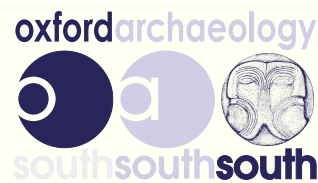


Old Ford Water Recycling Facility



Geoarchaeological Borehole Survey and Watching Brief Report



October 2011

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Old Ford Water Recycling Facility

Geoarchaeological Watching Brief and Borehole Report

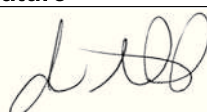
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Summary

Between July 2010 and February 2011 Oxford Archaeology South (OAS) were commissioned by Thames Water Utilities Ltd to undertake a geoarchaeological watching brief and borehole sampling at Old Ford, Stratford, in Greater London. The Site is located in the Lower Lea Valley, at the edge of the floodplain and immediately east of the current river channel. The purpose of the work was to provide baseline data regarding the character of alluvial deposits and assess the potential of the sediments to contain palaeoenvironmental and archaeological remains. This work forms part of mitigation strategy associated with the construction of a new water recycling facility as part of the Olympic Park Development.

Four boreholes were drilled just to the east of Old Ford Lock. A sequence of Holocene alluvium was recorded overlying Pleistocene gravel and sealed by up to 2m of 19th century fill and modern made-ground. The alluvial sequence consists of bedded silts, sands and organic clays, representing episodes of overbank flooding and marine incursions, interspersed with drier periods of increased surface stability and soil formation. Two potential landsurfaces were identified. The earliest surface occurs immediately above the Pleistocene gravel at +0.77m OD and may be of early Holocene date. The second surface, further up the sequence between +1.30-+1.70m OD, is likely to date to the later prehistoric or Roman period and contained fired clay, daub, bone and charcoal fragments.

No archaeological features or deposits were identified during the watching brief associated with these buried landsurfaces. Only a few fragments of animal bones, fired clay and frequent charcoal were recorded from the upper landsurface. The Site lies across the river from the historic river crossing at Old Ford and it is possible that a Roman river crossing is located near to the Site. However, no evidence of any associated timbers or archaeological features were identified during the watching brief. The path of the river may therefore have been much further west of its present course during this period, which may explain the absence of associated features on the site. However, the upper stabilisation surface was identified at a equivalent elevation and may reflect drier conditions associated with the effects of Roman floodplain management and channel modification.



Old Ford Water Recycling Facility

Geoarchaeological Watching Brief and Borehole Survey Report

1 INTRODUCTION

1.1 Location and scope of work

1.1.1 Between July 2010 and February 2011 Oxford Archaeology South (OAS) was commissioned by Thames Water Utilities Ltd to undertake geoarchaeological field investigations at the Old Ford Water Recycling Works, Stratford, Greater London. The work was undertaken as part of a mitigation strategy to create a new water recycling facility as part of the Olympic Park Development.

1.1.2 The investigation was requested by David Divers, Archaeological Officer for Greater London Archaeological Advisory Service (GLAAS), as part of the mitigation process of archaeologically significant deposits that could be affected by the construction works. The Site is located within the alluvial floodplain of the River Lea, within an archaeological study area associated with the London Olympics and Lea Valley Mapping Project (Corcoran *et al.* 2011) It is also adjacent to Old Ford Lock which is believed to be near the location of a Roman river crossing.

1.1.3 A series of four boreholes were initially undertaken to characterise the underlying sedimentary sequence and obtain samples suitable for palaeoenvironmental assessment. Following the identification of two possible buried landsurfaces at the site with the potential to contain archaeological features, a watching brief was maintained during the construction of the facility. This report presents the results of the field investigation and discusses the wider archaeological significance of the sequence in terms of its position within the Lea Valley floodplain.

1.2 Geology and topography

1.2.1 The Site is located in Stratford, Greater London, in the London Borough of Newham (TQ 37403 83904), at the confluence of the River Lea and Lea Navigation. The River



Lea lies to the west and the Olympic Park to the east (Figure 1). Immediately to the west is Old Ford Lock, an historical crossing point over the River Lea.

- 1.2.2 The Site extends across the former floodplain of the River Lea that was reclaimed during the post medieval period. It comprises large areas of broad-leaved woodland, the remains of the former water pumping station, redeposited gravels from the Olympic Park Development and areas of grassland. Modern ground elevations range between c 5m OD in the west to c 7m OD in the east.
- 1.2.3 The geology is mapped as silty clay alluvium overlying sands and clays of the Lambeth Group (BGS Sheet 256, Solid and Drift 1:50,000). The transition to London Clay is less than 50m to the west.

1.3 Archaeological and historical background

- 1.3.1 The archaeological potential of the Site has been outlined previously in the desk-based assessment (OA 2009) which is summarised in the following sections.

Prehistoric (500,000BC – 43AD)

- 1.3.2 The early prehistoric period is represented in the area by only a few isolated findspots. Evidence of Palaeolithic and Mesolithic activity is very rare within the area and no significant evidence of occupation has been identified. A Mesolithic or Neolithic burnt mound was identified 650m to the east of the Site and an arrowhead just to the west. No associated archaeological features have been identified on the Site.
- 1.3.3 Evidence of early Bronze Age activity is generally sparse within the Greater London region, with most evidence recovered from rivers channels or secondary contexts. The middle and late Bronze is better represented (Brown and Cotton 2000); late Bronze Age activity was discovered during the ground works for the Olympic Park Development (Wessex forthcoming) and within the centre of Old Ford. There has also been a number of findspots of Bronze Age date within the area surrounding the Site, including an axe, spearhead and pottery. Bronze Age features have been found in association with the floodplain peats of the Thames and its tributaries.
- 1.3.4 The region lies beyond the main hillfort dominated areas, and its inhabitancy do not appear to have taken any part in the Iron Age tribal politics of the time (Wait and Cotton 2000). The only evidence identified in the area has been an Iron Age ditch at Old Ford and rare pottery scatters to the west and along Morville Street. However, there is some suggestion that the Roman Road from London to Colchester had Iron Age origins.

**Roman (43AD – 450AD)**

- 1.3.5 In the Roman period, *Londinium* (London) developed into an urban centre and later the provincial capital of Roman Britain (Perring and Bridgham 2000). A network of roads was constructed, connecting London to the regional centres, such as *Caesaromagus* (Chelmsford). The road to *Caesromagus* crossed the River Lea at Old Ford, just 80m south of the Site. This was where the river was shallowest and could be crossed on foot (Weinreb *et al.* 2008). Evidence of riverside structures and a Roman metalled surface was identified just south and east of Site at Old Ford, potentially suggesting higher ground of the terrace towards the south-west.
- 1.3.6 There has been a significant amount of work undertaken within the surrounding area, which has uncovered evidence of Roman occupation to the west. A settlement was identified at Old Ford dating from the 3rd and 4th centuries AD, which may have been associated with tile production. A high status Roman cemetery has also been excavated at Old Ford (MoLAS 2007) and an early Roman jetty/bridge crossing was excavated to the west along Dace Road (Alexander 2004).
- 1.3.7 The main archaeological work carried out to the east has been the recent excavations associated with the Olympic Park Development, which identified Roman buildings fronting the Roman road, with a network of associated yards and fields (MOLA website).

Saxon and Medieval (450AD – 1539AD)

- 1.3.8 After the Romans left London, the city fell into decline. There is little documentary evidence for Saxon *Ludwenwic*, and even less for the outlying areas. Only one Saxon pond feature has been recorded within the wider area surrounding the Site.
- 1.3.9 In c 1110 Queen Matilda commissioned Bow Bridge to be built to the south of Old Ford, due to the increasing dangers of crossing the river (Weinreb *et al.* 2008). Evidence of the first Bow Bridge was recorded during the demolition of a pub in the late 18th century.
- 1.3.10 Chapman and Andre's 18th century map of the area shows a network of man-made channels within the Site area that powered water driven tidal mills. Some of these mills such as Three Mills, still survive today.

Post-Medieval (1540AD – 1900AD)

- 1.3.11 The 1703 parish map of St Dunstan Stepney shows the Site to be located within undeveloped marshland called Bow Marsh and also shows a road from Old Ford



meeting the River Lea immediately south of the site. There is no adjoining road to the east, possibly suggesting that the road led to a jetty or revetment. By the 1937 the Metropolitan Water Board had built a number of buildings within the Site. The main building was located in the centre, with a smaller building known as 'The Cottage' shown to the south of the main buildings.

1.4 Previous archaeological work

- 1.4.1 In general, it has been appreciated that the archaeology within the Stratford marshes is too deeply buried for surface scatters to hint at the proximity of archaeology beneath the ground surface. The findings of excavation and antiquarian findspots recorded on the Greater London Sites and Monuments Record (GLSMR) therefore do not necessarily reflect the archaeological potential of the buried floodplain sequence. Alternative techniques, such as geoarchaeological deposit modelling, have been employed to better assess the archaeological potential.
- 1.4.2 A large geoarchaeological study of the Lea Valley was undertaken as part of the Aggregates Levy Sustainability Fund (ALSF), called the Lea Valley Mapping Project (Corcoran *et al.* 2011) that used geotechnical borehole data in an attempt to gain a better understanding of the archaeological potential of the floodplain sequence. When London won the 2012 Olympics the data gathered and assessed for the Lea Valley Mapping Project was re-examined in more detail in the area surrounding the proposed Olympic Park. This was also updated with new data from Carpenters Road (OL-001 05), Warton Road (OL-003 05) and an early phase of geotechnical work (VYC04).
- 1.4.3 A series of deep evaluation trenches were also dug into the alluvial sequence to the north and east of the Site (MoLAS 2008). The trenches were targeted on buried topographical features identified during the geoarchaeological mapping and areas of proposed impact. The evaluation found evidence of activity preserved within the alluvium, associated with a series of landsurfaces (*ibid*). The updated geoarchaeological mapping of the deposits helped to identify variations in the palaeotopography. Further excavations undertaken as part of the Olympics project have helped to clarify the relationship between areas of archaeological activity and palaeotopography.

1.5 Acknowledgements

- 1.5.1 OA would like to thank Claire Hallybone of Thames Water who facilitated the works and for her advice during the project. The author would also like to thank Gary Smith and



Matthew Davies of Black and Vetch Ltd. The fieldwork and reporting was undertaken by Christof Heistermann and Carl Champness.



