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UXBRIDGE BUSINESS PARK, PLOT A, SOUTH BUCKINGHAMSHIRE: GEOARCHAEOLOGICAL ASSESSMENT

Prepared for Cotswold Archaeology

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Contents

FIGURES

SUMMARY

This report is a geoarchaeological assessment of strata sampled in ten boreholes drilled at Plot A, Uxbridge Business Park.

Gravels of the Late Devensian Colney Street Gravel Member were encountered at the base of the sedimentary sequence outcropping at between +29.58m OD and +30.85m OD. In several boreholes the Colney Street Gravel Member was overlain by minerogenic alluvial strata of possible Lateglacial to Early Holocene date comprising both channel (lithoclast tufa) and point bar (fining-upwards sandy silt/clay) facies. The minerogenic strata were overlain by peats which formed across the site, most likely during the Mesolithic period. Later, rising base levels led to the formation of a reedswamp across the site resulting in the deposition of organic mud strata. Following the formation of the reedswamp, channels filled with oncoidal tufa deposits formed at the site, overlain in places by thin silt/clay deposits, related to later overbank deposition in a floodplain environment. The sedimentary sequence at the site is capped by modern Made Ground, probably related to the construction of the Sanderson factory, which truncates the Late Quaternary sedimentary sequence.

The fining-upwards point bar strata overlying the Colney Street Gravel Member are assessed as being of moderate archaeological potential as, although no specific indicators of human activity were noted at the site, similar strata which are likely to be of similar age were associated with in-situ *Final Upper Palaeolithic and Mesolithic scatters at the nearby site at Three Ways Wharf. Peat and organic mud strata at the site are assessed as being of low to moderate archaeological potential since human activity is more likely to have focused on drier more open areas in the vicinity of the site. The peat and organic strata are, however, assessed as being of high palaeoenvironmental potential. This potential was demonstrated by recent multi-proxy palaeoenvironmental analysis of similar strata at the nearby William King Flour Mill which provided 'off-site' palaeoenvironmental context to the Upper Palaeolithic and Mesolithic occupation at Three Ways Wharf.*

1. INTRODUCTION

1.1 In November 2014 and at the request of Cotswold Archaeology (CA) on behalf of their client The Baynham Meikle Partnership, ARCA carried out a geoarchaeological assessment of Uxbridge Business Park Plot A (henceforth 'the site'). The geoarchaeological assessment was carried out as part of an archaeological watching brief and trial trench evaluation carried out by CA as outlined in the Written Scheme of Investigation (WSI) (Cotswold Archaeology 2014).

1.2 This document assesses the stratigraphic sequence beneath the site. It is arranged as follows: first a brief account is provided of the geographical, geological and methodological background to the geoarchaeological project; secondly the borehole litho- and magneto-stratigraphy is described in detail; thirdly the potential of the sample resource in the boreholes to address the questions outlined in Section 1.6 is assessed. A bibliography and appendices containing borehole stratigraphic logs complete the document.

1.3 The site lies within Uxbridge Business Park, which is situated *c.*750m north of Uxbridge town centre. The site is bounded to the west by a tributary of the River Colne and to the east by a waterway known as the Shire Ditch, and Sanderson Road. Plot A lies to the south of the existing business park buildings within an area of open grassland and planned wooded grassland. The site lies within the valley of the River Colne, a major tributary of the Thames, rising in the Chilterns, and confluent with the Thames at Staines. The site lies towards the eastern edge of the present floodplain, which is traversed by a network of channels, both natural and artificial. The general ground level is *c.* +32.50m OD, with a gentle slope towards higher ground to the east.

1.4 The British Geological Survey (BGS) map the site as lying on bedrock of the Lambeth Group, a Palaeogene deposit dating from 66-56 my BP. The younger London Clay Formation, dating from 56-34 my BP, is mapped to the south and east of the site. Superficial deposits of Holocene alluvium are mapped on the site, with outcrops of progressively older Pleistocene terraces occurring on the higher ground to the east: the Lynch Hill Gravel Member immediately east of the site, and the Black Park Gravel Member *c.*500m further to the east (BGS 2014). Gravels immediately underlying the present floodplain of the Colne in

the vicinity of the site are referred to as the Colney Street Gravel Member, dated to the Late Devensian (Gibbard 1985, 81-2).

1.5 Previous archaeological investigations have been undertaken at the site as part of the wider development of the Business Park on what now constitutes the completed Plots 1 – 3 and within a flood relief channel in the far southern part of the development (MoLAS 2002; 2006). These investigations revealed a suite of alluvial strata directly analogous to (and apparently broadly contemporary with) Lateglacial and Early Holocene strata associated with the nationally-important Upper Palaeolithic and Mesolithic remains at Three Ways Wharf, approximately 200m to the south of the site (Lewis and Rackham 2011). At Three Ways Wharf, *in-situ* lithic and faunal scatters were encountered within fine-grained mineral strata overlying the Colney Street Gravel Member which in turn were sealed by a sequence of black humic clay, tufa, and fine-grained mineral alluvial strata. Preservation of palaeoenvironmental proxy indicators at Three Ways Wharf was generally poor; however more recent investigations at the former William King Flour Mill, immediately north west of Three Ways Wharf (and immediately south west of Uxbridge Business Park) have demonstrated the potential to derive high-quality multi-proxy palaeoenvironmental data from similar and broadly contemporary sedimentary sequences (Grant *et al.* 2014).

1.6 The specific aims of the watching brief and trial trench evaluation were to (Cotswold Archaeology 2014, 8):

1.6.1 Identify whether there is any further evidence of Upper Palaeolithic and Mesolithic hunter-gatherer activity as previously identified within the Business Park (MoLAS 2006).

1.6.2 Determine the level of modern disturbance that may have occurred as a result of quarrying and the former factory and the impact this may have had on the survival of earlier remains.

1.6.3 Update the existing deposit model of the site through sample excavation and by undertaking a programme of borehole sampling to:

- Determine the level and depth of below ground disturbance or obstruction;
- Determine the potential survival and depth of archaeological deposits;
- Determine the palaeoenvironmental potential of the site;

- Update the geoarchaeological deposit model of the site; and in turn:
- Inform the next phase of archaeological mitigation (if required), in particular location, depth and archaeological and palaeoenvironmental potential.

