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# PENINSULA SITE CHELMER WATERSIDE CHELMSFORD, ESSEX

## Geoarchaeological Fieldwork and Deposit Model Report

**NGR**: TL 7156 0633

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**Written by:** Dr C.R. Batchelor
& Dr D.S. Young

**QUEST**, School of Archaeology, Geography and Environmental Science, Whiteknights, University of Reading, RG6 6AB

**Tel**: 0118 378 7978 / 8941
**Email**: c.r.batchelor@reading.ac.uk
http://www.reading.ac.uk/quest

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# CONTENTS

# 1. NON-TECHNICAL SUMMARY

Three geoarchaeological boreholes were put down at the Chelmer Waterside site at the location of sediments of possible palaeoenvironmental potential highlighted within a previous desk-based deposit modelling exercise for the site (Batchelor, 2017a). The results of the investigations indicate the presence of a north-west to south-east/east aligned deep channel in the London Clay, infilled with Anglian aged Chalky Till / Gravel. This and the rest of the site are overlain by late Devensian / early Holocene River Chelmer Gravels, and largely inorganic or contaminated Holocene Alluvium, capped by Made Ground. The Palaeolithic potential of the site is negligible, as it is unlikely that any remains will be present in the sediments infilling the buried channel, and certainly none in primary context. No significant changes in topography are indicated in the overlying River Chelmer Gravels or, as confirmed by the geoarchaeological field investigations, the Holocene Alluvial deposits. The archaeological potential of the site has already been assessed and is considered low-moderate. On the basis of the three new geoarchaeological boreholes, the sediments at the site are also of limited palaeoenvironmental potential; where organic sediments are recorded, these are largely localised in nature, thin, and in places contaminated. No further environmental archaeological assessment of the site is therefore recommended.

# 2. INTRODUCTION

## 2.1 Site Context

This report summarises the findings arising out of the geoarchaeological field investigations and deposit modelling undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development of land at the Peninsula Site, Chelmer Waterside, Chelmsford (centred on NGR TL 7156 0633; Figure 1). The development area comprises the Wharf Road car park and land to the east, between the River Chelmer and the Chelmer and Blackwater Navigation Basin. Quaternary Scientific were commissioned by RPS Group on behalf of Taylor Wimpey East London to undertake the geoarchaeological investigations.

The British Geological Survey (1 : 50,000) shows the site underlain by London Clay bedrock overlain by Alluvium, described as comprising clay, silt, sand & gravel. In fact, the alluvial deposits are almost everywhere underlain by Late Devensian Late Glacial Gravels, and this gravel is widely recorded in boreholes in the vicinity of the site. The site occupies almost the entire width of the floodplain along this stretch of the River Chelmer, and is bounded to the south by River Terrace Gravels, and to the north by Middle Pleistocene glaciofluvial deposits of sand and gravel. A considerable number of geotechnical investigations have taken place on the site in 1999 (AEA), 2003 (Arup), 2013 (WYG) and JNP Group (2016). The results of a recent desk-based deposit modelling exercise that integrated these records (Batchelor, 2017a) demonstrated the presence of north-west to south-east/east aligned deep channel in the London Clay, infilled with Anglian aged Chalky Till / Gravel. This and the rest of the site are overlain by late Devensian / early Holocene River Chelmer Gravels and Holocene Alluvium, capped by Made Ground. Organic-rich/Peaty horizons were recorded in a small number of records.

## 2.2 Geoarchaeological, Palaeoenvironmental and Archaeological potential

The existing records indicate variation in the height of the River Terrace Gravels, and thickness of the subsequent Holocene deposits within the vicinity of the site. Such variations are significant as they represent different environmental conditions that would have existed in a given location. For example: (1) the varying surface of the River Terrace Gravels may represent the location of former channels and bars (as outlined above); and (2) the Alluvium represents periods of channel activity / changing hydrological conditions. Thus by studying the sub-surface stratigraphy across the site and wider area in greater 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) appear to be limited on the site, but have potential to provide a detailed reconstruction of past environments on both the wetland and dryland. In particular, they provide the potential to increase knowledge and understanding of the interactions between hydrology, human activity, vegetation succession and climate. Significant vegetation changes include the Mesolithic/Neolithic decline of elm woodland, the Neolithic colonisation and decline of yew woodland; the Late Neolithic/Early Bronze Age growth of elm on Peat, and the general decline of wetland and dryland woodland during the Bronze Age. Such investigations have

successfully been carried out through the assessment/analysis of palaeoecological remains (e.g. pollen, plant macrofossils & insects) and radiocarbon dating.

Finally, areas of high gravel topography, soils and peat represent potential areas that might have been utilised or even occupied by prehistoric people, evidence of which may be preserved in the archaeological (e.g. features and structures) and palaeoenvironmental record (e.g. changes in vegetation composition). The potential for archaeological remains on the Chelmer Riverside site has been considered as part of the archaeological desk-based assessment (CgMs Consulting, 2016). The potential for palaeoenvironmental remains in sediments dating to the Palaeolithic and Mesolithic, and for archaeological material dating to the Roman period, is considered low to moderate. A generally low archaeological potential is identified for all other periods. Previous development is considered to have had a severe and widespread archaeological impact on the underlying deposits, with considerable potential for substantial contamination.

### 3.4 Aims & Objectives

As outlined within the Written Scheme of Investigation (Batchelor, 2017b) and subsequent desk-based geoarchaeological deposit model (Batchelor, 2017a) the existing geotechnical boreholes indicate that the site has some geoarchaeological and palaeoenvironmental potential, and thus further environmental archaeological investigation of the site may be required. It was noted however that due to substantial contamination across the site, boreholes should only be collected if deemed safe to do so, and from areas identified as of lowest risk. A total of three geoarchaeological boreholes were therefore put down at the site at locations where organic sediments have been recorded within the geotechnical records.