2 AIMS AND METHODOLOGY

2.1 Aims

2.1.1 The main aims of the field investigation are summarised below. This also includes a consideration of the wider regional research objectives included in the Historic Environment Research Strategy for Greater London (EH 2008):

2.1.2 The main aims of the borehole assessment were:

- to describe and interpret the sediment sequence from the borehole samples in the area of proposed impact, and to recover palaeoenvironmental samples where possible
- to identify the location and extent of any waterlogged organic deposits and address the potential and likely locations for the preservation of archaeological and palaeoenvironmental remains
- to re-assess the archaeological significance of the site and whether further mitigation should be recommended
- Make available the results of the field investigation to the larger Olympic Park geoarchaeological study

2.1.3 The main aims of the watching brief were:

- To preserve by record any archaeological remains (if present) that the works may remove or damage within the area of the site being investigated
- Seek to establish the extent, nature and date of any archaeological deposits encountered
- To secure the analysis, conservation and long-term storage of any artefactual/ecofactual material recovered from the site
- To signal, before the destruction of the material in question, the discovery of a significant archaeological find, for which the resources allocated are not sufficient to support a treatment to a satisfactory and proper standard

2.2 Methodology

2.2.1 The investigation of the site involved a two fold strategy. Four boreholes were drilled on Site to investigate the sedimentary sequence within the proposed development. This was followed by an archaeological watching brief to look for signs of any archaeological preservation. The borehole locations and watching brief areas are shown in Figure 2, in relation to the proposed new buildings and tanks.



Borehole sampling methodology

- 2.2.2 The boreholes were drilled using a Terrier percussion rig (Plate 1) in order to recover undisturbed samples suitable for palaeoenvironmental assessment and sediment description. Each borehole was drilled to the top of Pleistocene gravels. A continuous sequence of undisturbed core samples (0.125m in diameter and 1.4m in length) was recovered from each of the four sampling locations (Plate 2).
- 2.2.3 The sediments were recorded on site by a OA geoarchaeologist according to Jones *et al* 1999, who monitored and logged the core samples. The monitoring was undertaken in accordance with GLAAS and English Heritage Guidance papers (2009). The sequence was recorded on a summary proforma sheet which included sample numbers and location with reference to Ordnance Datum and the National Grid.

Watching brief

- 2.2.4 Following the results of the borehole survey a watching brief was maintained during the ground reduction associated with the excavation of the water treatment and processing tanks of the recycling facility. Two areas required significant ground reduction: Area A was the location of a new water treatment tank and Area B was the location of a rectangular processing tank. The location of the two areas are shown in Figure 2.
- 2.2.5 These areas were taken down by a mechanical excavator in spits under archaeological supervision. A running section of each tank was maintained from the top of the excavations. None of the excavations were entered due to their depth and risk of flooding. All recording took place from the edge of the excavations and from the current ground surface. The edges of the excavations were also shuttered off during the work so only the sections exposed in the middle of the excavations were available for recording (Plate 3). All spoil were checked for finds.



3 RESULTS

3.1 Introduction

- 3.1.1 The results presented in the main text of this report provide an overview of the findings of the geoarchaeological field investigations. The detailed descriptions of the sample cores are included in Appendix A. Each sedimentary unit is referred to in terms of positive depths below borehole ground level (bgl) and metres above sea-level (m OD).
- 3.1.2 The section data from the watching brief is recorded in Appendix B. The deposits are described with their dimensions and any relevant dating evidence.
- 3.1.3 The sediments are discussed in terms of both the individual sample locations and the site-wide sequence.

3.2 General site conditions

- 3.2.1 The soils and sediments recorded throughout the Site were found to be quite variable, especially in the upper part of the sequence where a significant amount of Victorian and modern made-ground was identified. The lower alluvial sequence was more consistent and various equivalent deposits could be traced across the boreholes and during the digging of the water tanks.
- 3.2.2 The majority of the boreholes were drilled at their intended locations, or as close as possible, and were able to penetrate the full depth of the Holocene sequences to the basal gravels. Boreholes OABH2 and OABH4 were relocated by several metres from their proposed positions due to the presence of dense vegetation across most of the Site.

3.3 Description of the sedimentary sequence

- 3.3.1 Based on the results of the borehole survey and watching brief a sequence of commonly occurring lithological deposits was identified. These were correlated into stratigraphic units in order to aid in the interpretation of the changing sedimentary environment (see Figure 3). A preliminary deposit model (an interpretation of the sedimentary environment) has been produced for the Site based on the deposits identified within the four boreholes. This model has aided in the assessment of the archaeological and palaeoenvironmental potential of the sequence. The following stratigraphic sequence was identified in order of deposition:



- Sandy gravels
- Lower stabilisation deposits
- Clayey sands and silts
- Upper stabilisation deposits
- Upper silty clays
- Made-up deposits

3.3.2 Assignment of individual lithologies to stratigraphic units is based on texture, nature of inclusions and sedimentary contacts. However, it should be noted the model is based on only four sample locations and the observations made during the watching brief, and consequently may not be wholly representative of the entire alluvial sequence within the area. Localised sedimentary sequences can often occur in fluvially active environments due to different variations in topography and hydrology.

Pre-Holocene deposits

Sandy gravels

- 3.3.3 The basal sandy gravels were reached in all four boreholes. These deposits were encountered at a depth between 3.42m (+1.35m OD) and 3.94m bgl (+0.84m OD). They comprised loose light yellowish brown fine to medium well-sorted sub-rounded sandy gravel, with inter-stratified beds (30-40mm) of moderately firm yellowish fine sand. These sediments are likely to have accumulated within high-energy braided stream channels during the last glaciation (Devensian). The bedded character of the deposits reflects seasonal fluctuations in the river discharge. Any archaeological finds recovered from these deposits are likely to have been the subject of significant reworking.
- 3.3.4 The surface of the gravel essentially defines the topography of the early Holocene landscape. Bates and Barham (1998) refers to this as the 'topographic template' and suggests that variations in the template largely dictated later patterns of landscape evolution as flooding and sedimentation ensued during the prehistoric period. At terrace edge locations, and in areas of complex palaeotopography, sedimentation patterns can often change significantly over short distances. Only by the mapping of this template can we begin to interpret the floodplain deposits and assess archaeological potential.



- 3.3.5 The edge of the gravel terrace is indicated by the BGS mapping 100m to the west (BGS sheet 256). The previous subsurface mapping undertaken as part of the Olympic Park Development and the Lea Valley Mapping Project (MoLAS 2007; Corcoran *et al.* 2011; Wessex forthcoming) indicate the Site lies at the edge of a channel cut and an area of higher ground (see Figure 4). The floodplain area between the two main channels of the Hackney Brook and the main channel of the Lea are thought to contain a complex sequence of gravel islands and smaller channels, which lead to the development of a mosaic of different wetland environments on the floodplain during the early Holocene.
- 3.3.6 A basic cross-section of the Site's stratigraphic sequence is presented in Figure 4. The gravel elevations appear to be relatively consistent across the boreholes, although there is a general trend for lower elevations from east to west, towards the river. These elevations are consistent to those within the 'shallow basin' between the two main channel areas recorded by MoLAS (Figure 6; MoLAS 2011).

Holocene sedimentary sequence

Lower stabilisation horizon:

- 3.3.7 Soft dark blackish brown organic rich clayey silt and dark grey pebble clay was identified just above the gravels between 3.75m and 3.94m bgl (+1.01m and +0.84m OD). These deposits contained small angular pebbles (15%) and wood fragments.
- 3.3.8 The organic clays and silts are thought to have originally accumulated during the late glacial and early Holocene period, latterly reworked by soil formation processes forming a prehistoric landsurface. The angular pebble inclusions probably relate to bioturbation of the underlying gravels by soil organisms.

Lower clayey sands and silts:

- 3.3.9 A sequence of loose greyish brown fine sands and olive grey silty and clayey sands were found to seal the early Holocene landsurface described above. These deposits accumulated between 2.88m to 3.41m bgl, (+1.73m OD to +1.36m OD), and were on average 0.5m in thickness. The character of these deposits would suggest periods of channel instability and accumulation by over-bank flooding and alluviation. However, in places these deposits were interstratified with organic rich clays that suggest periods of lower-energy deposition.

Upper stabilisation horizon:



- 3.3.10 A series of upper organic rich dark greyish brown silty clay deposits were identified between 2.40m and 2.88m bgl (+2.38m OD and 1.73m OD). These deposits also contained reddish mottling and small angular pebbles. Small fragments of fired clay and daub, with rare charcoal inclusions were also noted in OABH3 and OABH4.

Upper silty clay:

- 3.3.11 The Holocene sequence is capped by a series of soft light-grey to greyish-brown sandy clays and silty clays, occasionally with organic clay lenses and pebbles near to they base. This unit is between 3.00m and 1.5m bgl (+1.77m and +3.20m OD) and approximately 0.90m in thickness. The surface of the alluvium was recorded between +2.81m OD and +3.20m OD. At Carpenters Road an intact alluvial sequence was identified at just under +3.00m OD (Howell and Corcoran 2005), suggesting that only very minor if any truncation of the alluvium has occurred within the Site.

Make-up deposits:

- 3.3.12 A series of post medieval to modern make-up deposits were present across the Site overlying the upper alluvium. These deposits varied in thickness from between 2.0m in the west to 1.40m in the east. They variously consisted of layers of mixed sand, silty sand and gravel.
- 3.3.13 These deposits represent ground raising activities of a similar nature to those identified throughout the Stratford marshes and the Olympic Park. Much of the sequence has previously been dated to the 19th century, associated with a major phase of ground levelling activity on the marshes.

3.4 Results of the watching brief

- 3.4.1 The monitoring of the main processing tank area (Area B) recorded a sequence of organic and minerogenic alluvial silts overlying Pleistocene gravels (Figure 6). These deposits were removed in spits under archaeological supervision. No significant archaeological features or deposits were identified.
- 3.4.2 The gravels (1013) were encountered at the base of the excavations in Area B at depths between 4.00m and 4.20m (+0.70m to +0.57m OD). These were recorded as matrix supported dark greyish sandy gravels (25% clast inclusions). These deposits were overlain by a 0.20m thick sequence of fine organic sands and silts (1012) that appeared to have been stabilised during the early Holocene. This deposit contained



frequent sub-rounded clast inclusions and evidence of small rootlets, indicative of soil development.