1.6.4 This report therefore directly addresses the aims outlined in Section 1.6.3, above.

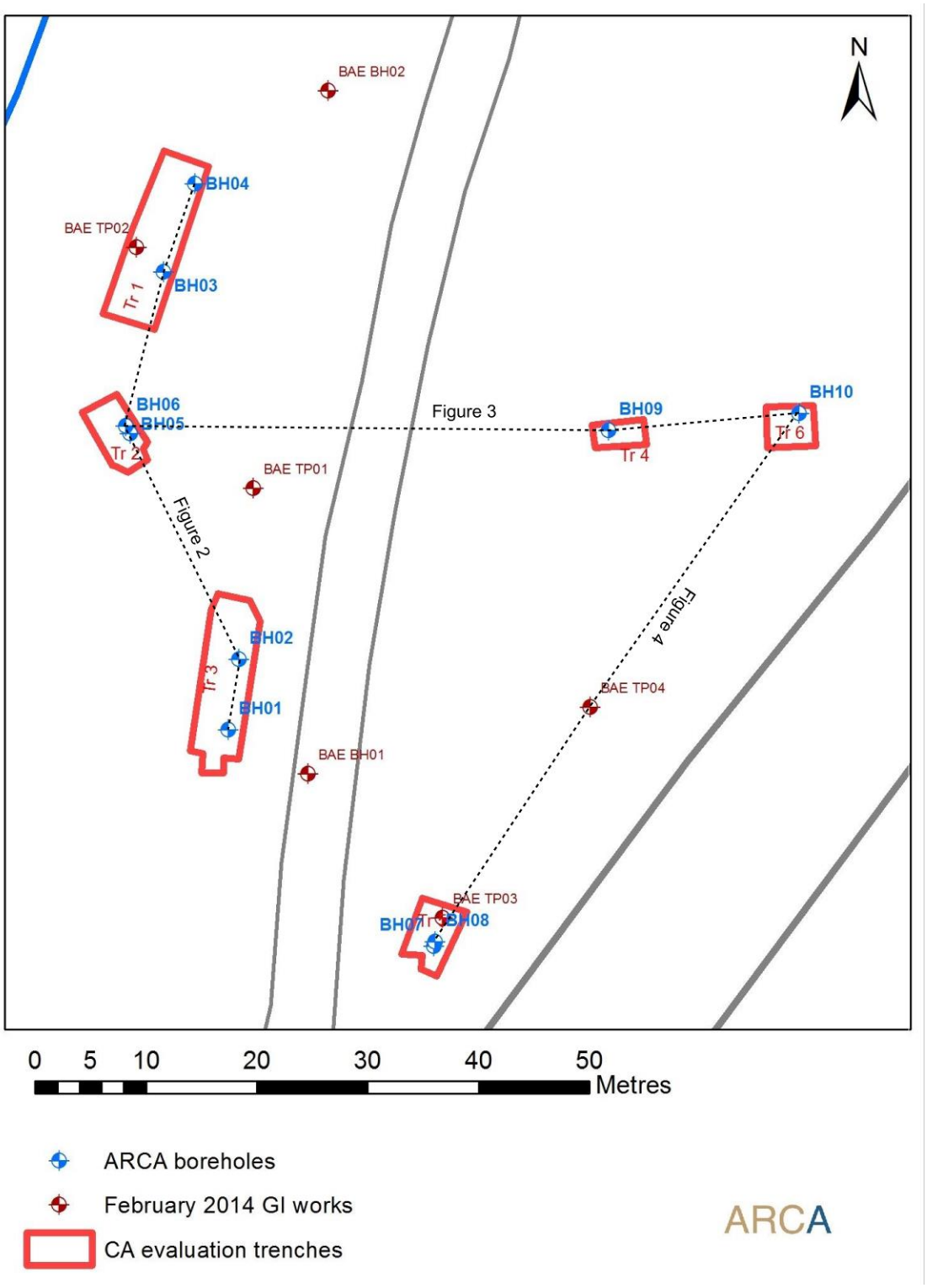

Figure 1: Position of boreholes.

2. METHODOLOGY

2.1 Boreholes were positioned within the footprint of the archaeological trial trenches as shown in Figure 1.

2.2 The boreholes were drilled from the base of the first 'step' of each trench to the top of the Colney Street Gravel Member using Eijkelkamp gouge augers / core sampler driven by a hand-held Makita drill.

2.3 Following the completion of sample excavation and recording in 1-2 boreholes were drilled in each trench (8 boreholes in total) using gouge augers. Sediments recovered in the gouge were photographed, described on site using standard geological criteria (Tucker 1982; Jones *et al.* 1999; Munsell Color 2000) and discarded.

2.4 Based on the stratigraphy of the gouge auger boreholes, two additional boreholes were drilled using an Eijkelkamp core sampling device to recover continuous 1m long sleeved samples of undisturbed sediment. The cores were labelled and sealed on site and returned to ARCA's Winchester laboratory for further assessment.

2.5 Borehole locations were surveyed to Ordnance Survey NGR and Ordnance Datum using a Leica RTK GPS by a CA archaeologist.

2.6 In the laboratory the 53mm diameter plastic tubes containing the cores were cleaned to remove surface mud. Volume magnetic susceptibility readings were then taken at 30mm intervals using a Bartington MS2C core logging sensor attached to an MS2 meter. The plastic tubes were then sliced open using a bench mounted stone saw and a sharp blade was used to split the cores lengthways in two. One half of the core was used for sedimentary description while the other was wrapped in plastic film and placed in storage.

2.7 The sediments revealed in the core half section used for stratigraphic description were carefully hand-cleaned, photographed and described using standard geological criteria (Tucker 1982; Jones *et al.* 1999; Munsell Color 2000). Following description the core half sections were wrapped in plastic film to minimise moisture loss and also placed in storage.

2.8 Lithological descriptions were combined with positional information within a RockWorks database (RockWare 2013).

Additional lithostratigraphic data obtained during the previous archaeological evaluation (MoLAS 2002) and geotechnical ground investigations carried out by BAE in February 2014 were also manually input into the RockWorks database. The RockWorks software was then used to combine lithological units into higher-level groupings (informal and formal members and formations) corresponding to geological/geographical and archaeological events. The RockWorks software was then used to plot the cross sections presented in Figure 2, Figure 3, and Figure 4, the logs presented in Figure 5 and Figure 6, and the stratigraphic surface model presented in **Error! Reference source not found.**.

2.9 The geoarchaeological archive from the site consists of 6m of core samples and digital records (photographs of the cores, RockWorks database entries [lithological descriptions and magnetic susceptibility data]), which are retained at the University of Winchester. The cores have been retained in storage at the University of Winchester pending decisions on the analytical programme (if applicable).

3. BOREHOLE STRATIGRAPHY

3.0.1 Six major stratigraphic units (formal and informal formations and members) present at the site were revealed in the boreholes drilled during the present works. These are reviewed below in chronological order.

3.1 Colney Street Gravel Member

3.1.1 Coarse sandy flint gravels of the Colney Street Gravel Member were encountered at the base of all boreholes drilled at the site.

3.1.2 The Colney Street Gravel Member outcropped at elevations of between +29.58m OD (BH07) and +30.85m OD (BH10), suggesting that the surface of the gravel dips slightly towards the south and is highest towards the east.

3.1.3 The geoarchaeological boreholes drilled at the site did not penetrate the Colney Street Gravel Member; however, geotechnical boreholes drilled at the site in February 2014 indicate that the gravels are *c.*4.00m thick and unconformably overlie bedrock of the Lambeth Group (BAE BH02 shown in Figure 1).

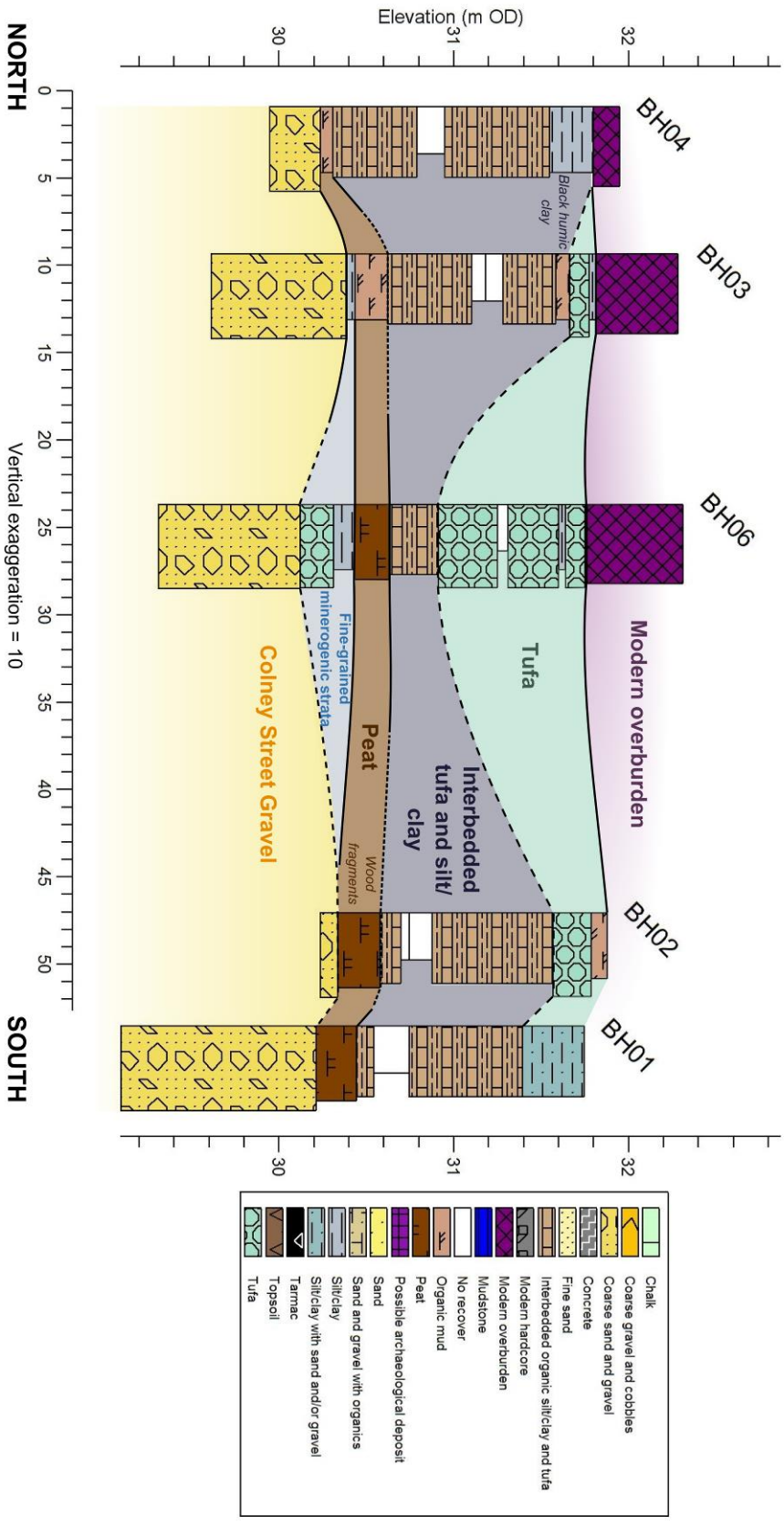

Figure 2: North to south borehole transect.