Five significant research aims relevant to geoarchaeological investigations at the site were identified within the WSI (Batchelor, 2017b):

1. To clarify the nature of the sub-surface stratigraphy across the site;
2. To clarify the nature, depth, extent and 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).

In order to address the first the first two of these aims in more detail, the following objectives were undertaken:

1. To collect an additional three geoarchaeological borehole sequences at locations of palaeoenvironmental potential;
2. To use the stratigraphic data from the new locations, and existing records to update the deposit model of the major depositional units across the site;

3. To assess the potential of the new geoarchaeological boreholes to provide information on the environmental history of the site and its environs, and to make recommendations for any further environmental archaeological assessment.

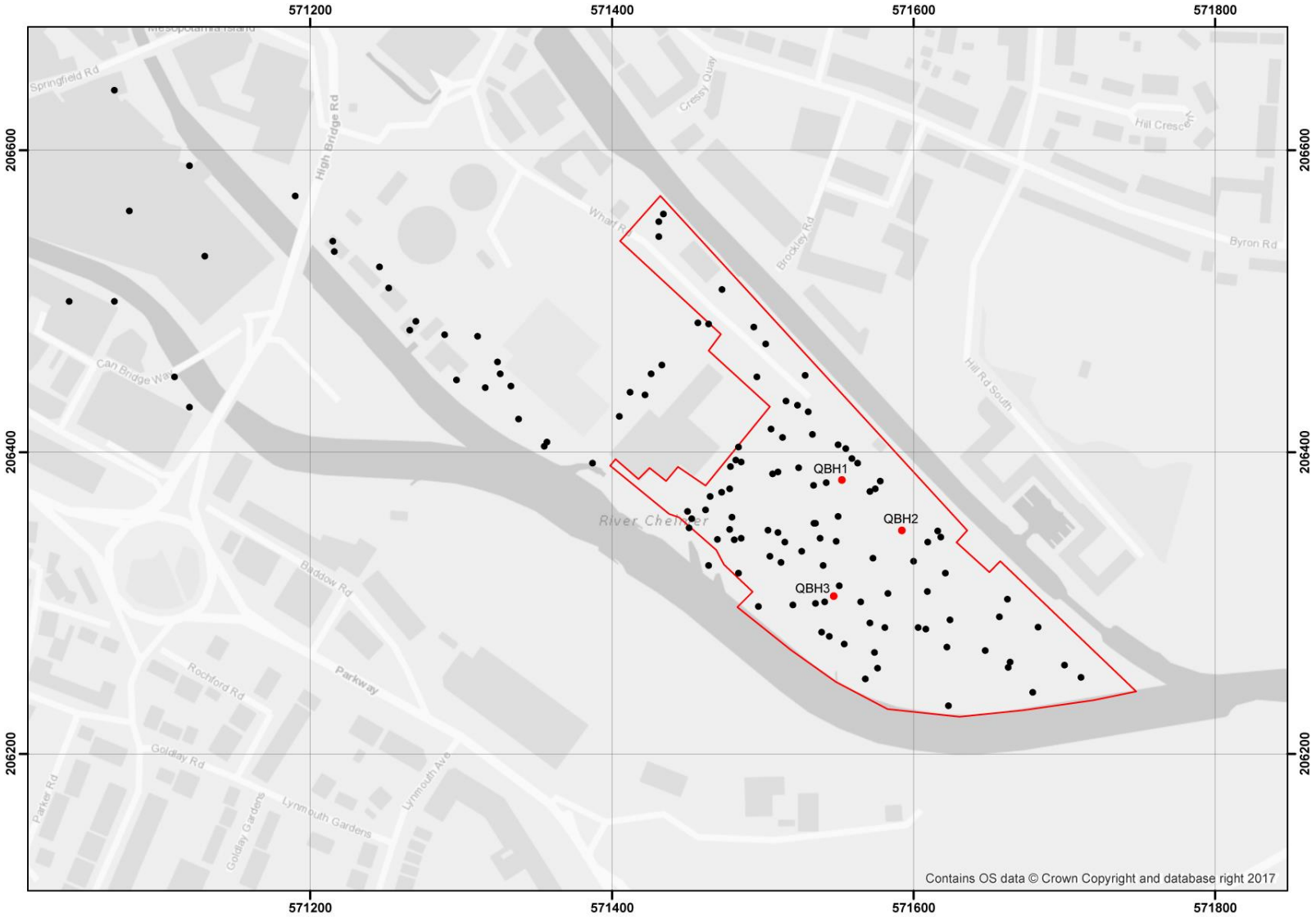


**Figure 1: The Peninsula Site, Chelmer Waterside, Chelmsford, showing SI borehole and test-pit locations (black) and the new geoarchaeological boreholes (red).**

# 3. METHODS

## 3.1 Field investigations

A total of three geoarchaeological boreholes (boreholes QBH1 to QBH3) were put down at the site in July 2017 by Quaternary Scientific (Figure 2). The borehole core samples were recovered using an Eijkelkamp window sampler and gouge set using an Atlas Copco TT 2-stroke percussion engine. This coring techniques provide a suitable method for the recovery of continuous, undisturbed core samples and provides sub-samples suitable for not only sedimentary and microfossil assessment and analysis, but also macrofossil analysis. Spatial co-ordinates for each borehole were obtained using a Leica Differential GPS (see Table 1).