- 3.4.3 This deposit was overlain by a dark greenish grey sandy silty clay deposits (1011), that contained no coarse inclusions but did contain lenses of fine-grained sands that might indicate episodes of adjacent fluvial activity. These deposits were alluvial in origin and represented overbank riverine alluviation. They were 0.90m in thickness.
- 3.4.4 An overlying stabilisation horizon was encountered at depths between 3.20m and 2.90m bgl within Area B (+0.77m-+2.10m OD). This horizon comprised an organic rich lower silt deposit (1010) containing wood and plant material, overlain by a lesser organic rich greyish brown silt (1009) with frequent small sub-rounded clast inclusions.
- 3.4.5 These deposits were overlain by sequence of soft mid greenish grey and greenish brown silty clay deposits (1008-1005). A greater degree of stratification was recorded in the north of Area B in section 1001 compared to the south in section 1002. Also a 0.5m thin organic lens was recorded at the base of context 1007 suggesting a possible return to slightly drier conditions on the site during this period.
- 3.4.6 The sequence recorded in the area of the Water tank (Area A) was similar to the upper sequence recorded from the previous area. Three upper alluvial silty clay deposits (1001-1003) were found to underlie 2.10m of make-up deposits (1000) and modern made-ground. The excavations were only monitored to a depth of 3m and therefore did not record the full depth to Pleistocene gravels. However the nature of the full sedimentary sequence within this area is recorded within OABH4.

3.5 Palaeoenvironmental sequence

- 3.5.1 As part of the mitigation of the Scheme a palaeoenvironmental assessment was undertaken on one representative sample sequence from OABH3, which assessed the preservation potential of pollen, plant remains, diatoms, insect and mollusca. This aimed to assess the preservation potential of environmental indicators and material suitable for dating from this sequence. The results of the assessment are summarised below and the individual specialist reports can be found in Appendices C and D.
- 3.5.2 The pollen and plant remain assemblages from the basal organic deposit overlying the Pleistocene gravels would suggest the development of a dry woodland at the site during the early Holocene. The pollen assemblage at 3.78-3.80m bgl indicated a woodland dominated landscape, with pine as its largest component. Pine woods are likely to have been widespread, a typical feature of the early Holocene in South East



England (Wilkinson *et al*, 1999). The pollen in this sample suggests that this replaced a more mixed early woodland. The relatively high values of alder (*Alnus glutinosa*) pollen are unexpected in the Thames Valley before 8500 BP, but this date is being increasingly revised in light of the data from new palaeoenvironmental studies.

- 3.5.3 The evidence for a dry woodland soil is also supported by the waterlogged plant remains that indicates pine woods were growing close to the site, possibly on the adjacent gravel islands. Further supporting evidence is provided by the a single aerophile diatom species that suggest dry conditions on a site free from alluviation.
- 3.5.4 Pollen and waterlogged plant remains were poorly preserved within the overlying alluvial silts at depths of 3.33-3.35m and 3.05-3.07m bgl. The pollen profile records the presence of some mixed woodland with open grassland and freshwater communities. The later is suggested by pollen from the bulrushes (*Typha latifolia* and *T. angustifolia*). Pine and alder were the major tree types recorded but oak (*Quercus*), lime (*Tilia*) and hazel (*Corylus avellana*) were also noted. No diatoms were preserved within this context.
- 3.5.5 The pollen recorded from the upper stabilisation horizon at a depth of 2.41m-2.43m bgl suggests a much more open landscape with grasses (Poaceae) and dandelion-type (Asteraceae (Lactcoideae)) dominating the pollen assemblage. The presence of a single tetrad of bulrush pollen suggest freshwater conditions are also present on site. Again no diatoms were preserved from this context.
- 3.5.6 The return to accumulation of minerogenic silts within the sequence reflect increasing wetness and water-logging at the site. The diatom assemblage records the presence of brackish incursions within the deposits. The pollen at a depth of 2.28-2.30m bgl in this unit was very low and no inference about the vegetation could be made. Above at 2.17-2.19m bgl pollen was more plentiful and the landscape was one of grassland, waste and damp ground environments with occasional trees possibly on the higher ground.
- 3.5.7 Insufficient identifiable plant remains were recorded during the assessment that were suitable for radiocarbon dating. The dating of the humic and humin component of the organic stabilisation deposits may help to establish a framework to the sequence. However the absence of archaeology on the site, the poor preservation of the environmental sequence and the significant body of similar studies undertaken as part of the Olympic development close to the site, make its uncertain whether any further



work on this sequence would greatly enhance our knowledge of the palaeoenvironment in this part of the Lea Valley.

- 3.5.8 Mollusca remains were also identified in low numbers within the organic deposits but these were too broken and abraded to offer any meaningful interpretation. Insect remains were also not found to be preserved within the sequence.

3.6 Finds summary

- 3.6.1 No datable artefacts were recovered from the borehole cores or during the watching brief. A piece of fired clay was recovered from the upper stabilisation surface in OABH3 at a depth of 2.55m bgl (2.23m OD). Fine inclusions of charcoal and possibly daub were also noted in OABH4 between 2.00m and 2.48m bgl (2.77-2.29m OD), from what is believed to be an equivalent stratigraphical context.
- 3.6.2 Bone fragments were also identified from equivalent upper surface (1010) at 3.30m in depth during the watching brief in Area B. No other finds were recovered during the fieldwork.

4 DISCUSSION

4.1 Reliability of the field investigations

- 4.1.1 The borehole survey and watching brief were able to successfully record the sediment sequences at the Site and retrieved undisturbed core samples for palaeoenvironmental assessment. Visibility was restricted at times during the watching brief due to the frequent egress of water (Plate 4), however sufficient monitoring of the excavations was maintained to make the results an accurate reflection of the archaeological potential of the site. No significant archaeological features or deposits were identified within the footprints of the water recycling tanks that would warrant any further mitigation.
- 4.1.2 Unfortunately the full depth of Area A (tank) was not archaeologically monitored in the field and recording of the sequence only extends to a depth of just under 3m in this area. Post-excavation recording of the sequence was not possible due to the high water-levels and collapsed material present in the base of the excavation (Plate 5). However the borehole samples do provided a full sedimentary record for this area of the site.



4.2 Environmental sequence

- 4.2.1 The earliest landsurface deposits overlying the gravels are likely to be early to mid Holocene in date and may relate to a period of relative landscape stability prior to alluvial inundation of the site. Boreal pine forest appears to have formed across the floodplain during the early Holocene replacing an earlier mixed forest of alder, pine and hazel, with occasional birch and willow. It should be noted, however, the accumulation of the fluvial sand lens within this deposit may indicate the close proximity of active channels to the site which may have resulted in some localized erosion and reworking of material in the area.
- 4.2.2 Evidence of early prehistoric soils buried underneath the alluvial sequence have been identified in the recent Olympics and Stratford City Developments (Corcoran *et al.* 2011) and the Channel Tunnel Rail Link at Stratford Box (Wessex 2003). The Lea Valley has produced a concentration of environmental evidence relating to the early Holocene. This is believed to have been a result of unusual dryness of the Lea Valley during the early prehistoric period (Corcoran *et al.* 2011), which may also explain the absence of thick prehistoric peat deposits on the floodplain that are so characteristic of the Lower Thames and its other tributaries.
- 4.2.3 This early landsurface appears to have been inundated and buried by alluvium associated with a river edge environment. Rising water-levels on the floodplain during the late prehistoric period possibly reflect the effects of increased woodland clearance and surface run off in the Lea Valley. It may also reflect the effects of rising groundwater levels on the floodplain due to the knock-on effects of rising sea-levels in the later prehistory. This is supported by the environmental sequence which indicates a transition to a more open mixed deciduous woodland with areas of open ground and freshwater wetland environments extending onto the floodplain.
- 4.2.4 The development of the upper landsurface appears to relate to a later phase of prehistoric or more probably Roman floodplain stability. There is a significant reduction of river levels recorded in the Thames during the late Roman period (Corcoran *et al.* 2011). It is highly likely that the extensive Roman activity identified on the gravel terrace at Old Ford could have also extended to parts of the floodplain especially to areas of higher ground. The recovery of fired clay and charcoal from this horizon indicates activity within the immediate area of the Site. The environmental evidence suggests an open landscape on the floodplain dominated by grasses and dandelion-type, dissected by freshwater streams. The number of Roman sites known within the



immediate area and along the Roman road may suggest some form of floodplain and river management. The extent of this floodplain management is unclear, but conditions were certainly recorded as being drier on site during this period.

- 4.2.5 The minerogenic alluvial units most likely accumulated under conditions of rising groundwater, backing-up of freshwater systems and marine inundation as a consequence of rising sea-levels during the late Roman and post Roman periods. The period of inundation responsible for the deposition of the upper alluvial deposits in the Lea Valley is part of a region-wide trend which has been recorded at many sites along the Lower Thames (Bates *et al.* 2004, Sidell *et al.* 2000; 2004). During transgressive periods settlement activity is likely to have retreated to the higher ground though seasonal exploitation of wetland resources would have continued on the floodplain, with islands of drier ground a particular focus. It is currently uncertain whether the entire floodplain island was submerged at this time or whether higher elevations remained drier into the early historic period.

4.3 Palaeotopography and archaeology

- 4.3.1 Comparisons with the geological modelling for the Olympic Park Development (MoLAS 2004, 2011 and Wessex Forthcoming) provide an opportunity to study the site within the wider context of Lea Valley's palaeotopography. This work has helped to confirm the presence of buried landsurfaces within the alluvial sequence at the edge of the gravel island with the potential to contain cut archaeological features from the Mesolithic to early Roman periods. Even though no archaeology was identified during the watching brief, this work has highlighted that there is still the potential for features and deposits to be preserved within the area of the Site unaffected by the tanks.
- 4.3.2 Based on the previous topographic mapping, the Site is located on the edge of an area of higher ground forming part of a floodplain island within the Lea Valley. River channels extend both to the east and west separating it from the gravel terrace. It is not currently known whether the western channel is a former path of the River Lea, an enlarged version of the Hackney Brook or some other unknown channel.
- 4.3.3 Temporary hunting camps of early prehistoric date have been found upstream in the Rivers Lea and in the Colne Valley particularly associated with the river banks. This activity appears to have occurred within a dry floodplain landscape. This suggests for a large part of the site only archaeological remains dating to the Mesolithic and early Neolithic periods may be found directly associated with these early buried surfaces.