3.1.4 The Colney Street Gravel Member was conformably overlain (i.e. there was a non-erosive gradual boundary) by peat strata (see Section 3.3) in BH01, BH02 and BH04. In all other boreholes the gravel was conformably overlain by minerogenic alluvial strata (Section 3.2).

3.2 Minerogenic alluvial strata

3.2.1 In BH03, BH05, BH06, BH07, BH08, BH09, and BH10 the Colney Street Gravel Member was conformably overlain by a fining-upwards sequence of minerogenic alluvial strata. Two facies were encountered at the site: i) lithoclast tufa comprising sand to silt-sized reworked tufa grains and occasional carbonate encrusted flint granules and pebbles in a fine calcareous matrix; and, ii) fining-upwards sandy silt/clay.

3.2.2 Lithoclast tufa was encountered above the Colney Street Gravel Member in BH05, BH06, BH07 and BH08. Lithoclast tufa is typically an allochthonous facies indicative of deposition of reworked tufa within a channel (Ford and Pedley 1996). The fining-upwards sequence of gravels grading into sandy silt/clay may be indicative of the development of a point bar, and is thus a channel marginal facies.

3.2.3 Lithoclast tufa encountered in BH05 and BH06 was overlain by *c.*0.20m of greyish brown silt/clay, indicating lateral migration of the channel away from the location of these boreholes.

3.2.4 The minerogenic alluvial strata at the site were generally conformably overlain by peat in all boreholes.

3.3 Peat

3.3.1 Peat strata were encountered in all boreholes at the site. Peats were encountered overlying the Colney Street Gravel Member in BH01, BH02 and BH04, and overlying minerogenic alluvial strata in all other boreholes. The peat ranged in thickness from 0.07m in BH04 to 0.94m in BH09.

3.3.2 Peat strata at the site outcropped between +30.22m OD and +31.44m OD.

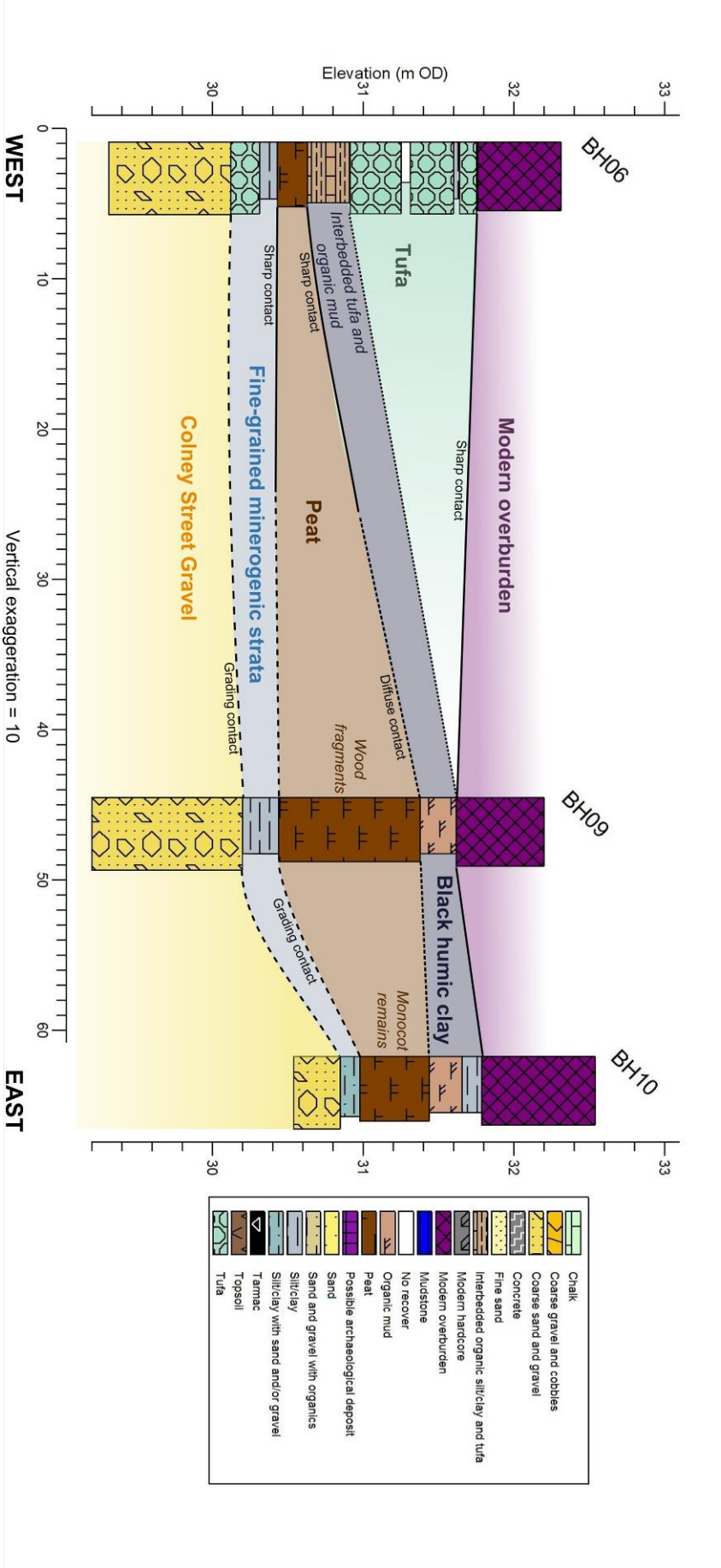

Figure 3: West to east borehole transect (BH06 - BH10).

3.3.3 Peat strata at the site were generally well-humified fen-type peats, occasionally with well-preserved plant macrofossils: pebble-sized wood remains were observed in the peat strata in BH01 and BH02, whilst poorly-humified monocotyledon remains were noted in BH10. Similarly, the degree of mineral input into the peat showed some lateral variability, with the strata in BH03, BH04 and BH07 tending towards organic sandy silt/clay. The lateral variability apparent is the peat strata is likely to reflect a laterally variable range of damp woodland and fen depositional environments in which the peat formed.

3.3.4 In all boreholes the peat was overlain by organic mud strata.

3.4 Organic mud

3.4.1 Organic mud strata, ranging in thickness from 0.10m to 1.49m, were encountered in all boreholes at the site. These strata outcropped between +30.31m OD and +31.79m OD.

3.4.2 Organic mud strata at the site comprise two distinct facies: i) dark greyish brown organic mud indistinctly interbedded with occasional tufa granules; and, ii) black soft, 'greasy-textured', very humic clay.

3.4.3 Where both facies were encountered within the same borehole sequence (BH03, BH04, and BH08), the interbedded organic mud and intraclast tufa was consistently overlain by the black very humic clay. The presence of sand to fine pebble-sized (presumably reworked) tufa particles (intraclasts) interbedded with the organic mud in the former is indicative of deposition in a higher-energy environment (i.e. nearer to an active channel) than the latter.

3.4.4 The lower contact between the interbedded organic mud and intraclast tufa and the underlying peat strata was typically sharp, whilst diffuse or gradational boundaries were encountered where peat strata were directly overlain by the black humic clay. In the boreholes were both organic mud facies were encountered, there was a diffuse (i.e. conformable) transition between facies.