## 3.2 Lithostratigraphic description

A combination of laboratory- and field-based lithostratigraphic descriptions of the new borehole samples was carried out using standard procedures for recording unconsolidated sediment and peat, noting the physical properties (colour), composition (gravel, sand, clay, silt and organic matter) and inclusions (e.g. artefacts). The procedure involved: (1) cleaning the samples with a spatula or scalpel blade and distilled water to remove surface contaminants; (2) recording the physical properties, most notably colour; (3) recording the composition e.g. gravel, fine sand, silt and clay; (4) recording the degree of peat humification, and (5) recording the unit boundaries e.g. sharp or diffuse. The results are displayed in Tables 2 to 4.

## 3.3 Deposit modelling

The deposit model for the Peninsula Site was based on a review of 129 records (Figure 1). Sedimentary units from the boreholes were classified into four groups: (1) London Clay Bedrock, (2) Till & Gravel, (3) Alluvium, and (4) Made Ground. The classified data for groups 1-4 were then input into a database within the RockWorks 16 geological utilities software, the output from which was displayed using ArcMAP 10. Models of surface height were generated for the London Clay, Till & Gravel and Alluvium using an Inverse Distance Weighted algorithm (Figures 2-4). Thickness of the Alluvium and Made Ground (Figures 5-6) were also modelled (also using an Inverse Distance Weighted algorithm).

Because the boreholes are not uniformly distributed over the area of investigation, the reliability of the models generated using RockWorks is variable. In general, reliability improves from outlying areas where the models are largely supported by scattered archival records towards the core area of commissioned boreholes. Because of the 'smoothing' effect of the modelling procedure, the modelled levels of stratigraphic contacts may differ slightly from the levels recorded in borehole logs and section drawings. As a consequence of this the modelling procedure has been manually adjusted so that only those areas for which sufficient stratigraphic data is present will be modelled. In order to achieve this, a maximum distance cut-off filter equivalent to a 50 or 25m radius around each record is applied to the deposit models. In addition, it is important to recognise that multiple sets of boreholes are represented, put down at different times and recorded using different descriptive terms and subject to differing technical constraints in terms of recorded detail including the exact levels of the stratigraphic boundaries.

Table 1: Spatial attributes and lithostratigraphic data for the new geoarchaeological boreholes at Chelmer Waterside, Chelmsford.

| Borehole | Easting | Northing | Elevation (m OD) | Total Depth (m) | Alluvium surface (m bgl) | Gravel surface (m bgl) |
|---|---|---|---|---|---|---|
| QBH1 | 571552.74 | 206381.23 | 23.55 | 3.00 | 1.40 | 2.40 |
| QBH2 | 571590.99 | 206344.55 | 23.48 | 3.00 | 1.00 | 2.50 |
| QBH3 | 571547.47 | 206305.14 | 23.39 | 2.20 | 1.10 | 2.00 |

# 4. RESULTS, INTERPRETATION & DISCUSSION OF THE LITHOSTRATIGRAPHIC DESCRIPTIONS & DEPOSIT MODELLING

The results of the lithostratigraphic descriptions of the new geoarchaeological boreholes are shown in Tables 2 to 4, with the deposit models displayed in Figures 2 to 6; these comprise surface elevation and thickness models for each of the main stratigraphic units. The results of the deposit modelling indicate that the number and spread of the logs is sufficient to permit modelling with a high level of certainty across the site.

The full sequence of sediments recorded in the boreholes comprises:

Made Ground – widely present
Alluvium – widely present
Gravel – widely present
London Clay – widely present

## 4.1 London Clay

London Clay bedrock was reached in 37 of the 126 sequences put down across the site (Figure 2). None of the new geoarchaeological boreholes reached the surface of the bedrock; however, the previous modelling exercise indicated that the surface of the London Clay is recorded between 15 and 20m OD across much of the northern part of the site and surrounding area. On the southern part of the site, the London Clay surface descends sharply towards 6m OD; similar levels are indicated in a few isolated records towards the north-west of the site. The results therefore indicate a large trough/channel in the surface of the London Clay with a north-west to south-east/east trajectory that very broadly follows the course of the River Chelmer. This channel was identified within the Cambell-Reith report (2011), but at that time, too few records existed to determine its likely trajectory. It has also been recognised at the nearby Baddow Street car-park site (HER Ref: 46297; NGR TL 7130 0631). Here, the trough was reported as cutting at least 25m into the London Clay deposits (CgMs Consulting, 2016).

## 4.2 Till & Gravel

Overlying the London Clay within the deep channel is an alternating sequence of clay and gravel deposits. The clay is frequently described as containing chalk fragments, and such material can confidently be interpreted as representing Chalky Till of Anglian (Marine Isotope Stage 12) age (*ca.* 478-424k BP). The alternating beds of Gravel and Till within the infill of this channel is to be expected within a glacial sequence of this type. These deposits reach between 12 and 14m in thickness (Figure 3).

Above the MIS12 Chalky Till and Gravel deposits infilling the channel, and directly overlying the London Clay beyond the confines of the channel, Gravel is recorded. This Gravel generally ranges between 1 and 2m in thickness, and is interpreted as representing a deposit of the River Chelmer

(Figure 3). It is most likely that this Gravel unit is of late Devensian / early Holocene age (i.e. broadly equivalent to the Shepperton Gravel of the River Thames sequence).

Due to the similarity of the MIS12 Chalky Till / Gravel and late Devensian / early Holocene Gravels, it is almost impossible to distinguish them in the geotechnical records. As such the units have been amalgamated, and their combined thickness is displayed in Figure 3; unsurprisingly, it closely reflects the shape of the underlying London Clay surface topography. The surface of these deposits (almost certainly the late Devensian / early Holocene Gravels) is displayed in Figure 4; this indicates a relatively even surface, ranging between 20 and 22m OD. The surface of the River Chelmer Gravel can be identified in the geoarchaeological boreholes, where its surface was recorded at 21.15, 20.98 and 21.39m OD in boreholes QBH1-QBH3 respectively.