Inundation of this surface would have occurred in the later prehistoric period associated with rising water-levels on the floodplain and inundation of the wetland basin identified beyond the gravel island. However on the gravel island to the east (Figure 5), where the surface of the gravels are elevated, inundation may have occurred much later. As flooding ensued during the Holocene these areas would have been reduced to islands of dry ground within a predominantly wetland environment. As such they may have acted as a focus for human activity exploiting the abundance of resources available on the floodplain, perhaps seasonally. Activity within the surrounding wetland area like that of the Site is likely to have been very low-level.

- 4.3.4 The palaeotopography of the area would have had a significant influence on floodplain sedimentation patterns and the location of Roman and later river crossing points. Timber piles of Roman date have been found to the west of the modern channel along Dace Road, at Old Ford (Alexander 2004). A potential Roman stabilisation horizon mixed with occasional dumped material was identified within the alluvial sequence at +1.5m OD on the site. However, no similar evidence of any associated timbers or archaeological features has been identified on the eastern river banks. The upper stabilisation horizon identified on the Site lay at a equivalent elevation to the Roman levels identified across the river. The path of the river may therefore been much further west of its present course during the early Roman period. The present day river may therefore have removed much of the eastern edge of the Roman river crossing.

4.4 Conclusions

- 4.4.1 The results of the watching brief would indicate that no significant archaeology features or deposits were affected by the construction of the recycling facility. The borehole samples from the Site provided a palaeoenvironmental sequence that spans early prehistory to the post-medieval period. However, the environmental sequence was found to be too poorly preserved to significantly enhance our understanding of the Lea Valley floodplain sequence or its archaeological potential.
- 4.4.2 Insufficient datable materials were recovered from the borehole samples to be able to confirm the proposed floodplain chronology. No further sediment dating of the deposits were undertaken due to the poor environmental preservation and absence of archaeology on the Site. The broad dating of the Site sequence and surfaces therefore relies on the more detailed and better preserved floodplain sequences identified within the surrounding area.



- 4.4.3 No further work is recommended on the sequence. The submission of this report to the SMR and the completion of an OASIS is considered to be the appropriate level of publication.

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APPENDIX A. WATCHING BRIEF DATA

Area A (Section 1000)						
General description				Orientation	E-W	
Section through Area A. The sequence comprised alluvial silts underlying thick deposits of Victorian make-up deposits and made-ground deposits. No archaeology present.				Avg. depth (m)	2.60	
				Width (m)	15m	
				Length (m)	20m	
Contexts						
context no	type	Width (m)	Depth (m)	comment	finds	date
1000	Layer	-	0-2.10	Make up deposits	-	Victorian
1001	Layer	-	2.10-2.20	Alluvial silty clay (weather surface)	-	Post Roman?
1002	Layer	-	2.20-23.0	Alluvium silty clay	-	Late Roman/post Roman?
1003	Layer	-	2.30-2.60	Alluvium silty clay	-	Late Roman/post Roman?

Area B (Sections 1001 and 1002)						
General description				Orientation	NE-SW	
Two sections through Area B. The sequence comprised two stabilisation horizon inter-stratified within a floodplain alluvial sequence overlying Pleistocene gravels. Sealed by Victorian make-up deposits and modern made-ground. No archaeological features present.				Avg. depth (m)	4.20m	
				Width (m)	10m	
				Length (m)	15m	
Contexts						
context no	type	Width (m)	Depth (m)	comment	finds	date
1004	Layer	-	0-1.38	Make-up deposits	-	Victorian
1005	Layer	-	1.38-1.70	Alluvium (weather surface)	-	post Roman?
1006	Layer	-	1.70-2.00	Alluvium	-	Late Roman/post Roman?
1007	Layer	-	2.00-2.30	Alluvium	-	Late Roman/post Roman?
1008	Layer	-	2.30-2.80	Alluvium	-	Late Roman/post Roman?
1009	Layer	-	2.80-	Upper Stabilisation	Fired clay	Late Prehistoric/



			3.20	horizon	and animal bone	Roman
1010	Layer	-	3.20- 3.50	Upper Stabilisation horizon	-	Late Prehistoric/ Roman
1011	Layer	-	3.50- 4.00	Alluvium	-	Late Prehistoric?
1012	Layer	-	4.00- 4.20	Early buried soil	-	Early Holocene
1013	Layer	-	4.20-	Sandy gravel	-	Pleistocene



APPENDIX B. BOREHOLE LOGS

FIELD SEDIMENT LOGGING SHEET

SITE CODE: OFW10

NG EASTING: 537379.524

DATE: 28/05/10

BH NO: OABH1

ELEVATION: 4.77

NG NORTHING: 183865.696

LOGGER: CH

Depth	Lithology	Cores	Description
0.00			0.00, 0.42 Very dark grey, loose, fine to coarse silty sand with pebbles of granite. (MAKE-UP DEPOSITS).
0.50			0.42, 0.60 Black, firm to stiff sandy clay with rare small white mortar clasts and red brick fragments. (MAKE-UP DEPOSITS).
			0.60, 0.90 Dark olive brown with dark brownish grey mottles, firm to stiff silty clay with small angular pebbles. (MAKE-UP DEPOSITS)
1.00			0.90, 1.19 Black, firm to stiff silty clay with small to medium pebbles (40%). (MAKE-UP DEPOSITS)
			1.19, 1.71 Olive brown with dark grey mottles, firm sandy clay with sand lenses and pebbles of flint (30%). (MAKE-UP DEPOSITS).
1.50			
			1.71, 2.03 Dark greyish brown with small dark red and black mottles, firm silty clay with small subangular pebbles (20%), rare small charcoal flecks and an iron fragment included. (MAKE-UP DEPOSITS)
2.00			
			2.03, 2.20 Dark olive with fine reddish brown mottles, firm silty clay. (ALLUVIUM)
2.50			2.20, 2.55 Light olive brown with yellowish red and light grey mottles, firm silty clay. (ALLUVIUM)
			2.55, 2.82 Dark olive grey becoming darker towards base, soft humic silty clay. (ALLUVIUM)
3.00			2.82, 3.00 Black firm organic rich clayey sily with rare black mottles. (UPPER SOIL SURFACE)
			3.00, 3.17 Dark olive grey, firm organic rich silt. (FLUVIAL SAND)
3.50			3.17, 3.41 Very dark grey soft organic rich clayey sand. (FLUVIAL SAND)
			3.41, 3.71 Black soft organic rich clayey silt. (EARLY HOLOCENE SOIL)
4.00			3.71, 3.75 Very dark grey humic rich clayey fine sand with small angular pebbles (15%). (EARLY HOLOCENE SOIL)
			3.75, 4.00 Dark grey, lose fine to coarse sand with small pebbles (20%). (PLEISTOCENE GRAVEL)
4.50			4.00, 4.20 Olive grey, soft to lose. graded, fine sand becoming fine to coarse with small pebbles (25%). (PLEISTOCENE GRAVEL)
			4.20, 4.45 Olive grey, graded, fine to coarse sand (25%) with small to large subrounded to subangular pebbles (25%). (PLEISTOCENE GRAVEL).
5.00			

NOTES:

The void at 3.00 to 3.10m BGL was spread out between the alluvial units in this core. A 20mm deep unit at the top the core 4-5m BGL was taken out as contamination.

FIELD SEDIMENT LOGGING SHEET

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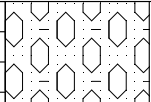
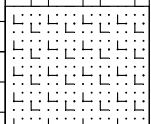
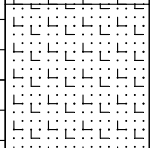
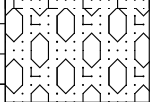
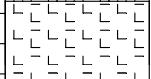
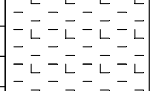
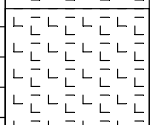
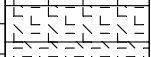

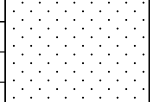
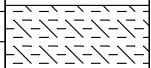
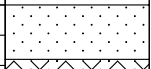
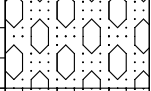
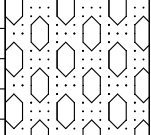
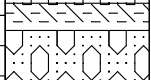

DATE: 28/05/10

BH NO: OABH2

ELEVATION: 4.61

NG NORTHING: 183876.482

LOGGER: CH

Depth	Lithology	Cores	Description
0.00			0.00, 0.35 Dark greyish brown silty sand with angular pebbles of granite and rare Tarmac. (MAKE-UP DEPOSITS)
0.50			0.35, 0.75 Black firm sandy clay with pebbles (25%) and rare small brick fragments. (MAKE-UP DEPOSITS)
1.00			0.75, 1.25 Olive brown sandy clay with flint pebbles and rare brick and charcoal fragments. (MAKE-UP DEPOSITS)
1.50			1.25, 1.56 Yellowish brown firm clayey sand with small pebbles (60%) and lenses of silty clay. (MAKE-UP DEPOSITS)
2.00			1.56, 1.77 Dark greyish blue, soft to firm silty clay with rare reddish brown blackish mottles. (ALLUVIUM).
2.50			1.77, 2.14 Dark greenish grey with rare small reddish brown and fine blackish mottles, soft clayey silt. (ALLUVIUM).
3.00			2.14, 2.54 Greenish grey soft silty clay with yellowish brown fine mottles (25%). Colour change towards the base. (ALLUVIUM).
3.50			2.54, 2.66 Dark grey soft organic rich silty clay. (UPPER SOIL SURFACE)
4.00			2.66, 2.88 Dark greyish brown firm organic rich silt. Rare angular pebbles at base. (UPPER SOIL SURFACE)
4.50			2.88, 3.28 Greyish brown fine sand with small inclusions of organic matter. (FLUVIAL SAND).
5.00			3.28, 3.50 Black, firm homogenous organic rich silt. (EARLY HOLOCENE SOIL)
5.50			3.50, 3.68 Dark greenish grey slightly silt and clayey sand with small organic inclusions. (EARLY HOLOCENE SOIL)
6.00			3.68, 4.00 Dark grey fine to coarse sand with small to medium pebbles (40%), 30mm lenses of sand and small fragments of organic matter. (PLEISTOCENE GRAVEL)
6.50			4.00, 4.46 Dark grey fine to coarse sand, small angular pebbles (20%) and rare dark brown organic matter. (PLEISTOCENE GRAVEL)
7.00			4.46, 4.55 Black, organic rich silt with small organic detritus included (30%). (PLEISTOCENE GRAVEL)
7.50			4.55, 5.00 Dark grey fine to coarse sand with occasional lenses of gravelly sand and a lense of dark grey organic rich silt at 4.90 to 4.94m BGL. (PLEISTOCENE GRAVEL)

NOTES:

A void between 2.00 and 2.14 m was spread out between the Alluvial units of the same core. A void between 4.00 and 4.35m BGL was removed by spreading the sandy gravel to the top, as it seems to have been poured out on site immediately after recovery.