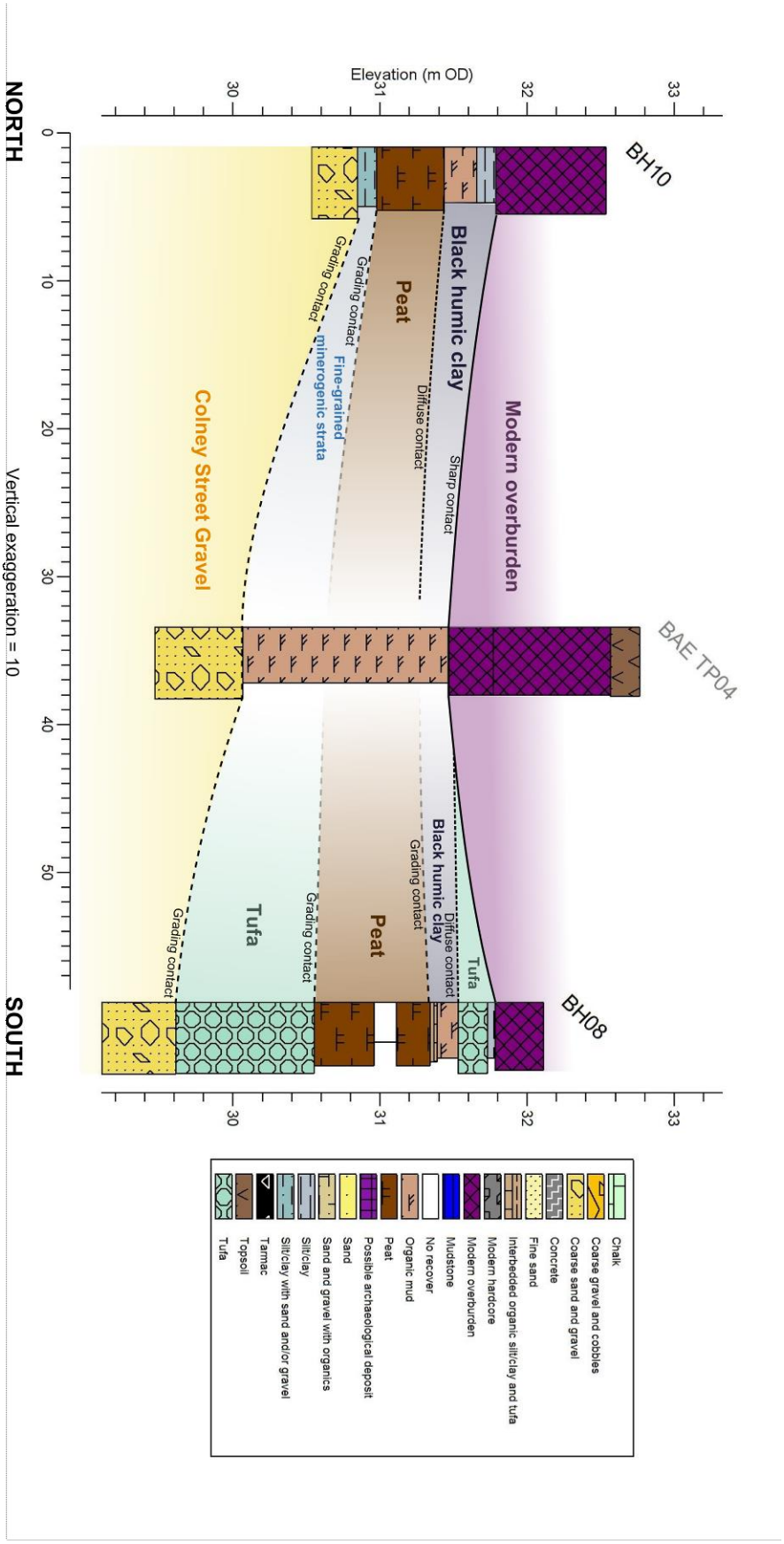

Figure 4: North to south borehole transect (BH10 – BH08).

3.4.5 Both facies are characterised by high organic content and by the frequent presence of monocotyledonous plant remains (e.g. Cyperaceae (sedge family), *Phragmites* (reed), *Typha latifolia* (bulrush) etc.) indicating the organic mud strata formed in a wet fen/reedswamp environment.

3.4.5 The organic mud was unconformably overlain in BH04, BH09, and BH10 by Made Ground, in all other boreholes the organic mud was overlain by oncoidal tufa.

3.5 Oncoidal tufa and floodplain sediments

3.5.1 Deposits of tufa were encountered at the top of the alluvial sequence in BH01, BH02, BH03, BH05, BH06, BH07, and BH08. Tufa deposits ranged in thickness from 0.15m (BH03) to 0.85m (BH06).

3.5.2 The upper tufa strata were generally composed of crumbly oncoidal tufa (weak subrounded granule to fine pebble-sized concretions) with variable amounts calcareous mud matrix. Although some well-preserved oncoids, showing distinctive concentric layering were observed, most oncoids appeared to have been partially degraded.

3.5.3 Oncoidal tufas such as those encountered at the site may have formed either as the fill of a channel or as a paludal deposit forming on a channel margin.

3.5.4 In BH02, BH03, BH05, BH06, and BH08 the upper tufa deposits were conformably overlain by up to 0.09m of greyish brown silt/clay indicative of overbank deposition in a floodplain environment.

3.5.5 The upper tufa and floodplain strata were unconformably overlain by Made Ground.

3.6 Made Ground

3.6.1 'Made Ground' is a term used by the British Geological Survey to encompass deposits formed as a product of human action (BGS 2014). Deposits of Modern Made Ground capped the sedimentary sequence across the site, but were not recovered in BH01 or BH02 as these boreholes were drilled from the base of the first step of Tr.3 which was below the base of the Made Ground strata.

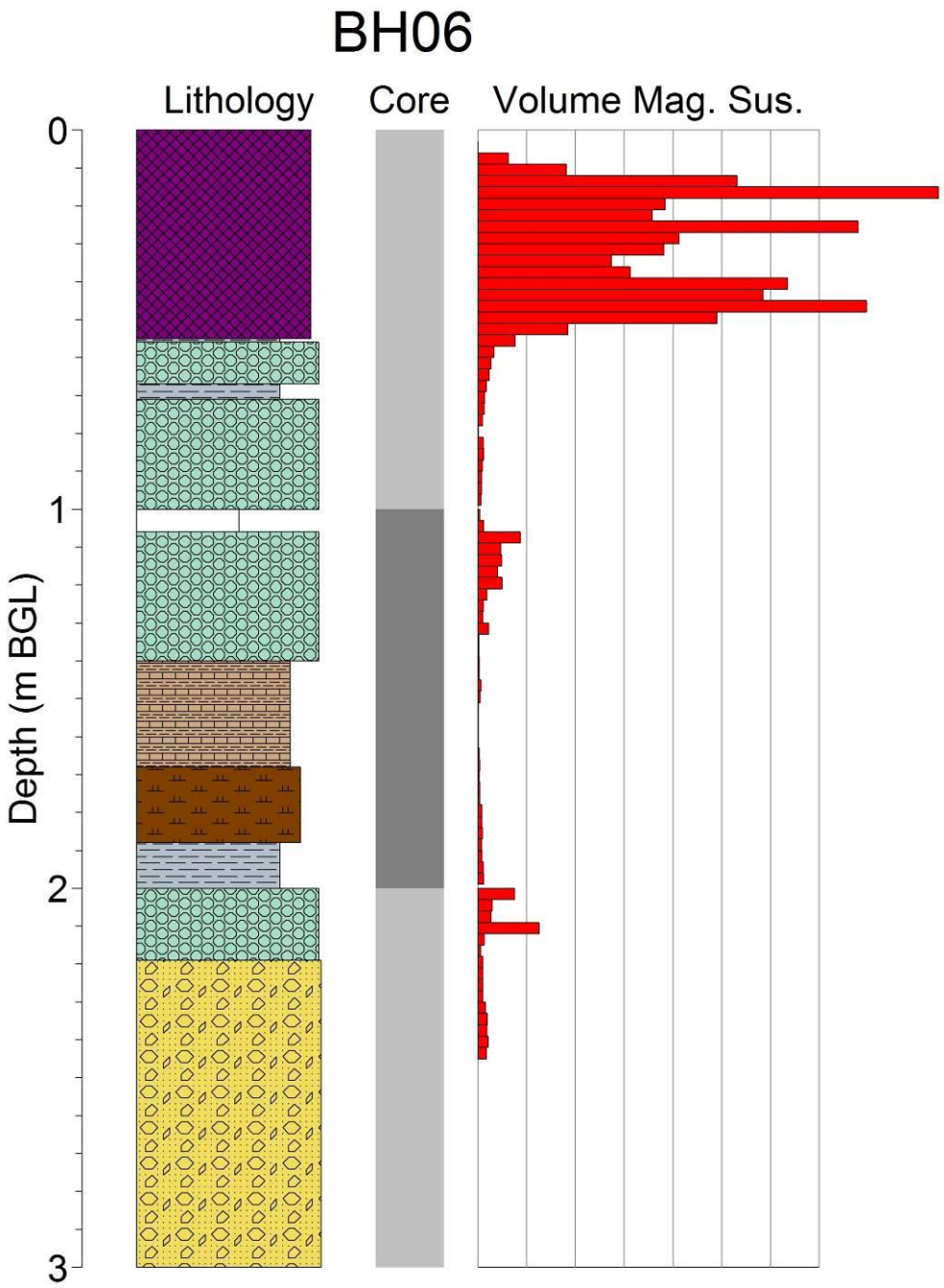

Figure 5: Lithology and volume magnetic susceptibility, BH06.