### 4.3 Alluvium

The River Chelmer Gravels are overlain by Alluvium that ranges between <0.5 and 3m in thickness (Figure 4). In the new geoarchaeological sequences it was recorded at 1.0, 1.5 and 0.9m thick in boreholes QBH1-QBH3 respectively. The alluvium comprises clays, silts, sands and gravels throughout, generally becoming coarser with depth as might be expected. The alluvium is recorded as almost entirely inorganic, however, there are a few records where peat and/or organic-rich remains are recorded; 6 on the site itself, and 5 to the northwest (Figure 4). In the new geoarchaeological boreholes the alluvium was largely inorganic, and of limited palaeoenvironmental potential; in borehole QBH2 traces of organic matter were recorded between 22.48 and 21.88m OD, but this sequence was clearly affected by hydrocarbon contamination.

The alluvial deposits indicate a range of environments from slow to fast moving water, with pockets of semi-aquatic / semi-terrestrial conditions, most likely supporting sedge-fen / reed-swamp type communities; combined, this picture is typical of a floodplain environment. The surface of the Alluvium is relatively even, ranging between 22 and 23m OD (Figure 5).

### 4.4 Made Ground

The deposits of Chelmer Waterside are capped by Made Ground which ranges between 0 and 3m in thickness (Figure 6). In some cases it is likely that the Made Ground truncates part of the alluvial deposits, but complete truncation is rare, only happening in 6 of 126 records across the modelled area.

It should be noted however, that substantial contamination has been identified on the Chelmer Waterside site (CgMs Consulting, 2016; Campbell Reith, 2011); this includes high levels of asbestos, cyanide, lead, beryllium and hydrocarbons.

**Table 2: Lithostratigraphic description of borehole QBH1, Chelmer Waterside, Chelmsford.**

| Depth (m OD) | Depth (m bgl) | Description | Stratigraphic group |
|---|---|---|---|
| 23.55 to 22.15 | 0.00 to 1.40 | Concrete hardstanding over brick and concrete rubble. | MADE GROUND |
| 22.15 to 21.15 | 1.40 to 2.40 | As3 Ag1 Gg+; blueish grey silty clay with occasional gravel clasts. | ALLUVIUM |
| 21.15 to 20.55 | 2.40 to 3.00 | Gg3 Ga1 Ag+; greyish orange sandy gravel with a trace of silt. Clasts are flint, well-rounded to sub-angular, average diameter 20mm (occasionally up to 60mm). | GRAVEL |

**Table 3: Lithostratigraphic description of borehole QBH2, Chelmer Waterside, Chelmsford.**

| Depth (m OD) | Depth (m bgl) | Description | Stratigraphic group |
|---|---|---|---|
| 23.48 to 22.48 | 0.00 to 1.00 | Concrete hardstanding over brick and concrete rubble. | MADE GROUND |
| 22.48 to 21.88 | 1.00 to 1.60 | As3 Ag1 Sh+; black with possible traces of organic matter. Hydrocarbon contamination throughout. Diffuse contact in to: | ALLUVIUM |
| 21.88 to 20.98 | 1.60 to 2.50 | As2 Ag1 Gg1 Ga+; black silty gravelly clay with a trace of sand. Hydrocarbon contamination throughout. Sharp contact in to: | |
| 20.98 to 20.48 | 2.50 to 3.00 | Gg3 Ga1 Ag+; orangey brown sandy gravel with a trace of silt. Clasts are flint, well-rounded to sub-angular, average diameter 20mm (occasionally up to 50mm). | GRAVEL |

**Table 4: Lithostratigraphic description of borehole QBH3, Chelmer Waterside, Chelmsford.**

| Depth (m OD) | Depth (m bgl) | Description | Stratigraphic group |
|---|---|---|---|
| 23.39 to 22.29 | 0.00 to 1.10 | Concrete hardstanding over brick and concrete rubble. | MADE GROUND |
| 22.29 to 21.39 | 1.10 to 2.00 | Ag2 As2 Ga+ Dh+ Gg+; brownish grey silt and clay with a trace of sand, detrital herbaceous material and occasional gravel clasts. Sharp contact in to: | ALLUVIUM |
| 21.39 to 21.19 | 2.00 to 2.20 | Gg3 Ga1 Ag+; orangey brown grading to grey sandy gravel with a trace of silt. Clasts are flint, well-rounded to sub-angular, average diameter 30mm (occasionally up to 60mm). | GRAVEL |
| 21.19 | 2.20 | Obstruction (large cobble/boulder?) | |

