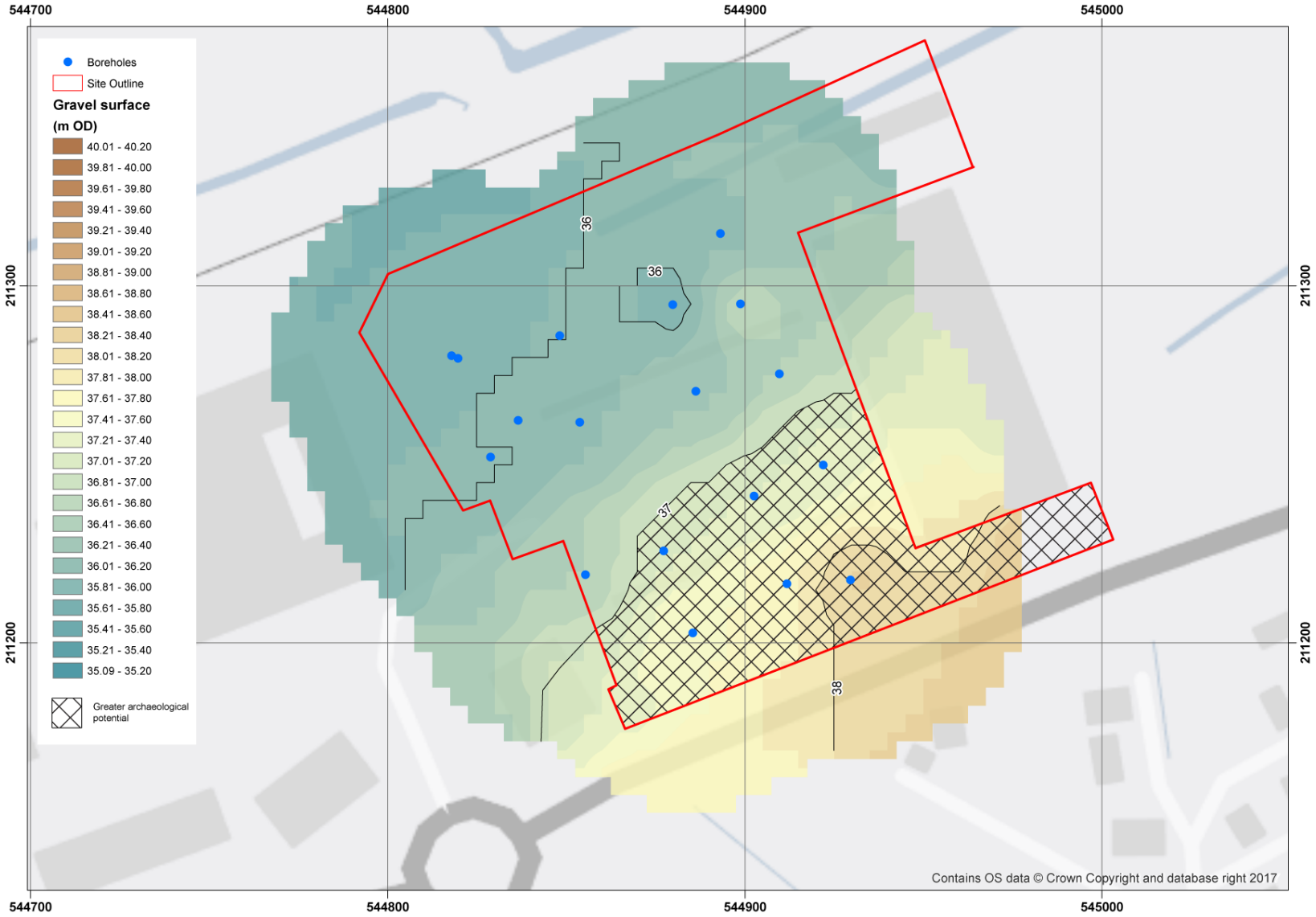

Figure 11: Proposed area of archaeological potential at the Pearson House site.

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8. APPENDIX 1: OASIS

OASIS ID: quaterna1-317077

Project details

Project name	Land adjacent to Pearson House, Harlow, Essex
Short description of the project	A programme of environmental archaeological assessment was undertaken at the Pearson House site. The results of the deposit modelling indicate that the site lies towards the edge of the floodplain and the edge of a former channel, the main axis of which probably traverses the north-western area of the site. Overlying the bedrock is a sequence of probably Late Devensian Gravel, Holocene alluvium and modern Made Ground. The alluvial sequence consists of a tripartite sequence of sandy Lower Alluvium, Organic Clay, and the clay-rich Upper Alluvium. Significantly, the organic unit at the site is indicative of a transition towards semi-terrestrial (marshy) conditions. It is generally present at elevations between ca. 38.5 and 35.5m OD, in thicknesses of between 2.6 and 0.18m. Radiocarbon dating of the base of the Organic Clay in borehole WS16 has provided a Late Roman/Early Medieval age for the onset of organic accumulation. The results of the pollen assessment are consistent with this age for the sequence; an open environment dominated by herbaceous taxa is indicated, with limited trees and shrubs and indications of human activity in the form of disturbance and/or cultivation indicators, including cereals. The floodplain environment is likely to have been relatively damp, dominated by sedge fen or reed swamp type vegetation. The pollen assemblage is relatively consistent throughout the Organic Clay and is poorly preserved. In addition, no identifiable macrofossil remains were found within the organic unit in WS16. On this basis, no further palaeoenvironmental analysis of the sequence is recommended. As stated in Young (2018), from an archaeological perspective, the site's location towards the margins of the floodplain (and potentially a former channel) suggest that the archaeological potential is considered to be limited to where the Gravel surface lies above ca. 37m OD.
Project dates	Start: 01-01-2018 End: 18-07-2018
Previous/future work	No / No
Type of project	Environmental assessment
Monument type	PEAT Roman
Monument type	PEAT Early Medieval
Survey techniques	Landscape

Project location

Country	England
Site location	ESSEX HARLOW HARLOW Land adjacent to Pearson House, Harlow, Essex
Postcode	CM20 2DQ
Site coordinates	TL 44908 11265 51.780786568856 0.100875096464 51 46 50 N 000 06 03 E Point

Project creators

Name of Organisation	Quaternary Scientific (QUEST)
Project brief originator	CgMs Consulting
Project design originator	D.S. Young
Project director/manager	D.S. Young
Project supervisor	D.S. Young
Type of sponsor/funding body	Developer

Project archives

Physical Archive Exists?	No
Digital Archive Exists?	No
Paper Archive recipient	Essex HER
Paper Contents	"Environmental","Stratigraphic"
Paper Media available	"Report"

Entered by	Daniel Young (d.s.young@reading.ac.uk)
Entered on	18 July 2018