FIELD SEDIMENT LOGGING SHEET

SITE CODE: OFW10

NG EASTING: 537386.001

DATE: 28/05/10

BH NO: OABH3

ELEVATION: 4.78

NG NORTHING: 183872.863

LOGGER: CH

Depth	Lithology	Cores	Description
0.00			0.00, 0.12 Dark greyish brown, loose sandy silt, humic rich, abundant grass roots. TOPSOIL.
0.12			0.12, 0.40 Dark grey, loose silty sand humic rich sand with angular pebbles of granite above industrial textile. MADE GROUND.
0.40			0.40, 0.65 Dark grey stiff sandy, slightly clayey silt, humic rich with fine brick fragments and wood fragments up to 140mm. MADE GROUND.
0.65			0.65, 0.95 Dark olive brown firm sandy clay, rare pebbles, rare clasts of mortar and tarmac. MADE GROUND.
0.95			0.95, 1.07 Dark grey sandy clay with flint pebbles (10%) and rare small brick fragments. MADE GROUND.
1.07			1.07, 1.35 Olive brown firm sandy clay with pebbles (20%) and rare fine brick fragments. MADE GROUND.
1.35			1.35, 1.97 Greenish brown with olive brown and black mottling, firm silty clay with rare pebbles and small brick fragments. MADE GROUND .
1.97			1.97, 2.14 Dark greenish brown firm clayey silt with fine reddish brown mottles.
2.14			2.14, 2.40 Light brownish grey with strong brown fine mottling (25%). (ALLUVIUM).
2.40			2.40, 2.55 Dark greenish grey with strong brown Fe concretions, soft silty clay. GR soil horizon. (UPPER STABILISED HORIZON)
2.55			2.55, 2.85 Dark grey with rare strong brown mottles, soft to firm sandy clay. (FLUVIAL)
2.85			2.85, 2.96 Light olive brown with fine rare strong brown mottles. (FLUVIAL)
2.96			2.96, 3.30 Dark greenish brown with reddish brown mottles soft silty clay with rare yellow and black fine inclusions. (EARLY STABILISED HORIZON?)
3.30			3.30, 3.63 Bluish grey with brown mottles, soft silty clay with abundant mottles and small pebbles between 3.47 and 3.55m. (FLUVIAL)
3.63			3.63, 3.77 Dark grey with very dark grey mottling (5%) soft clay. (FLUVIAL)
3.77			3.77, 3.82 Black firm organic silt with rare organic inclusions, hydromorphic A horizon. (EARLY HOLOCENE SOIL)
3.82			3.82, 3.94 Dark greenish grey soft organic rich sandy clay. (EARLY HOLOCENE SOIL)
3.94			3.94, 4.29 Dark greenish grey mottled pale olive soft clayey sand with blackish detritus (5%). (EARLY HOLOCENE SOIL)
4.29			4.29, 4.55 Dark greyish brown, firm graded fine to coarse sand with small subrounded pebbles (10-60%). (PLEISTOCENE GRAVEL)
4.55			4.55, 4.82 Dark greyish brown fine to coarse sand (20%) and small pebbles (80%). (PLEISTOCENE GRAVEL)

NOTES:

VOID between 2.00 and 2.16m BGL spread out between ALLUVIAL units in same core. Three organic rich units between 4.06 and 4.18 were taken out of the sequence as the seem to derive from contamination from higher up. The void from 4.00 to 4.18 was closed by moving the units in the core upwards.

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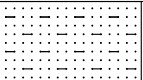
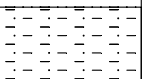
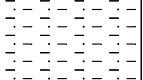
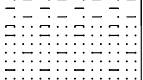
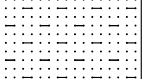
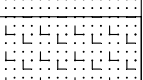
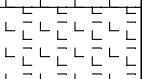
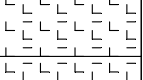
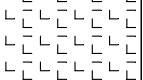
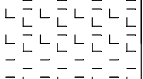
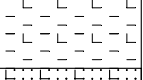
DATE: 28/05/10

BH NO: OABH4

ELEVATION: 4.77

NG NORTHING: 183879.586

LOGGER: CH

Depth	Lithology	Cores	Description
0.00			0.00, 0.28 Dark grey loose silty sand with angular granite pebbles. (MAKE-UP DEPOSITS)
0.50			0.28, 0.86 Black compacted to friable sandy silt with rare brick, mortar and tarmac fragments and rare pebbles. (MAKE-UP DEPOSITS)
1.00			0.86, 1.35 Light olive brown friable fine silty sand. (MAKE-UP DEPOSITS)
1.50			1.35, 1.58 Dark greyish brown stiff sandy clay with small to medium pebbles (40%) with rare white mortar specs and flecks of charcoal. (MAKE-UP DEPOSITS)
2.00			1.58, 2.00 Dark olive brown with fine reddish brown mottling and zones of dark grey mottling, firm to stiff silty clay. (ALLUVIUM).
2.50			2.00, 2.48 Olive grey with reddish brown mottling turning grey toward the base, firm silty clay.(ALLUVIUM)
3.00			2.48, 2.82 Greenish black with vertical olive brown mottles (roots), firm clayey silt with fine inclusions of charcoal, shell fragments, possible daub and wood. (UPPER SOIL HORIZON)
3.50			2.82, 2.94 Dark bluish grey with small olive mottles, firm sandy clay with rare fine blackish flecks and fine Vivianite minerals.(FLUVIAL SANDS)
4.00			2.94, 3.32 Dark greenish grey with fine blackish mottling, soft slightly silty clay with rare fine shell fragments and plant detritus (wood). (FLUVIAL SANDS)
4.50			3.32, 3.42 Greenish black soft organic rich slightly sandy silt with small to medium pebbles and wood fragments (5%). (EARLY HOLOCENE SURFACE)
5.00			3.42, 4.00 Dark olive brown, silty coarse to fine sand with small pebbles (70%). (PLEISTOCENE GRAVEL)

NOTES:

The void between 2.00 and 2.16m BGL was spread out between two large alluvial units in same core.



APPENDIX C. POLLEN AND PLANT REMAINS ASSESSMENT

By Elizabeth Huckerby (Oxford Archaeology North)

Introduction

C.1.1 A total of eight pollen and eight waterlogged plant remains samples were assessed from the Site. A series of four borehole were drilled through a Holocene sedimentary sequence just to the east of Old Ford Lock. The core retrieved from borehole OABH3 was sub-sampled for the assessment of pollen and water logged plant remains and these have been assessed at Oxford Archaeology North.

Methodology

C.1.2 **Quantification:** the deposit sequence was described and sub-sampled by Carl Champness (OAS) and eight pollen and eight waterlogged plant remains sub-samples were taken. The depths from which the samples were taken and a broad lithological description are shown in Table 1.

Lithology	Depth samples for pollen metre	Depth of samples for waterlogged plant remains metre
Alluvium	2.17-2.19, 2.28-2.30	2.17-2.22
Upper stabilised horizon	2.41-2.43,	2.41-2.46
Fluvial clay	2.56-2.58	2.56-2.61
Early stabilised horizon	3.05-3.07	3.05-3.10, 3.25-3.30
Fluvial silty clay	3.33-3.35	3.33-3.38
Early Holocene soil	3.78-3.80,	3.78-3.83,
Early Holocene soil	4.08-4.10	4.08-4.13

Table 1: showing depths from which the sub-samples were taken for the assessment of pollen and waterlogged plant remains.

C.1.3 **Pollen preparation:** the eight samples were prepared for pollen assessment using a standard chemical procedure (method B of Berglund & Ralska – Jasiewiczowa (1986), using HCl, NaOH, sieving, HF, and Erdtman's acetolysis, to remove carbonates, humic acids, particles > 170 microns, silicates, and cellulose, respectively. The samples were then stained with safranin, dehydrated in tertiary butyl alcohol, and the residues mounted in 2000 cs silicone oil. Slides were examined at a magnification of 400x



(1000x for critical examination) by ten equally-spaced traverses across at least two slides to reduce the possible effects of differential dispersal on the slide (Brooks & Thomas, 1967). The number of pollen grains, fern spores and *Lycopodium* marker spores were recorded and a note made of the preservation of the pollen and the presence of charcoal. Tablets with a known concentration of *Lycopodium* spores (Stockmarr, 1971) were added to a known volume of sediment at the beginning of the preparation so that pollen concentrations could be calculated. The results are presented in Tables 2. Plant nomenclature throughout follows Stace (1997).

C.1.4 **Waterlogged plant remains preparation:** the eight samples were prepared for assessment by wet sieving through a 250 micron sieve, The remaining material was retained in water. A representative sample from each was examined with a low powered binocular microscope and all readily identified plant remains were recorded. The results are shown in Tables 3.

Results and Discussion

C.1.5 **Pollen:** some pollen has been preserved in all of the samples assessed although the state of preservation was poor in all samples except at a depth of 3.78-3.80m. The concentration of pollen varied from 78,462 to 1,549 grains per cubic centimetre.