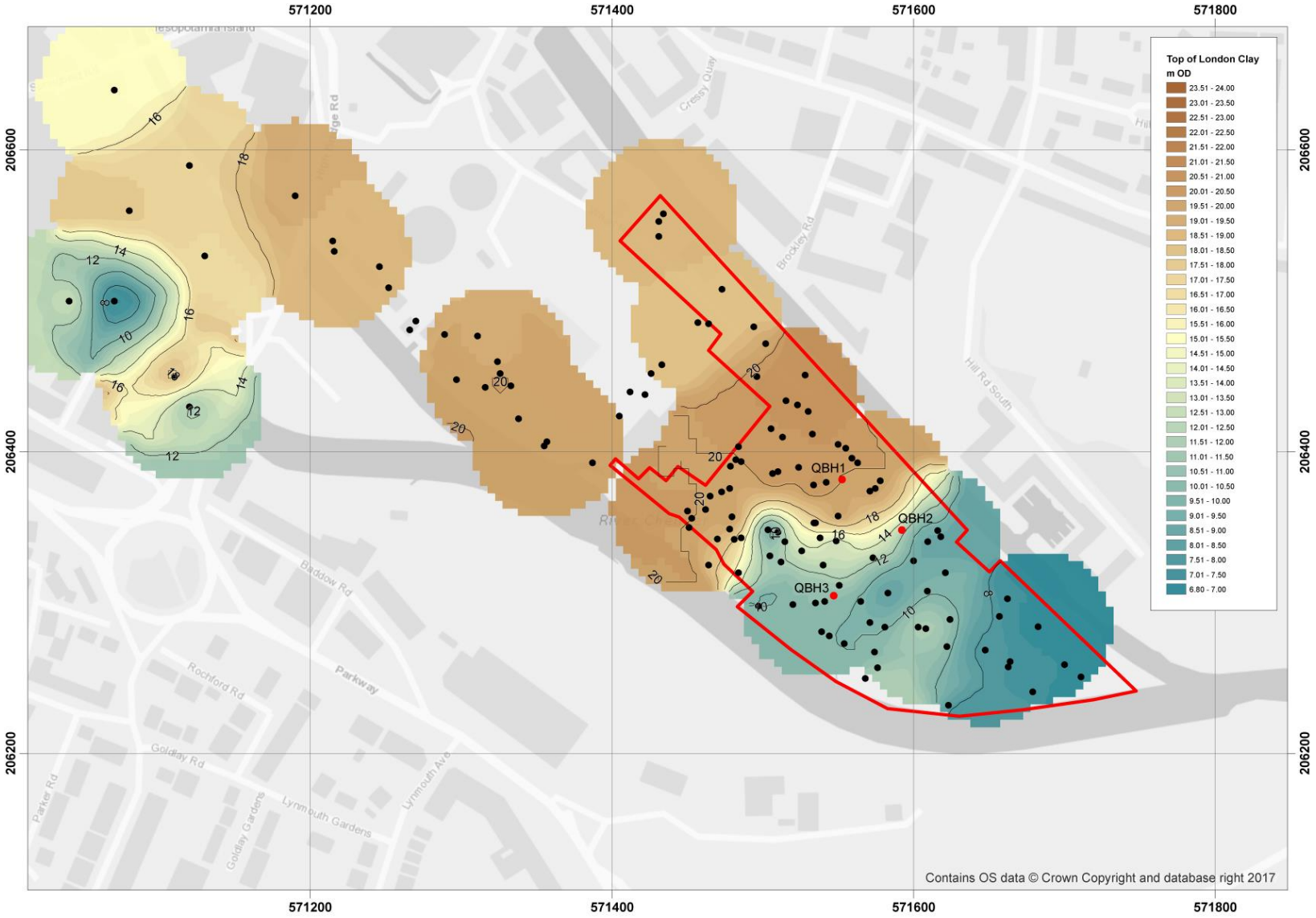


**Figure 2: Surface of the London Clay (m OD) showing SI borehole and test-pit locations (black) and the new geoarchaeological boreholes (red).**


**Figure 3: Combined thickness of the MIS12 Chalky Till / Gravel and late Devensian / early Holocene River Chelmer Gravels (m), showing SI borehole and test-pit locations (black) and the new geoarchaeological boreholes (red).**