3.6.2 Made Ground strata at the site generally consisted of very dark grey silt/clay with frequent angular gravel, cinder, CBM, coal and slag.

3.6.3 Volume magnetic susceptibility readings from the Made Ground strata in BH06 (Figure 5) and BH08 (Figure 6) show distinct peaks (up to a maximum of >900 SI units $x10^{-3}$ m^3, and generally >400 SI units $x10^{-3}$ m^3). These high readings are

almost certainly due to the inclusion of burnt material, fuel waste and slag in the Made Ground strata at the site. Smaller peaks visible towards the top of each core drive in both boreholes are very likely to reflect contamination from small particles of material driven down the borehole from the Made Ground during sampling.

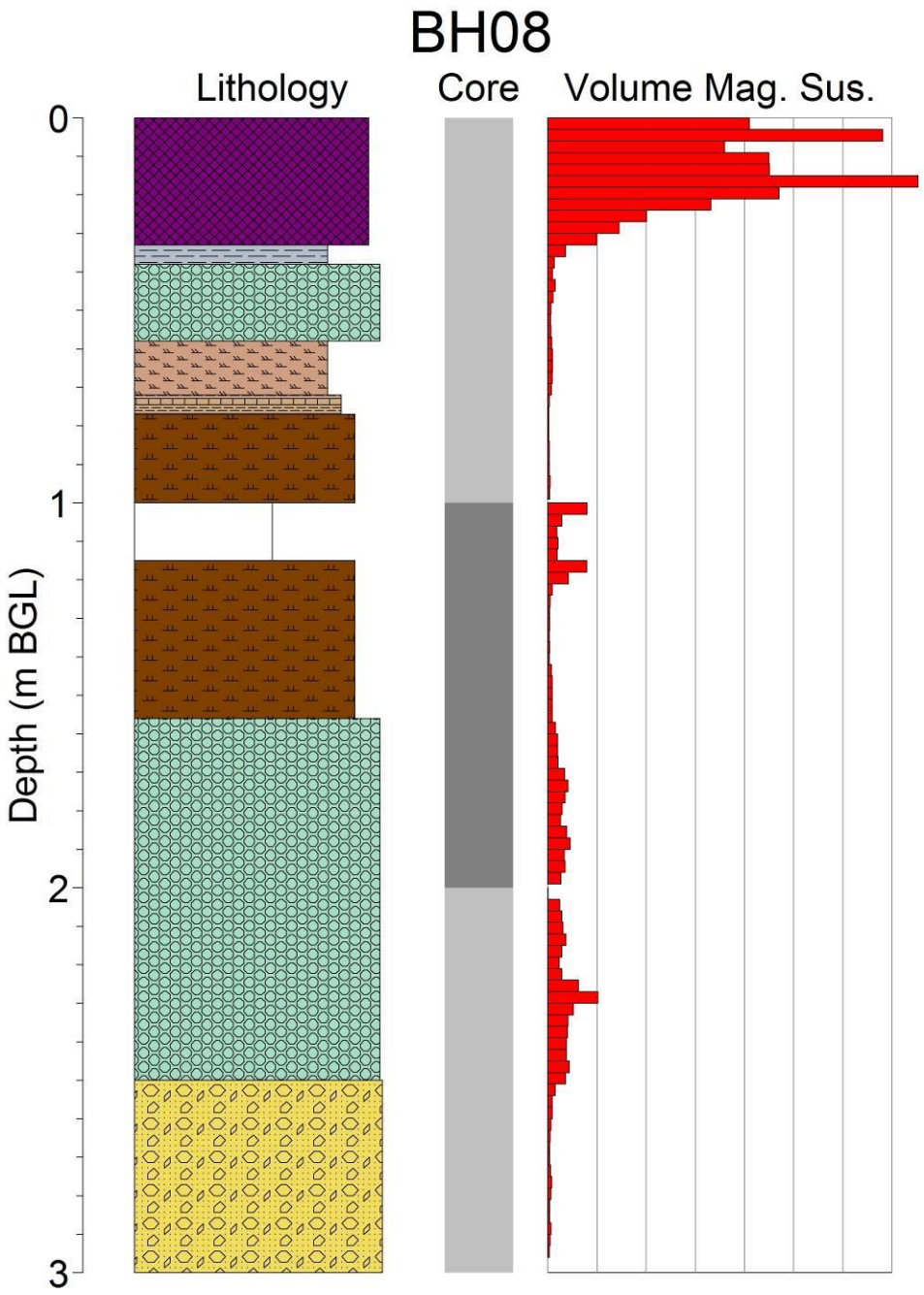

Figure 6: Lithology and volume magnetic susceptibility, BH08.

3.6.4 The Made Ground strata encountered at the site are likely to relate to the construction of the former Sanderson factory.

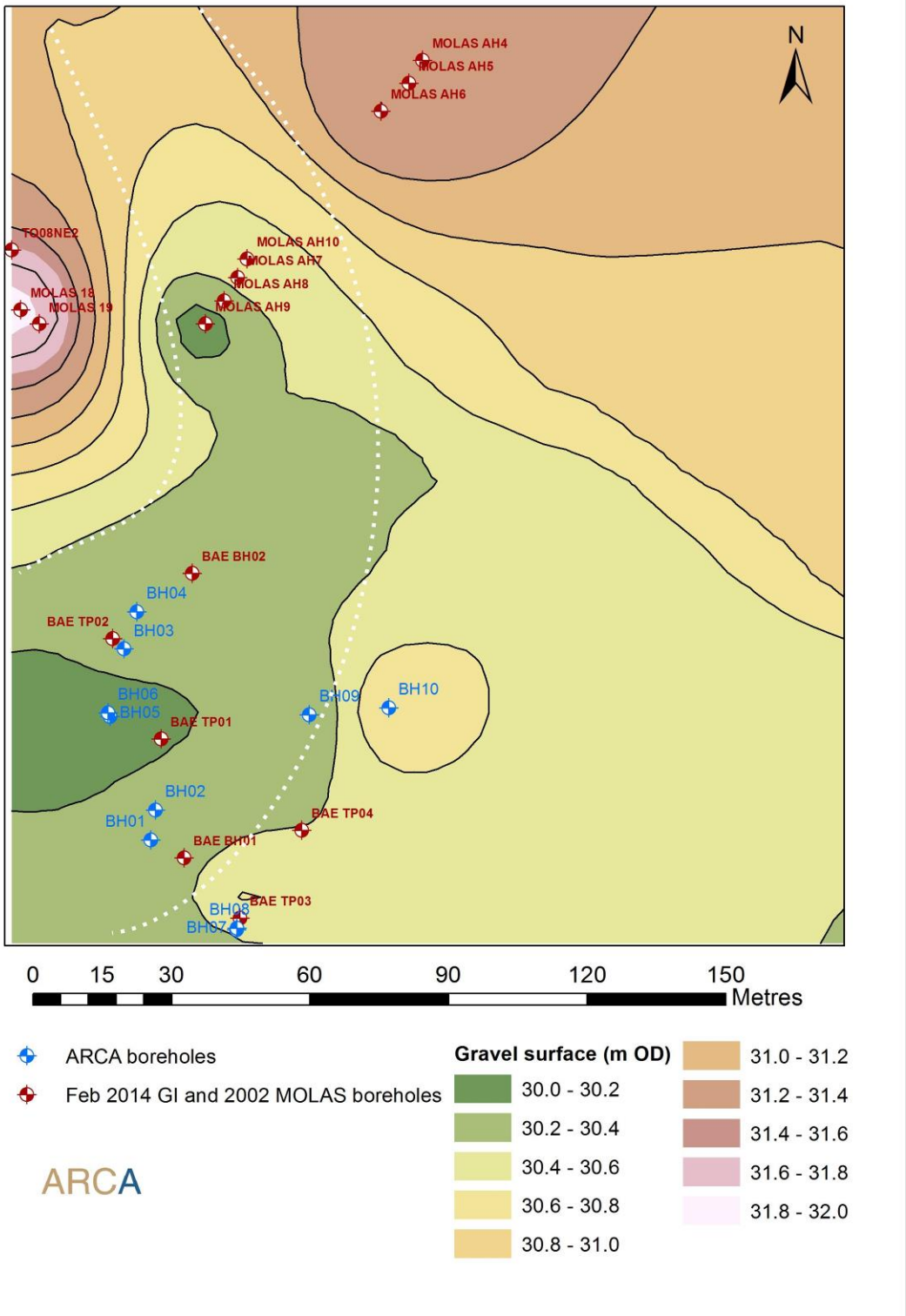

Figure 7: Model-predicted elevation of the surface of the Colney Street Gravel Member [Inverse distance, weighting exponent = 2]. The white dashed line indicates the possible course of a meandering palaeochannel curving from the north west to the south west of the site.