C.1.6 **Early Holocene Soil:** the pollen recorded in the early Holocene soil suggests that woodland dominated the landscape and at 3.78-3.80m pine woods are likely to have been widespread, a typical feature of the early Holocene in South East England (Wilkinson et al, 1999). The pollen in this sample suggests that this is replaced a more mixed woodland. The relatively high values of alder (*Alnus glutinosa*) pollen are unexpected as Devoy (1979) states that alder is unlikely to have been present in the Thames Valley before 8500 BP. However Wilkinson et al (1999) recorded alder pollen in the early Holocene at Silvertown and macrofossils were identified by Godwin (1964) from the "Arctic beds" in the Lea Valley and at Bramcote Green by Thomas and Rackham (1996).

C.1.7 **Fluvial silty clay and Early stabilised horizon:** a few grains of pollen were recorded at a depth of 3.33-3.35m in the clay. Pollen was similarly sparse at a depth of 3.05-3.07m in the Early stabilised horizon.

C.1.8 **Fluvial clay:** the pollen recorded suggests the presence of some mixed woodland with open grassy communities and a freshwater community. The later is suggested by pollen from the bulrushes (*Typha latifolia* and *T. angustifolia*). Pine and alder were the major



tree types recorded but oak (*Quercus*), lime (*Tilia*) and hazel (*Corylus avellana*) were also noted.

- C.1.9 *Upper stabilised horizon*: the pollen recorded in the single sample from this horizon at a depth of 2.41-2.43 suggests a much more open vegetation. Grasses (Poaceae) and dandelion-type (Asteraceae (Lactcoideae)) dominated the pollen assemblage. The presence of a single tetrad of bulrush pollen suggest freshwater conditions.
- C.1.10 *Alluvium*: the concentration of pollen at a depth of 2.28-2.30m in this unit was very low and no inference about the vegetation could be drawn. A few grains of alder and hazel pollen and a few polyploid (*Polypodium*) spores were noted. Above at 2.17-2.19m pollen was more plentiful and the landscape was one of grassland, waste and damp ground with occasional trees.
- C.1.11 ***Waterlogged plant remains***: very few seeds other than occasional elder (*Sambucus nigra*) and half a bramble (*Rubus fruticosus*) seed were recorded in the eight samples. Amorphous plant remains were noted in all but the two upper samples (2.17-2.22m and 2.41-2.46m). The two samples from the Early Holocene soil suggest that it may represent a woodland soil or that the pine woods were growing in close proximity to the site in the Early Holocene.
- C.1.12 Frequent broken fragments of mollusc shells were noted in the fluvial silty clay and early stabilised horizon. Pebbles, gravel, sand and silty clay were found in several of the samples. Three fragments of charcoal were identified at 3.25-3.30m in the early stabilised horizon and a small piece of brick in the alluvium at 2.17-2.22m.

Conclusion and Potential

- C.1.13 The pollen assessment suggests that the sequence started to accumulate above the Pleistocene gravels in the Early Holocene as described in the interim geoarchaeological report (OA, 2010). The frequency of wood fragments in the Early Holocene soil and the high values of pine pollen at a depth of 3.78-3.80 in this layer suggests that the soil may have supported a wood or the site lay in close proximity to pine woodland. The early record of alder pollen corroborates the possible presence of alder in the Late Glacial or very early Holocene at other sites in the Lea and Thames Valleys.
- C.1.14 No further work is recommended although some further analysis of the pollen in the Early Holocene soil, fluvial clay and the upper stabilised horizon might be possible. The author feels that further analysis of samples from borehole OABH3 would not greatly increase our knowledge of the palaeoenvironment in the Upper Lea Valley.



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APPENDIX D. DIATOM ASSESSMENT

By Nigel Cameron, Environmental Change Research Centre, Department of Geography, University College London.

Introduction

D.1.1 Six sub-samples from the Old Ford Blackwater Site, Stratford (OFW10) have been prepared and assessed for diatoms. The diatom samples were taken from a borehole sequence OABH3. The Site is located in the Lower Lea Valley, partly on the floodplain and immediately east of the current river channel. It was recommended that a palaeoenvironmental assessment of one main sequence from the Site be undertaken to assess its potential to inform about the nature of the changing floodplain environment. In particular if there are any brackish elements to the assemblages and to consider how wet were the potential alluvial surfaces. This should include an assessment of the full range of palaeoenvironmental evidence that includes diatoms (Champness 2010 and *pers. comm.*). The diatom assessment of each sample takes into account the numbers of diatoms, the state of preservation of the diatom assemblages, species diversity and diatom species environmental preferences.

Methods

D.1.2 Diatom preparation followed standard techniques (Battarbee 1986, Battarbee *et al.* 2001). Two coverslips were made from each sample and fixed in Naphrax for diatom microscopy. A large area of the coverslips on each slide was scanned for diatoms at magnifications of x200, x400 and x1000 under phase contrast illumination.

D.1.3 Diatom taxonomy follows Hendeby (1964), Werff & Huls (1957-1974), Hartley *et al.* (1996) and Krammer & Lange-Bertalot (1986-1991). Diatom species' salinity preferences use the classification data in Denys (1992), Vos & de Wolf (1988, 1993) and the halobian groups of Hustedt (1953, 1957: 199), these salinity groups are summarised as follows:

1. Polyhalobian: $>30 \text{ g l}^{-1}$
2. Mesohalobian: $0.2\text{-}30 \text{ g l}^{-1}$
3. Oligohalobian - Halophilous: optimum in slightly brackish water
4. Oligohalobian - Indifferent: optimum in freshwater but tolerant of slightly brackish water



5. Halophobous: exclusively freshwater
6. Unknown: taxa of unknown salinity preference.

Results & Discussion

Borehole	Diatom Sample Number	Sample Depth (m) Below Ground Level	Sediment type
OABH3			
	D1	2.17-2.19	Alluvium
	D2	2.41-2.43	Top of Upper Soil
	D3	2.56-2.58	Upper Soil
	D4	3.05-3.07	Early Soil
	D5	3.33-3.35	Fluvial Sand
	D6	3.78-3.80	Early Holocene Soil

Table 1. Samples from the OFW10 Site, OABH3 selected for diatom evaluation

D.1.4 The diatom sample numbers, sample depths below ground level and sediment types are shown in Table 1 above. The results of the diatom evaluation for the OABH3 samples are shown in Table 2.



Diatom Sample No.	Diatoms	Diatom numbers	Quality of preservation	Diversity	Assemblage type	Potential for % count
D1	+	very low	very poor	very low	brackish marine	none
D2	-	-	-	-	-	none
D3	-	-	-	-	-	none
D4	-	-	-	-	-	none
D5	-	-	-	-	-	none
D6	+	very low	very poor	one valve	possible aerophile	none

Table 2. Summary of diatom evaluation results for the OFW10 Site, OABH3 (+ present, - absent)

- D.1.5 Diatoms are absent from samples D2 to D5 in OABH3. These four samples were taken from upper soil, early soil and fluvial sand sediment units. The absence of diatoms may reflect unfavourable conditions for diatom silica preservation (Flower 1993, Ryves *et al.* 2001). It is not therefore possible to comment on the environment of deposition.
- D.1.6 The dissolved central area of a large naviculoid diatom, possibly an aerophilous (terrestrial and freshwater) *Pinnularia* sp., was found in the basal sample D6 which was taken from the Early Holocene Soil. However, the diatom valve fragment was very poorly-preserved and this identification is tentative.
- D.1.7 Three poorly-preserved diatom fragments were found in the top sample D1 taken from alluvium. All of the diatoms in D1 are non-planktonic species and represent brackish-marine conditions and therefore a tidal environment. One diatom fragment found in D1 was of the benthic mesohalobous taxon *Navicula navicularis*. A fragment of a large *Diploneis* sp., probably *Diploneis didyma*, is also typical of tidal, mud surface (epipellic) habitats. *Synedra gaillonii* is an attached marine-brackish (polyhalobous to mesohalobous) species that also indicates estuarine conditions.

Conclusions

- D.1.8 Diatoms are absent from four samples and present in two samples from the OABH3 sequence. The quality of preservation is very poor in the two diatomaceous samples and there is no potential for percentage diatom counting of these samples.
- D.1.9 In the basal sample a diatom fragment, possibly from an aerophilous species, was identified. In the top sample from alluvium, three brackish-marine diatom fragments were identified. These non-planktonic, mesohalobous and polyhalobous to mesohalobous diatom species represent a tidal environment.



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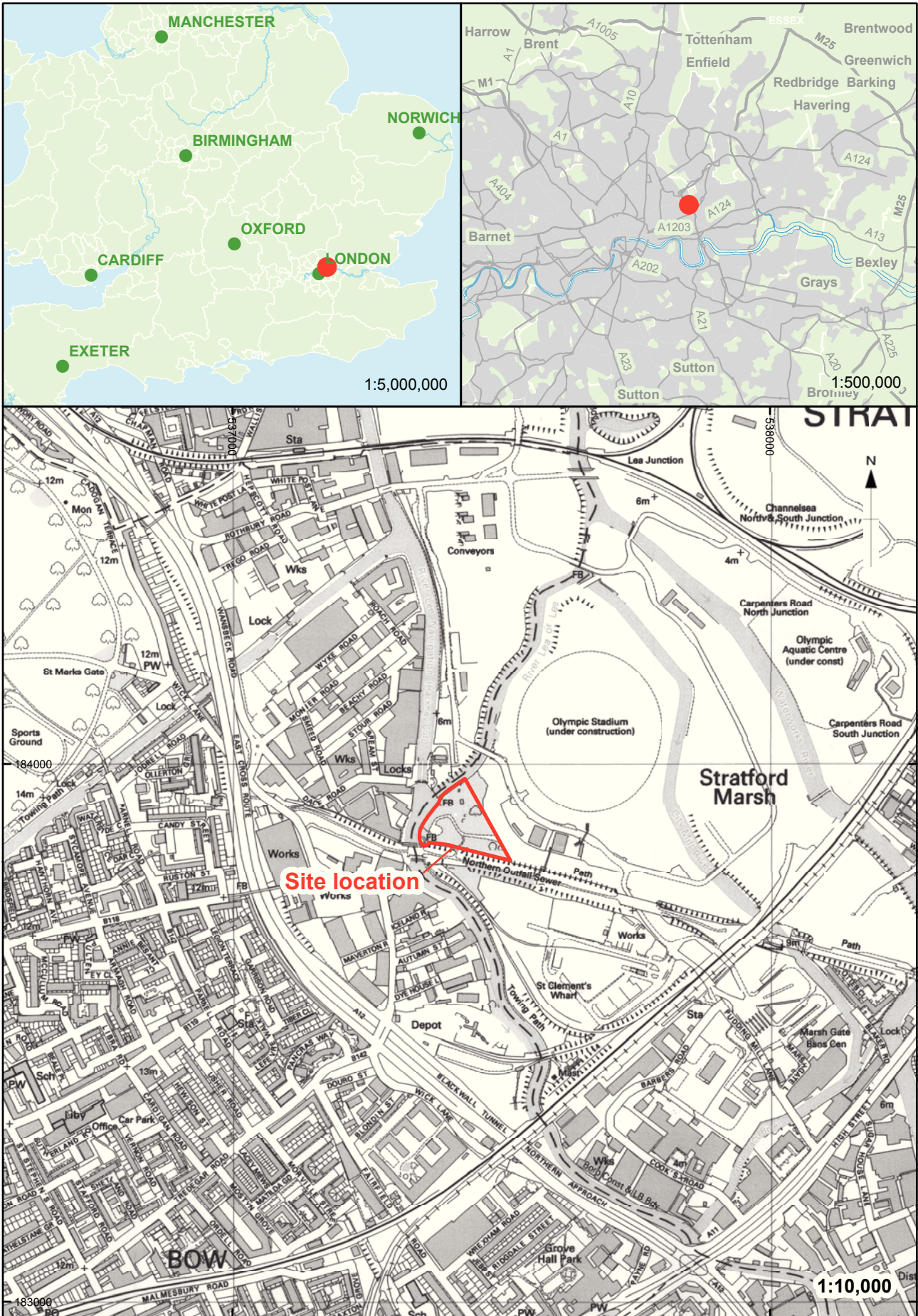
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APPENDIX E. SUMMARY OF SITE DETAILS