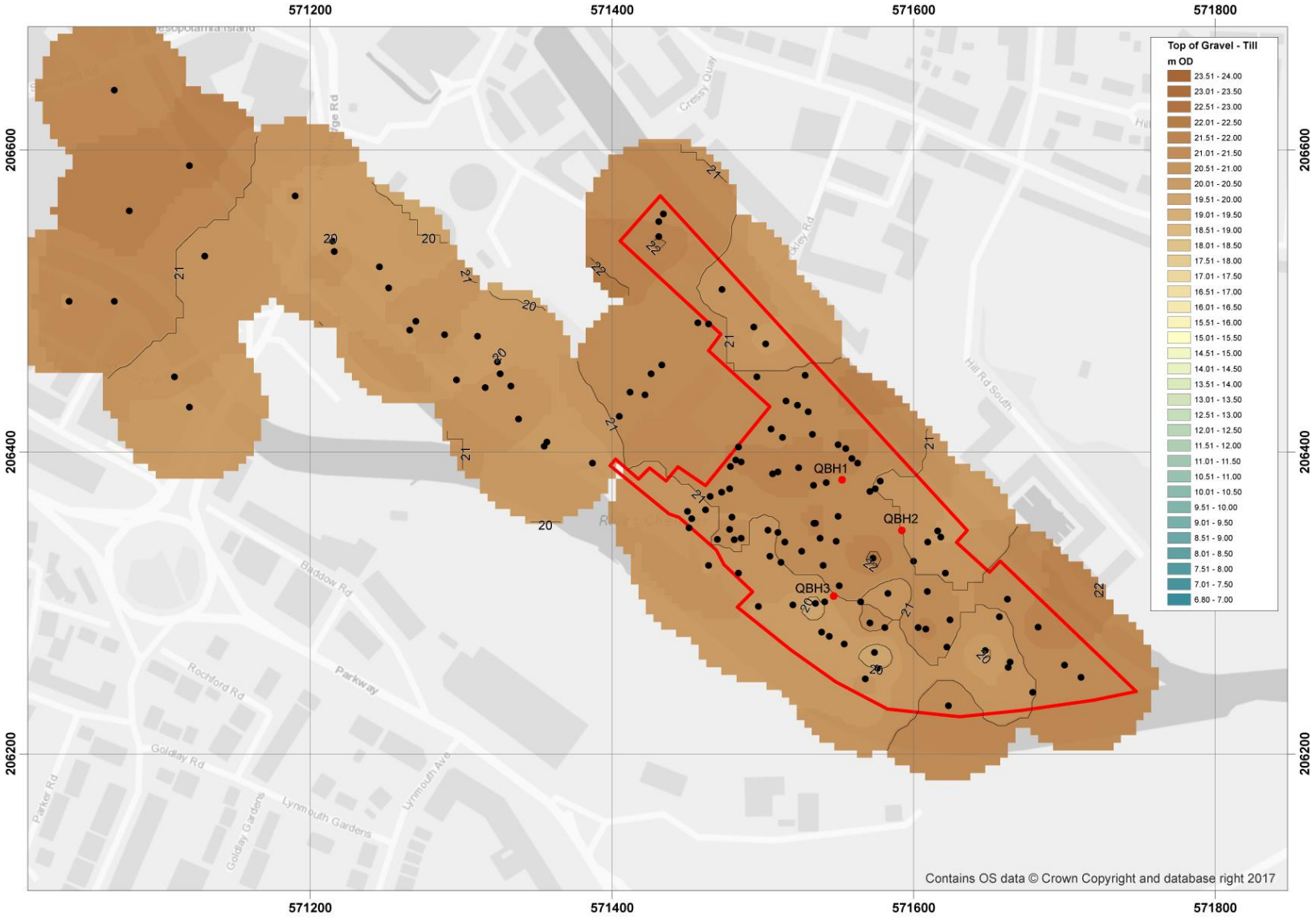


**Figure 4: Surface of the River Chelmer Gravels (m OD) showing SI borehole and test-pit locations (black) and the new geoarchaeological boreholes (red).**

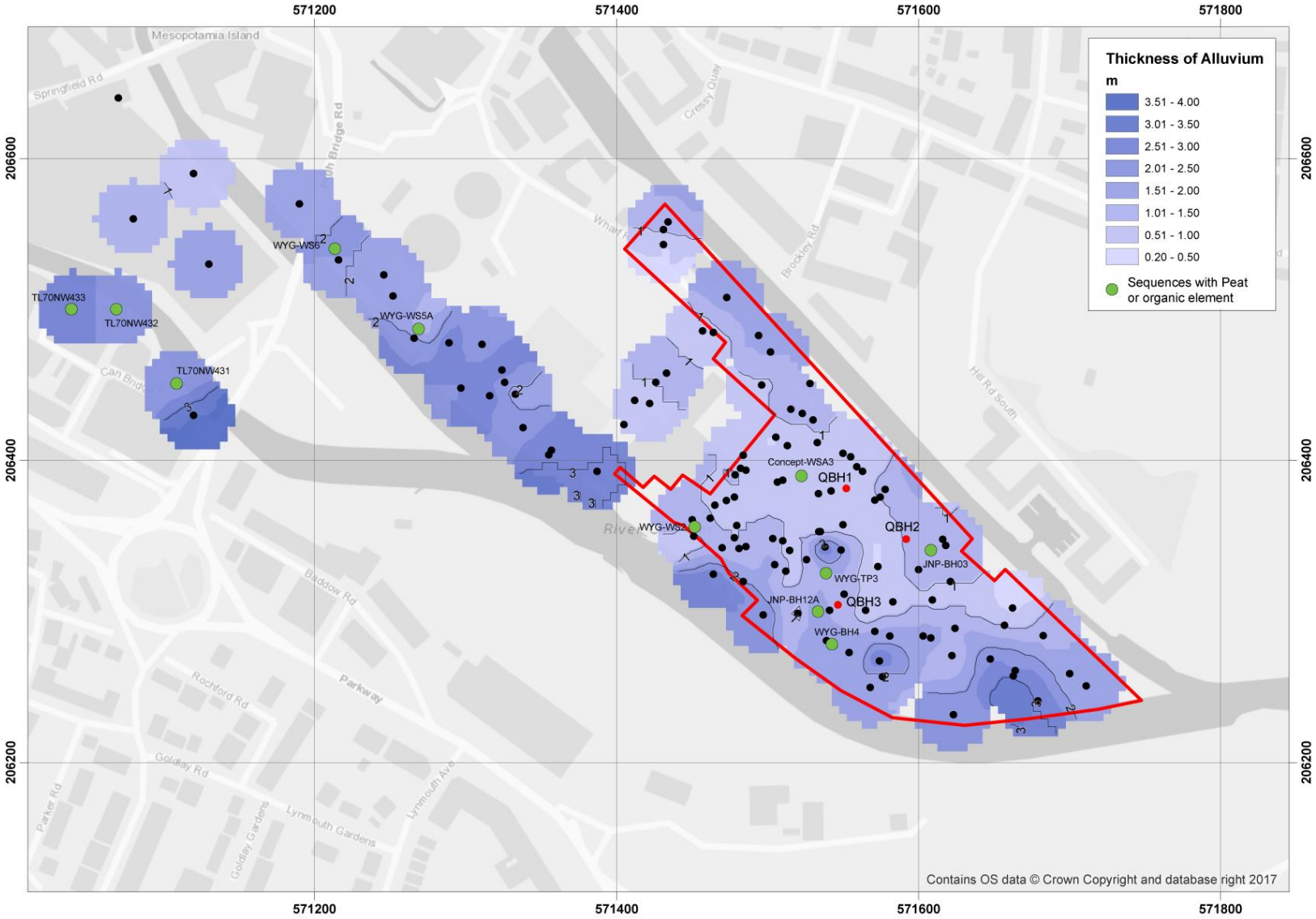


**Figure 5: Thickness of the Alluvium (m) showing SI borehole and test-pit locations (black) and the new geoarchaeological boreholes (red). Sequences with peat or organic elements also shown (green).**