4. ASSESSMENT

4.1 Late Quaternary sedimentary sequence

4.1.1 The Late Quaternary sedimentary sequence at the site began with the deposition of the Colney Street Gravel Member on the braid plain of the precursor to the modern River Colne during the Late Devensian stage of the Pleistocene. **Error! Reference source not found.** shows the surface of the Colney Street Gravel Member as predicted by the deposit model created using the RockWorks software package.

4.1.2 After the end of the Lateglacial period, one or more meandering channels flowed from north to south across the western parts of the site upon the surface the Colney Street Gravel Member. The white dashed line shown in **Error! Reference source not found.** indicates the position of this former channel. The basal minerogenic alluvial strata were deposited during this phase: lithoclast tufa forming within the channel, and fining-upwards sand and silt/clay strata accreting on point bars formed by the meandering channel.

4.1.3 Following this, probably in response to rising base levels, widespread peat formation occurred across the site. Vegetation cover across the site was variable with woodland forming in some locations (e.g. BH01, BH02, and BH09) and marshy herbaceous communities elsewhere. Similar peat strata encountered during the 2002 evaluation area to the north and at the William King Flour Mill to the south west have returned Mesolithic dates[1]. The rage of dates obtained from peat strata in the vicinity of the site suggest that this peat accumulation may have spanned several centuries, with the earliest peat strata broadly contemporary with the Early Mesolithic Scatter C at Three Ways Wharf (Lewis and Rackham 2011; Grant *et al.* 2014, 147).

4.1.4 A continued rise in base levels during the Mesolithic lead to formation of a reedswamp environment and the deposition of organic mud across the site. The interbedded organic mud and tufa strata are indicative of the presence of channels in the vicinity of the site at this time. It is possible that the transition from peat formation to the deposition of the organic mud was

[1] Beta-168948: 8170±60 BP (7340-7050 cal BC) and Beta-168949: 7380±70 BP (6400-6070 cal BC) (MOLAS 2002, 15); SUERC-41672 9310±28 (8640-8470 cal BC) and SUERC-41673 7539±30 (6470-6370 cal BC) (Grant *et al.* 2014, 136).

not synchronous across the whole of the site and that peat continued to form in the wooded area on the gravel rise in the east of the site (BH09 and BH10) whilst the reedswamp began to develop elsewhere. Rising water tables eventually led to the inundation of the wooded areas and to the formation of the distinctive black humic clay across much of the site. A similar black clay unit at the William King Flour Mill returned a date of 5620-5470 cal BC (Grant *et al.*2014, 136)[2].

4.1.5 Oncoidal tufa deposits encountered above the organic mud in BH01, BH02, BH03, BH05, BH06, BH07, and BH08 appear to have infilled abandoned channels which flowed across the site during the continued rise in base levels. These channels may have formed as the River Colne developed from a braided bedform to its later historic anastomosing form (Lloyd's 2012, 12). The transition to an anastomosing channel pattern may have been as a result of earlier peat formation and rising base levels which created river banks resistant to erosion (Makaske 2001).

4.1.6 Thin beds of fine-grained alluvium which cap the alluvial sequence at the site in BH02, BH03, BH05, BH06 and BH08 appear to have been deposited by later overbank flooding. Such deposits, however, were truncated by modern disturbance related to the construction of the Sanderson Factory.

4.2 Archaeological and palaeoenvironmental potential

4.2.1 The Colney Street Gravel Member at the site is of LOW to MODERATE archaeological potential given the likely late Devensian date of the strata and their formation on a high-energy braid plain in which people are unlikely to have been active. There is, however, some potential for the recovery of Final Upper Palaeolithic lithic and faunal scatters from the upper surface of gravels where these strata are overlain by fine-grained strata (see Section 4.2.3, below).

4.2.2 The Colney Street Gravel Member is assessed as being of LOW to MODERATE palaeoenvironmental potential since although fine-grained beds which may contain palaeoenvironmental indicators do occur within such strata, no specific indicators were identified at the site.

[2] SUERC-41674 6578±28

4.2.3 The fining-upwards minerogenic strata encountered between 1.58-1.90m below ground level (BGL) in BH03, 1.80-2.00m BGL in BH05, 1.88-2.00m BGL in BH06, 1.76-2.00m in BH09, and between 1.56-1.69m BGL in BH10 are assessed as being of MODERATE archaeological potential since these strata appear to have formed on a point bar on the edge of a meandering river channel which may have been attractive to hunter-gatherer groups in the final Upper Palaeolithic and Mesolithic periods. Excavation of a flood relief channel during previous evaluations at the Sanderson site (MOLAS 2002; 2006) recovered lithic scatters associated with similar strata which in turn are broadly contemporary with the nationally-important Three Ways Wharf site (Lewis and Rackham 2011). Previous assessment of similar deposits at the Sanderson site noted, however, that such *in-situ* scatters in the vicinity of the site tend to occur where only minerogenic alluvial strata overlie the surface of the gravels; at the present site (Plot A) the sedimentary sequence is capped with thick peat and organic mud strata. Lithoclast tufa deposits overlying the Colney Street Gravel Member in BH05, BH06, BH07, and BH08 are assessed as being of LOW to MODERATE archaeological potential since these strata are likely to have formed within channels where *in-situ* archaeological remains are unlikely to be recovered.

4.2.4 The basal minerogenic alluvial strata as a whole are assessed as being of LOW to MODERATE palaeoenvironmental potential since palaeoenvironmental indicators may be variably preserved in such clastic sediments and the source of microbiological remains may be difficult to determine (i.e. the particles are allochthonous). Exceptions to this are the fine-grained strata between 1.80-2.00m BGL in BH05 and 1.88-2.00m BGL in BH06 where rare granule-sized plant fragments were noted within the sediments, these strata are therefore assessed as being of MODERATE palaeoenvironmental potential.

4.2.5 Peat strata at the site are assessed as being of LOW to MODERATE archaeological potential. Although there is some potential for the recovery of stray Mesolithic finds within the peat, no artefacts or specific indicators of human activity were noted at the site and only very few during previous evaluations of the Sanderson site. The peat strata are likely to have formed in a marshy and densely-vegetated environment, whilst hunter-gatherer groups are likely to have focused activity in drier, more open areas.

4.2.6 The peat strata are assessed as being of HIGH palaeoenvironmental potential since such strata are likely to preserve a range of proxy indicators of past environmental conditions during the Mesolithic period. The high potential of these strata have been demonstrated by the multi-proxy investigations of similar sequences at the nearby William King Flour Mill (Grant *et al.* 2014), and by previous palaeoenvironmental assessment at the Sanderson site (MOLAS 2002). The paucity of palaeoenvironmental indicators contemporary with Upper Palaeolithic and Mesolithic occupation at Three Ways Wharf (Lewis and Rackham 2011), and the possible spatial heterogeneity of localised environmental conditions in the River Colne floodplain during the Early Holocene enhance the palaeoenvironmental potential of these strata.

4.2.7 The organic mud strata are assessed as being of LOW to MODERATE archaeological potential. These strata formed in a reedswamp in which at most humans are likely to have been only sporadically active. As noted above, drier, more open environments are more likely to have been the focus for activity by hunter-gatherer groups. Although there is some potential for stray artefacts to be recovered from the organic mud strata, no such finds were noted at the site.

4.2.8 The organic mud strata have a HIGH palaeoenvironmental potential as palaeoenvironmental indicators are likely to be well-preserved in such strata and both plant and mollusc macrofossils were noted in the borehole samples.

4.2.9 The oncoidal tufa deposits are of LOW archaeological potential since these strata are likely to have formed within a channel in which humans are not likely to have been active.

4.2.10 The oncoidal tufa strata have a MODERATE palaeoenvironmental potential; although some proxy indicators (e.g. Mollusca) may be preserved within such strata, no such indicators were noted. Alternatively, stable isotopic analysis of the tufa may have potential to provide palaeoclimatic proxy data.