Site name:	Old Ford Water Recycling Facility
Site code:	OFW10
Grid reference:	TQ 37403 83904
Type:	Watching Brief
Date and duration:	July 2010 - February 2011
Area of site:	1.3 ha
Summary of results:	<p>A borehole survey was undertaken to provide baseline information on the buried floodplain sequence at Old Ford. An intact sequence of floodplain deposits were identified underlying up to 2m of 19th century make-up deposits. Two early floodplain surfaces were identified within the sequence with high potential to contain important archaeological and palaeoenvironmental evidence. No significant archaeological features or deposits were identified during the subsequent watching brief.</p>
Location of archive:	<p>The archive is currently held at OA, Janus House, Osney Mead, Oxford, OX2 0ES, and will be deposited with the Museum of London in due course, under the following accession number: OFW10.</p>



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Figure 1: Site location

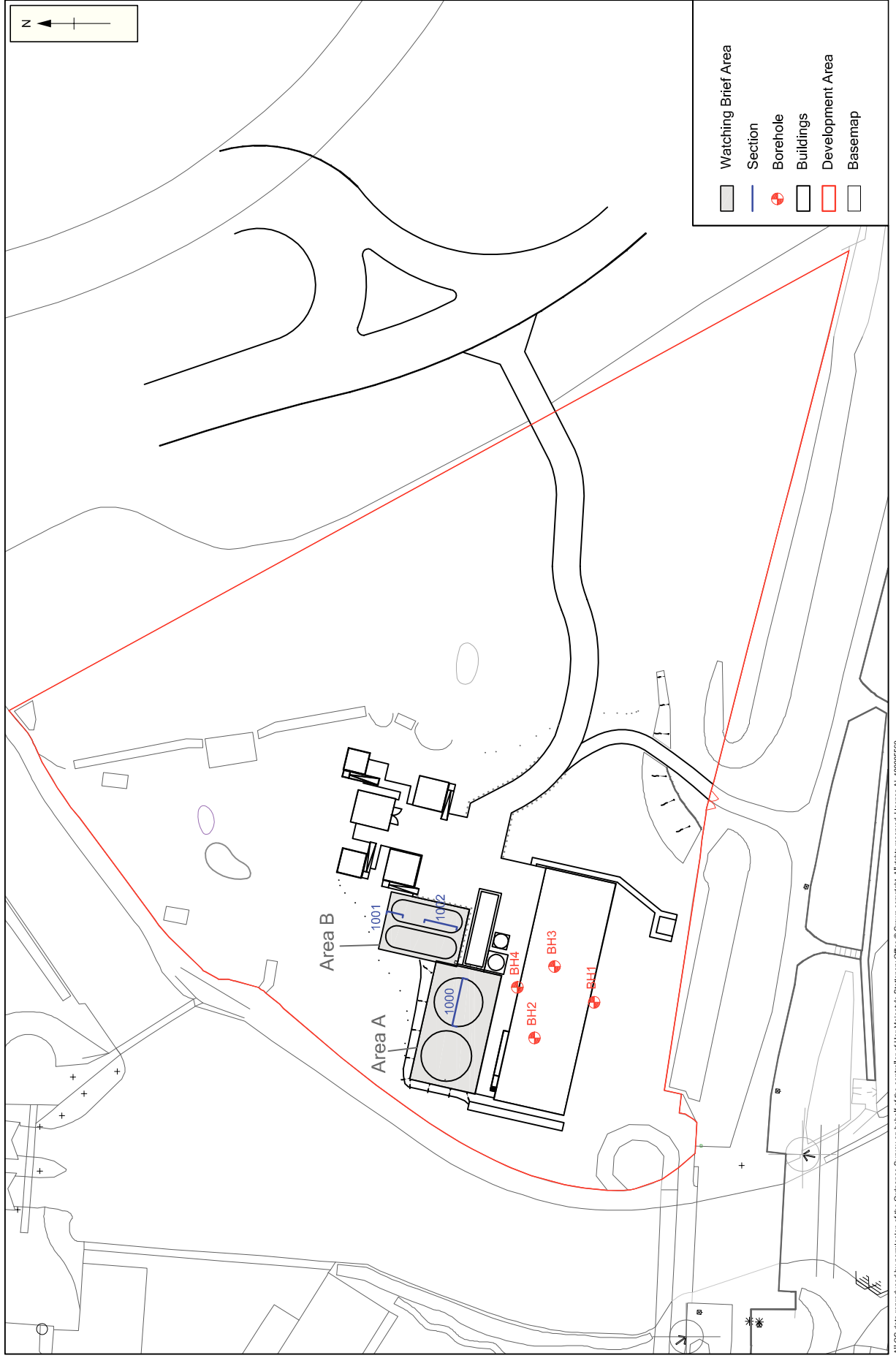


Figure 2 Borehole locations and watching brief areas

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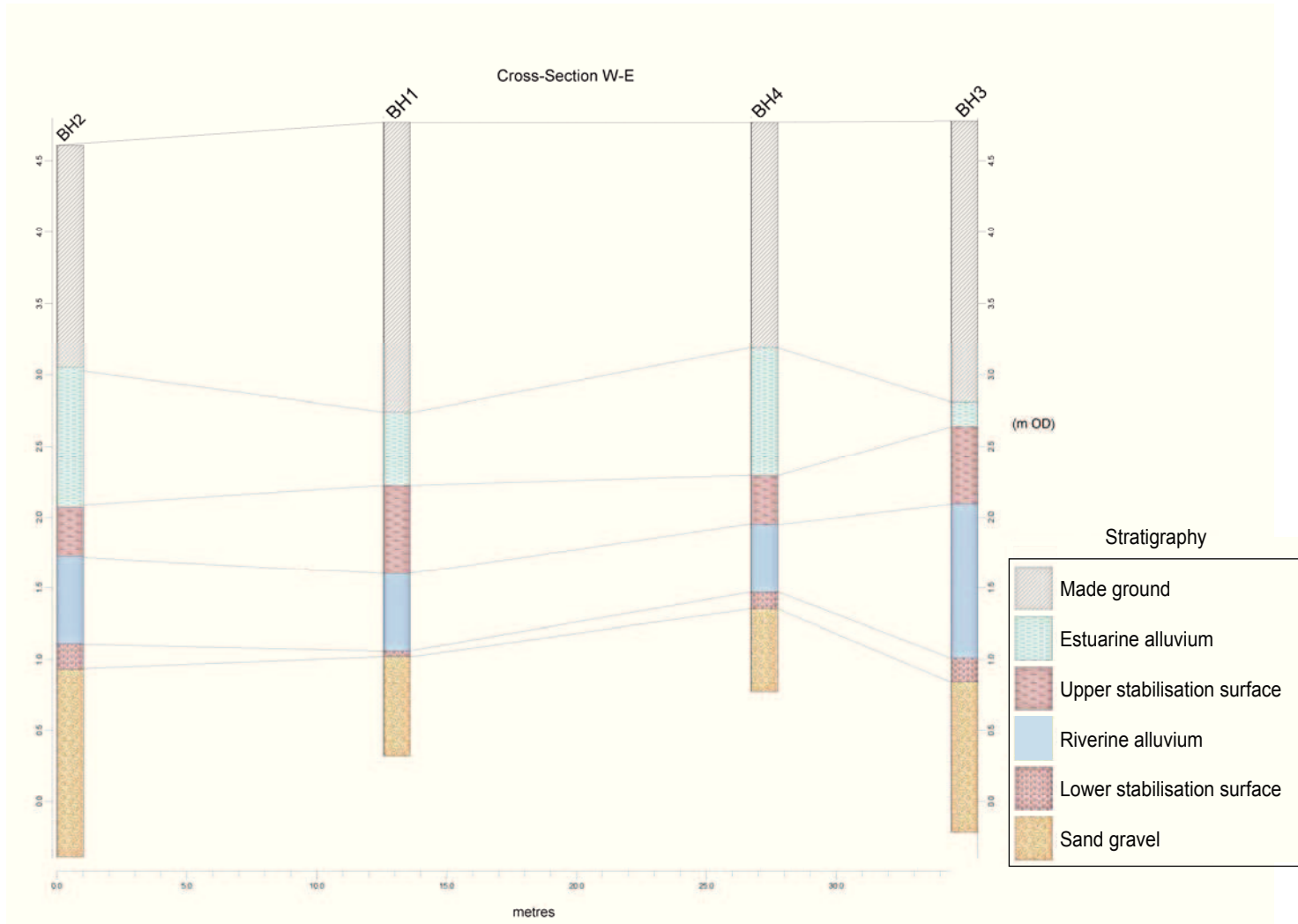