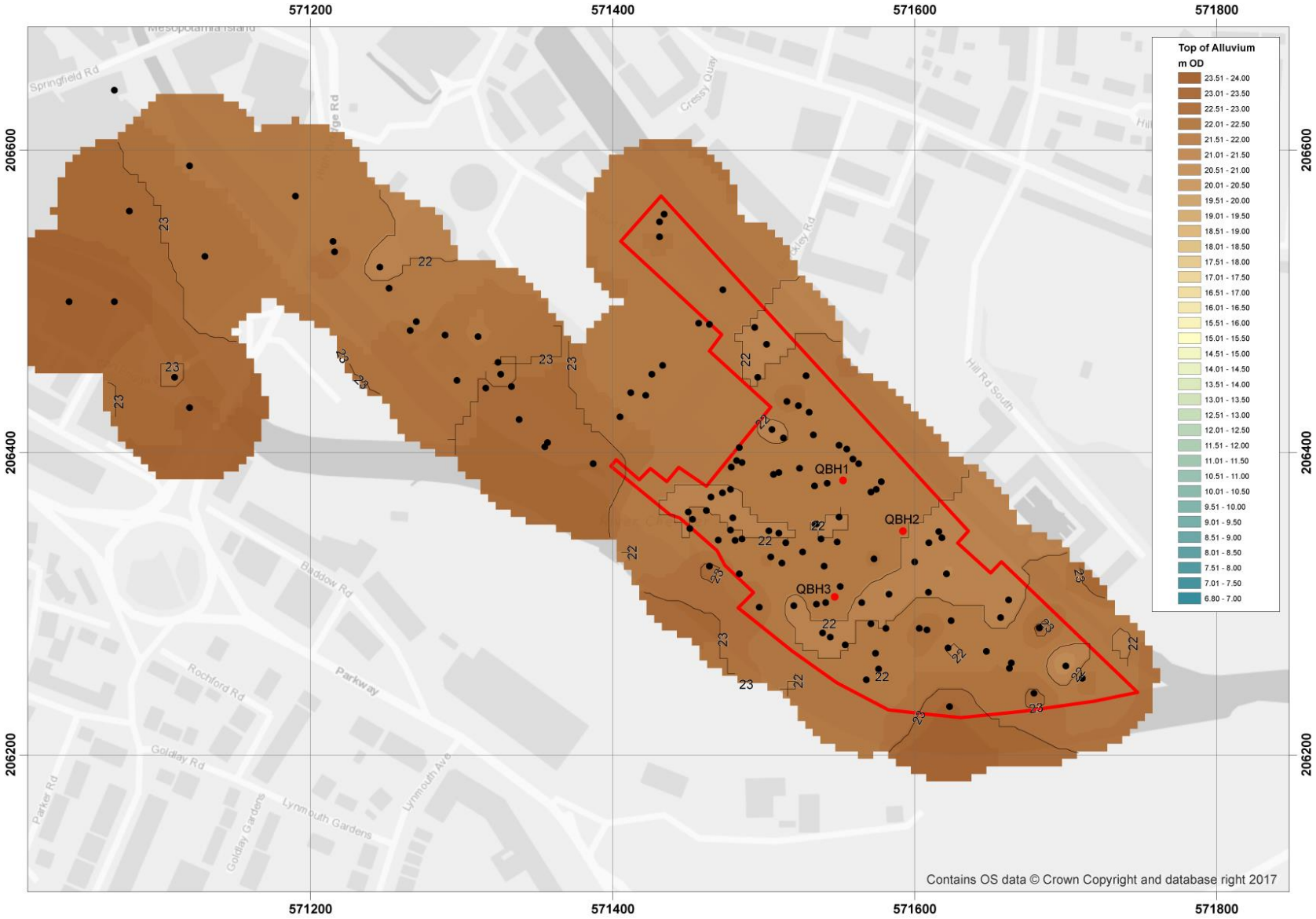


**Figure 6: Surface of the Alluvium (m OD) showing SI borehole and test-pit locations (black) and the new geoarchaeological boreholes (red).**