4.2.11 The archaeological potential of the Made Ground strata has been assessed during the archaeological evaluation of the site carried out by CA.

4.2.12 The Made Ground strata have a LOW palaeoenvironmental potential since proxy indicators are likely to be poorly preserved and of unknown provenance in such mixed deposits.

5. ACKNOWLEDGEMENTS

5.1 ARCA would like to thank Damian De Rosa and Chris Ellis (both of CA) for their help during the course of the project.

5.2 Geoarchaeological fieldwork was carried out by Nick Watson and Phil Stastney. The report was written by Phil Stastney, and the project was managed for ARCA by Dr Keith Wilkinson.

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APPENDIX 1: BOREHOLE LOGS

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH01	0.00	0.35	Silt/clay with sand and/or gravel	2.5 Y 6/2 Light brownish grey silt/clay with frequent weak medium sand-sized tufa particles (White 8/1). Occasional iron oxide staining. Occasional granular-sized shell fragments.
BH01	0.35	1.00	Interbedded organic silt/clay and tufa	2.5 Y 3/1 Very dark grey fibrous peaty silt/clay. Occasional to frequent whole shell (land and water). Lens of 6/1 Grey coarse sand-sized tufa particles at 0.83-0.89m.Occasional well-preserved pebble-sized monocot fragments, tufa oncoids and wood twigs. Rare granular-sized charcoal fragments.
BH01	1.00	1.20	No recover	Slump
BH01	1.20	1.30	Interbedded organic silt/clay and tufa	2.5 Y 3/1 Very dark grey fibrous peaty silt/clay. Occasional to frequent whole shell (land and water). Interbedded 6/1 Grey coarse sand-sized tufa particles. Occasional well-preserved pebble-sized monocot fragments and degraded tufa oncoids containing voids and granules of plant remains. Rare wood twigs. Sharp boundary to:

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH01	1.30	1.53	Peat	7.5 YR 3/2 Dark brown, oxidising to 7.5 YR 3.1 very dark brown well-humified wood peat. Occasional pebble-sized wood fragments. Gradual boundary to:
BH01	1.53	2.65	Coarse sand and gravel	7.5 YR 5/1 Grey flint gravel of subrounded pebbles. End of BH.
BH02	0.00	0.09	Organic mud	10 YR 3/1 Very dark grey silt/clay with pebble-sized disrupted lenses of 7.5 YR 4/2 Brown fibrous organic matter and greenish yellow ?plant material. Sharp boundary to :
BH02	0.09	0.31	Tufa	2.5 Y 6/1 Grey coarse sand-sized tufa with laminae at 0.24 m of 7.5 YR 5/1 Grey silt/clay. Gradual boundary to:
BH02	0.31	1.00	Interbedded organic silt/clay and tufa	2.5 Y 3/1 Very dark grey fibrous peaty silt/clay. Occasional to frequent whole shell (land and water). Interbedded 6/1 Grey coarse sand-sized tufa particles. Well-preserved monocot fragments and occasional degraded tufa oncoids containing voids and granular plant remains.
BH02	1.00	1.13	No recover	Void.
BH02	1.13	1.18	No recover	Slump.
BH02	1.18	1.30	Interbedded organic silt/clay and tufa	2.5 Y 6/1 Grey coarse sand-sized tufa with occasional degraded oncoids in a fibrous organic silt/clay matrix. Diffuse boundary to:

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH02	1.30	1.54	Peat	7.5 YR 3/2 Dark brown, oxidising to 7.5 YR 3/1 very dark brown, well-humified wood peat. Occasional pebble-sized wood fragments. Gradual boundary to:
BH02	1.54	1.64	Coarse gravel and cobbles	Gravels not retained in auger. End of BH.
BH03	0.00	0.47	Modern overburden	5 Y 3/2 Dark olive grey and 7.5 YR 3/2 Dark brown silt/clay with frequent coarse sand to fine pebble-sized clasts of angular rock fragments, coal and slag (made ground). Unknown boundary to:
BH03	0.47	0.51	Silt/clay	10 YR 3/1 Very dark brown silt/clay. Diffuse boundary to:
BH03	0.51	0.62	Tufa	10 YR 6/1 Grey silt/ clay with orange iron oxide staining at top. Frequent weak medium sand-sized grains of tufa. Diffuse boundary to:
BH03	0.62	0.70	Organic mud	10 YR 3/1 very dark grey silt/clay with occasional weak medium sand-sized grains of tufa. Rare organic fibres, very humic unit, sticky and plastic texture. Diffuse boundary to:
BH03	0.70	1.00	Interbedded organic silt/clay and tufa	2.5 Y 3/1 Very dark grey fibrous silt/clay. Occasional to frequent whole shell (freshwater). Frequent herbaceous plant material and horizontal, disrupted bands of sand-sized tufa particles on a cm scale. Occasional granular-sized tufa oncoids.
BH03	1.00	1.10	No Recover	Void.
BH03	1.10	1.18	No Recover	Slump.

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH03	1.18	1.66	Interbedded organic silt/clay and tufa	2.5 Y 3/1 Very dark grey fibrous organic silt/clay. Occasional to frequent whole shell (freshwater). Frequent herbaceous plant remains and horizontal, disrupted bands of sand-sized tufa particles on a cm scale. Lens of oncoidal tufa at 1.48-1.56 m. Diffuse boundary to:
BH03	1.66	1.85	Organic mud	10 YR 4/2 Dark greyish brown organic silt/clay with humified plant remains (fibres) and pebble-sized lenses of matrix supported granular to fine pebble-sized, angular to sub rounded flint gravel. Sharp boundary to:
BH03	1.85	1.90	Silt/clay	10 YR 4/3 Brown silt/clay. Sharp boundary to:
BH03	1.90	2.67	Coarse sand and gravel	10 YR 5/1 Grey medium sand-sized mineral grains with rare fine flint pebbles grading into clast supported fine flint gravel. End of BH.
BH04	0.00	0.15	Modern overburden	10 YR 3/2 Very dark grey silt/clay with occasional fine pebble-sized flint fragments. Rare CBM granules. Diffuse boundary to:
BH04	0.15	0.40	Silt/clay	5 Y 3/1 Very dark grey plastic and sticky silt/clay. Occasional iron oxide staining at top. Distinct boundary to:

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH04	0.40	1.00	Interbedded organic silt/clay and tufa	10 YR 3/2 Very dark greyish brown humic silt/clay interbedded with bands containing occasional white tufa particles and occasional degraded oncoids towards 1.00m with a bluish grey colour. Humic material decreases towards 1.00m with increase in the mineral fraction.
BH04	1.00	1.16	No Recover	Void.
BH04	1.16	1.64	Interbedded organic silt/clay and tufa	10 YR 3/2 Very dark greyish brown humic silt/clay interbedded with bands containing more white tufa particles and occasional degraded oncoids with a bluish grey colour. A fine pebble-sized flint gravel lens towards the base. Sharp boundary to:
BH04	1.64	1.71	Organic mud	10 YR 4/3 Brown silt/clay with rare plant fibres.
BH04	1.71	2.00	Coarse sand and gravel	Flint gravels with lenses of coarse sands. End of BH.
BH05	0.00	0.47	Modern overburden	10 YR 3/1 Very dark grey silt/clay with frequent granules of charcoal, flint and cinder. Lens of 5 YR5/3 Reddish brown granular gravel of cinders. Unknown boundary to:
BH05	0.47	0.49	Silt/clay	10 YR 5/2 Greyish brown silt/clay. Diffuse boundary to:
BH05	0.49	1.00	Tufa	10 YR 7/1 Light grey tufa with occasional oncoids.