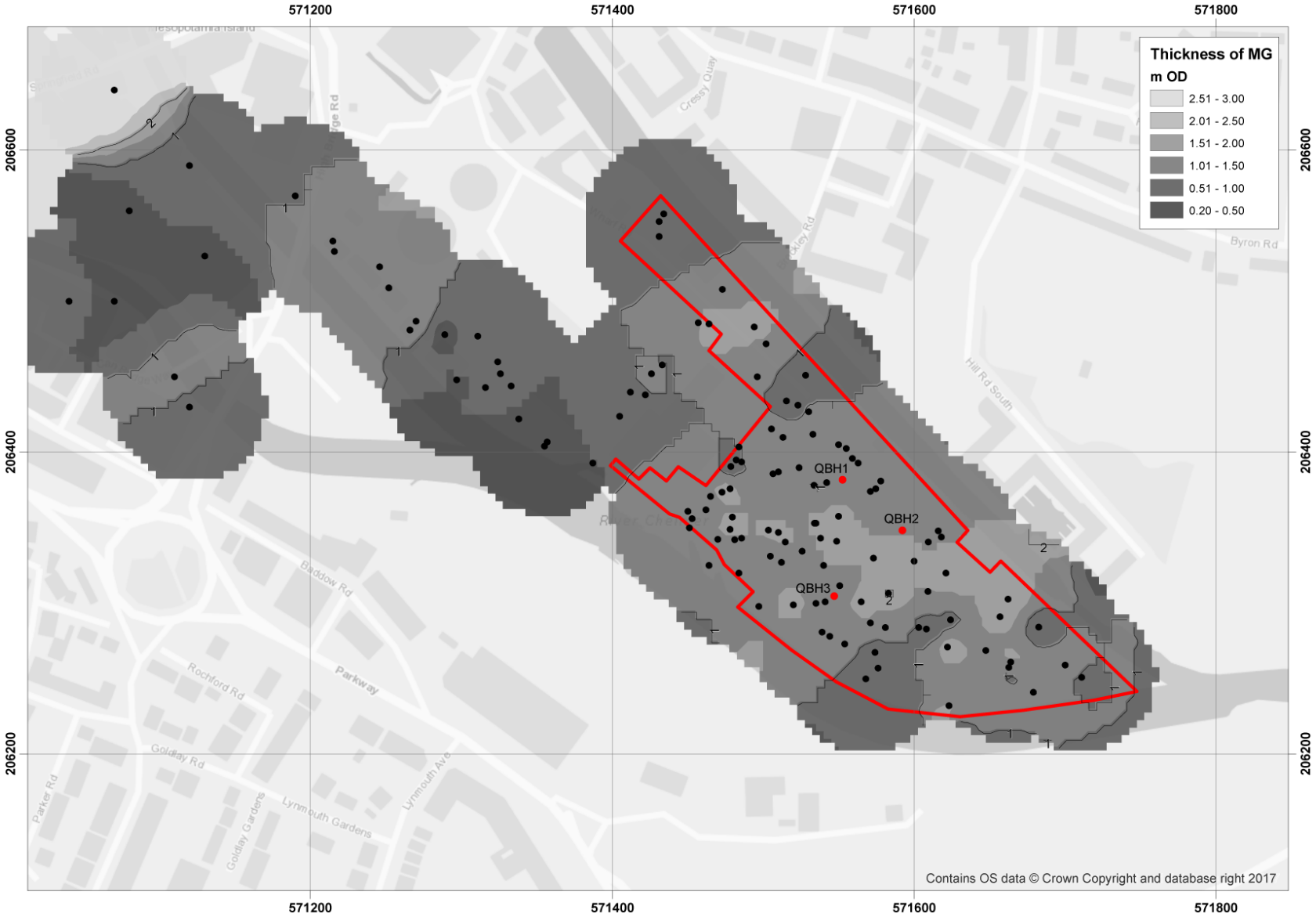


**Figure 7: Thickness of the Made Ground (m) showing SI borehole and test-pit locations (black) and the new geoarchaeological boreholes (red).**

# 5. CONCLUSIONS & RECOMMENDATIONS

The results of the geoarchaeological field investigations have largely confirmed those of the previous desk-based deposit modelling exercise (Batchelor, 2017a); the presence of a north-west to south-east/east aligned deep channel in the London Clay is indicated, infilled with Anglian aged Chalky Till / Gravel. This and the rest of the site are overlain by late Devensian / early Holocene River Chelmer Gravels, and largely inorganic Holocene Alluvium, capped by Made Ground.

As stated previously (Batchelor, 2017a), the Palaeolithic potential of the site is negligible, as it is extremely unlikely that any remains will be present in the sediments infilling the buried channel and certainly none in primary context. No significant changes in topography are indicated in the overlying River Chelmer Gravels or, as confirmed by the geoarchaeological field investigations, the Holocene Alluvial deposits. However, the variable nature of the sediments are important as they represent different environmental conditions that would have existed in a given location across the floodplain. For example: (1) the varying sediment sizes (clay-gravel) represent varying hydrological conditions, and (2) the peat/organic-rich sediment recorded in isolated records represent former semi-aquatic/terrestrial conditions. Thus studying the sub-surface deposits of the site has enabled us to start building our understanding of the former landscapes and environmental changes that took place over both space and time across the site.

The archaeological potential of the site has already been assessed and is considered low-moderate. On the basis of the three new geoarchaeological boreholes, the sediments at the site are also of limited palaeoenvironmental potential; where organic sediments are recorded, these are largely localised in nature, thin, and in places contaminated. No further environmental archaeological assessment of the site is therefore recommended.

# 7. REFERENCES

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# 8. APPENDIX: OASIS FORM

## OASIS ID: quaterna1-294033

### Project details

| | |
|---|---|
| Project name | Chelmer Waterside, Chelmsford |
| Short description of the project | Three geoarchaeological boreholes were put down at the Chelmer Waterside site at locations where organic sediments of possible palaeoenvironmental potential had been highlighted within a previous desk-based deposit modelling exercise (Batchelor, 2017a). The results of the investigations indicate the presence of a north-west to south-east/east aligned deep channel in the London Clay, infilled with Anglian aged Chalky Till / Gravel. This and the rest of the site are overlain by late Devensian / early Holocene River Chelmer Gravels, and largely inorganic Holocene Alluvium, capped by Made Ground. The Palaeolithic potential of the site is negligible, as it is unlikely that any remains will be present in the sediments infilling the buried channel and certainly none in primary context. No significant changes in topography are indicated in the overlying River Chelmer Gravels or, as confirmed by the geoarchaeological field investigations, the Holocene Alluvial deposits. The archaeological potential of the site has already been assessed and is considered low-moderate. On the basis of the three new geoarchaeological boreholes, the sediments at the site are also of limited palaeoenvironmental potential; where organic sediments are recorded, these are largely localised in nature, thin, and in places contaminated. No further environmental archaeological assessment of the site is therefore recommended. |
| Project dates | Start: 01-04-2017 End: 24-08-2017 |
| Previous/future work | Yes / No |
| Type of project | Environmental assessment |
| Survey techniques | Landscape |

### Project location

| | |
|---|---|
| Country | England |
| Site location | ESSEX CHELMSFORD CHELMSFORD Chelmer Waterside |
| Postcode | CM2 6LU |

| | |
|---|---|
| Site coordinates | TL 7156 0633 51.728894056917 0.484478633241 51 43 44 N 000 29 04 E Point |

## Project creators

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

## 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 | 24 August 2017 |