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH05	1.00	1.22	No Recover	Void.
BH05	1.22	1.70	Interbedded organic silt/clay and tufa	2.5 Y 2.5/1 Black friable organic silt/clay with granular to pebble- sized wood fragments interbedded with 2.5 Y 6/1 Grey coarse sand-sized to granular tufa with occasional oncoids. Bed thickness 0.01 to 0.05m. Sharp boundary to:
BH05	1.70	1.80	Peat	7.5 YR 3/2 Dark brown very well humified peat. Frequent fine pebbles of rounded flint in basal 5cm. Diffuse boundary to:
BH05	1.80	2.00	Silt/clay	10 YR 4/2 Dark greyish brown silt/clay with rare granular- sized plant fragments. Unknown boundary to:
BH05	2.00	2.50	Tufa	10 YR 7/3 Very pale brown coarse sand-sized tufa. From 2.40m: occasional rounded flint pebbles. Diffuse boundary to:
BH05	2.50	3.00	Coarse gravel and cobbles	10 YR 4/1 Dark grey clast supported gravel of angular to rounded and granular to cobble-sized flints. End of BH.
BH06	0.00	0.55	Modern overburden	10 YR 3/2 Very dark greyish brown silt/clay with frequent granular to fine pebble-sized angular fragments of cinder and slag. Lens of pinkish red granular cinder towards top. (Made ground) Sharp boundary to:
BH06	0.55	0.56	Silt/clay	10 YR 5/3 Brown silt/clay. Sharp boundary to:

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH06	0.56	0.67	Tufa	10 YR 7/2 Light grey coarse sand to granular-sized tufa with orange iron oxide mottling. Inter granular light evenly distributed light grey silt/clay matrix. Sharp boundary to:
BH06	0.67	0.71	Silt/clay	10 YR 5/3 Brown silt/clay. Sharp boundary to:
BH06	0.71	1.00	Tufa	10 YR 7/2 Light grey coarse sand to granular-sized tufa with orange iron oxide mottling. Inter granular, evenly distributed light grey silt/clay matrix.
BH06	1.00	1.06	No Recover	Void.
BH06	1.06	1.40	Tufa	10 YR 7/2 Light grey coarse sand to granular-sized tufa. Inter granular, evenly distributed light grey silt/clay matrix.
BH06	1.40	1.68	Interbedded organic silt/clay and tufa	10 YR 4/1 Dark grey intermixed granular tufa and black humic silt/clay particles (peat). Rare fine pebble-sized oncoid and freshwater shell (*Bithynia* sp.) Sharp, non-erosive boundary to:
BH06	1.68	1.88	Peat	7.5 YR 3/2 Dark brown oxidising to 2.5/1 Black very well humified soft peat. Occasional to rare fibres. Frequent subangular to subrounded granular to fine pebble-sized flints within the peaty matrix at the base. Sharp erosive boundary to:
BH06	1.88	2.00	Silt/clay	2 .5 Y 3/2 Very dark greyish brown, soft silt/clay with rare granular-sized plant

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
				fibres.
BH06	2.00	2.19	Tufa	10 YR 8/2 Very pale brown fine sand-sized tufa with rare granular-sized grains. 6/2 Light brownish grey inter granular silt/clay matrix. Sharp non-erosional boundary to:
BH06	2.19	3.00	Coarse sand and gravel	10 YR 4/1 Dark grey coarse sand to fine pebble-sized clast supported gravel of subangular to rounded flint clasts. Poorly sorted. End of BH.
BH07	0.00	0.15	Modern overburden	2.5 Y 2.5/1 Black silt/clay with frequent coarse sand to granular -sized clasts of cinder, CBM and flint. (Made ground). Sharp boundary to:
BH07	0.15	0.38	Modern overburden	2.5 Y 2.5/1 Black silt/clay with modern pottery. Sharp boundary to:
BH07	0.38	0.55	Tufa	2.5 Y 8/1 White tufa with frequent granular to fine pebble- sized oncoids. Sharp boundary to:
BH07	0.55	0.65	Organic mud	5 Y 2.5/1 Black silt/clay. Greasy texture. Rare, very fine sand-sized white ?tufa grains. Gradual boundary to:
BH07	0.65	0.77	Peat	5 Y 6/1 Grey very fine very peaty sand with occasional vertical root holes and roots. Irregular sharp boundary to:

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH07	0.77	1.58	Organic mud	10 YR 3/2 Very dark grey humic very fine sandy peaty silt /clay with frequent vertical roots. Grading into coarser sand towards base. Diffuse boundary to:
BH07	1.58	2.50	Tufa	10 YR 5/1 Grey tufa with occasional fine granular to pebble-sized oncoids irregularly and indistinctly interbedded with more humic material (rootlets and granule-sized plant fibres). Oncoids are bluish grey and degraded often with shell inclusions. Becomes sandy towards base. Diffuse boundary to:
BH07	2.50	3.00	Coarse sand and gravel	10 YR 4/1 Dark grey, granular to fine pebble-sized angular flint gravel, clast supported. Only 7 cm retained in auger. End of BH.
BH08	0.00	0.33	Modern overburden	10 YR 3/1 Very dark grey silt/clay with frequent granular, angular rock fragments including cinder. Pebble-sized lens of light yellow medium sand at 0.01m. Occasional CBM grains at the base. (Made ground). Sharp boundary to:
BH08	0.33	0.38	Silt/clay	2.5 Y 3/1 Very dark grey silt/clay. Diffuse boundary to:
BH08	0.38	0.58	Tufa	2.5 Y 7/2 Light grey coarse sand-sized tufa with 2.5 Y 3/1 Very dark grey silt/clay irregularly distributed between the grains and forming 50% of the unit. Diffuse boundary to:

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH08	0.58	0.72	Organic mud	2.5 Y 2.5/1 Black firm greasy textured homogenous organic silt/clay. Diffuse boundary to:
BH08	0.72	0.77	Interbedded organic silt/clay and tufa	2.5 Y 6/2 Light brownish grey, fine sand-sized tufa interlaminated with fine sand-sized dark brownish grey peat particles and organic silt/clay. Laminae are horizontal and very poorly developed. Gradual boundary to:
BH08	0.77	1.00	Peat	7.5 YR3/2 Dark brown very well humified, firm peat with rare granular sized fibres. Oxidises to 2.5/1 Black.
BH08	1.00	1.15	No Recover	Slump.
BH08	1.15	1.56	Peat	7.5 YR3/2 Dark brown, oxidising to 7.5 YR 2.5/1 Black, firm very well humified peat with rare granular-sized fibres. Gradual boundary to:
BH08	1.56	2.50	Tufa	5 Y 5/1 Grey coarse sand to granular-sized tufa with occasional degraded fine pebble-sized oncoids, and frequent carbonate encrusted subangular flint pebbles. Frequent, evenly distributed inter granular grey silt/clay matrix. White tufa is only rarely present in irregular pebble-sized patches. (Marginal tufa /alluvial clay facies?). Band of black humic clay at 2.16-2.20m. Gradual boundary to:

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH08	2.50	3.00	Coarse sand and gravel	10 YR 5/1 Grey clast supported poorly sorted gravel of coarse sand to fine pebble-sized subangular to subrounded flint clasts. End of BH.
BH09	0.00	0.58	Modern overburden	2.5Y 2.5/1 Black coarse sand to granular sized clast-supported gravel of cinders, brick, some silt/clay matrix. Made ground. Unknown boundary to:
BH09	0.58	0.82	Organic mud	2.5Y 3/1 Very dark grey silt/clay with pale blue/green (2.5 Y 3/1) mottles, grading into black (2.5 Y 2.5/1). Slightly greasy feel, slightly humic especially towards base. Gradual boundary to:
BH09	0.82	1.76	Peat	7.5YR 2.5/2 Dark reddish brown well humified slightly fibrous peat with frequent granular-sized plant fibres and fine pebble-sized wood fragments, especially towards the base. Grading into:
BH09	1.76	2.00	Silt/clay	2.5Y 3/2 Very dark greyish brown silt/clay with frequent granular to fine pebble-sized angular flints increasing towards the base. Grading into:
BH09	2.00	3.00	Coarse sand and gravel	10 YR 4/1 Dark grey, clast-supported gravel of subangular flint pebbles. End of BH.

Bore	Top (m BGL)	Base (m BGL)	Lithology	Comments
BH10	0.00	0.75	Modern overburden	2.5Y 3/1 Very dark grey silt/clay with occasional granular to pebble-sized CBM and flint. Made ground. Sharp boundary to:
BH10	0.75	0.88	Silt/clay	2.5Y 3/1 Very dark grey, mottled 2.5Y 5/1 grey, silt/clay grading into:
BH10	0.88	1.10	Organic mud	2.5Y 2.5/1 Black very soft "greasy" very humic silt/clay rare granular-sized organic fibres. Diffuse boundary to:
BH10	1.10	1.56	Peat	7.5YR 2.5/2 Very dark brown, oxidises to 7.5 YR 2.5/1 Black, fibrous, well-humified peat with very frequent horizontal well-preserved monocot remains. Grading into:
BH10	1.56	1.69	Silt/clay with sand and/or gravel	10YR 3/1 Very dark grey sandy clay. Grading into:
BH10	1.69	2.00	Coarse sand and gravel	10 YR 4/1 Dark grey, clast supported flint gravel of subrounded to subangular flint granules and pebbles. End of BH.