Figure 3: Borehole cross-section

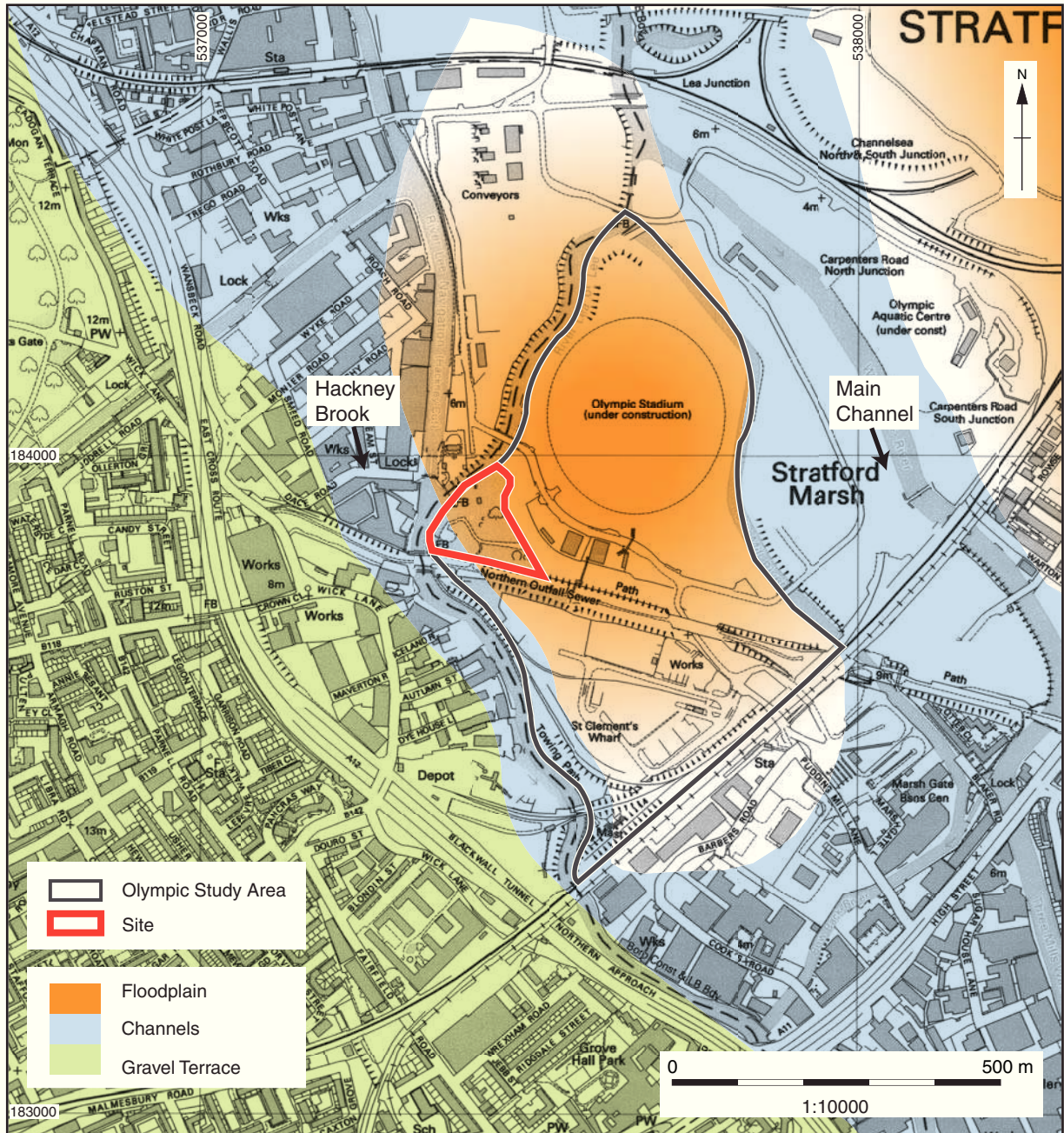


Figure 4: Palaeotopography of the Olympic Park (data provided by Wessex Archaeology)

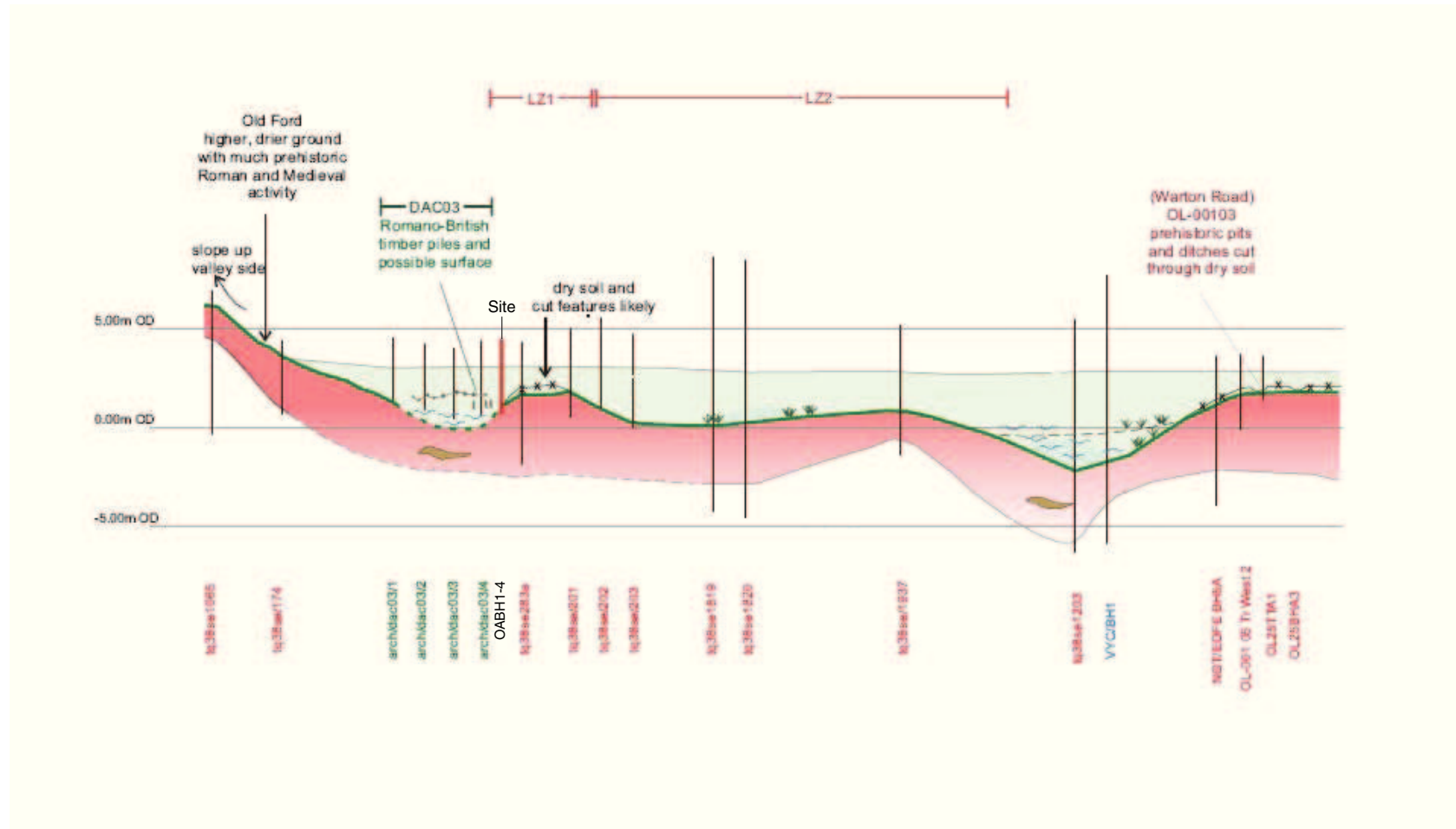


Figure 5: Interpretative cross-section (MoLAS 2011)

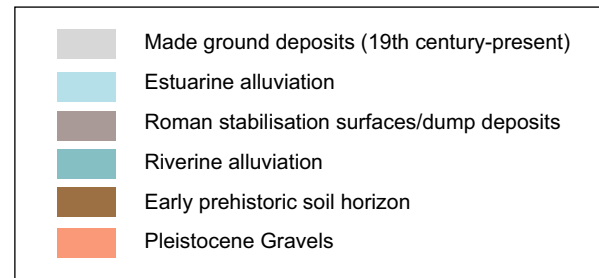
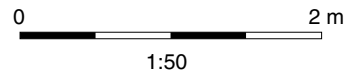
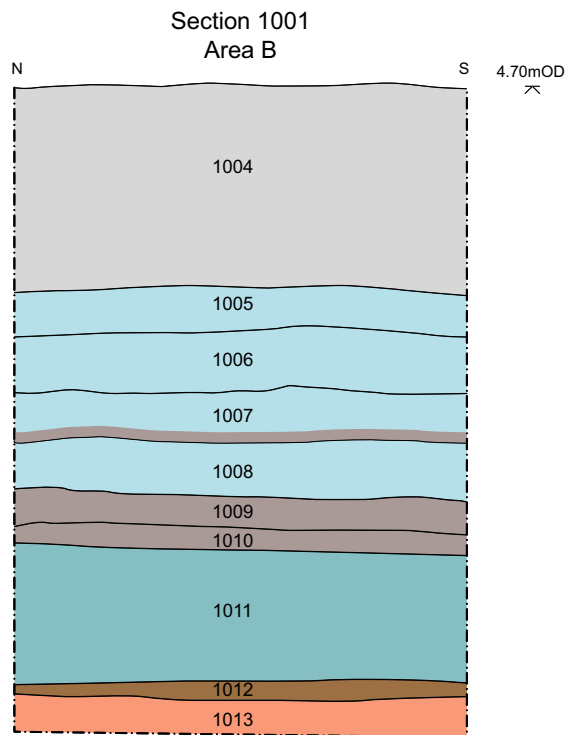
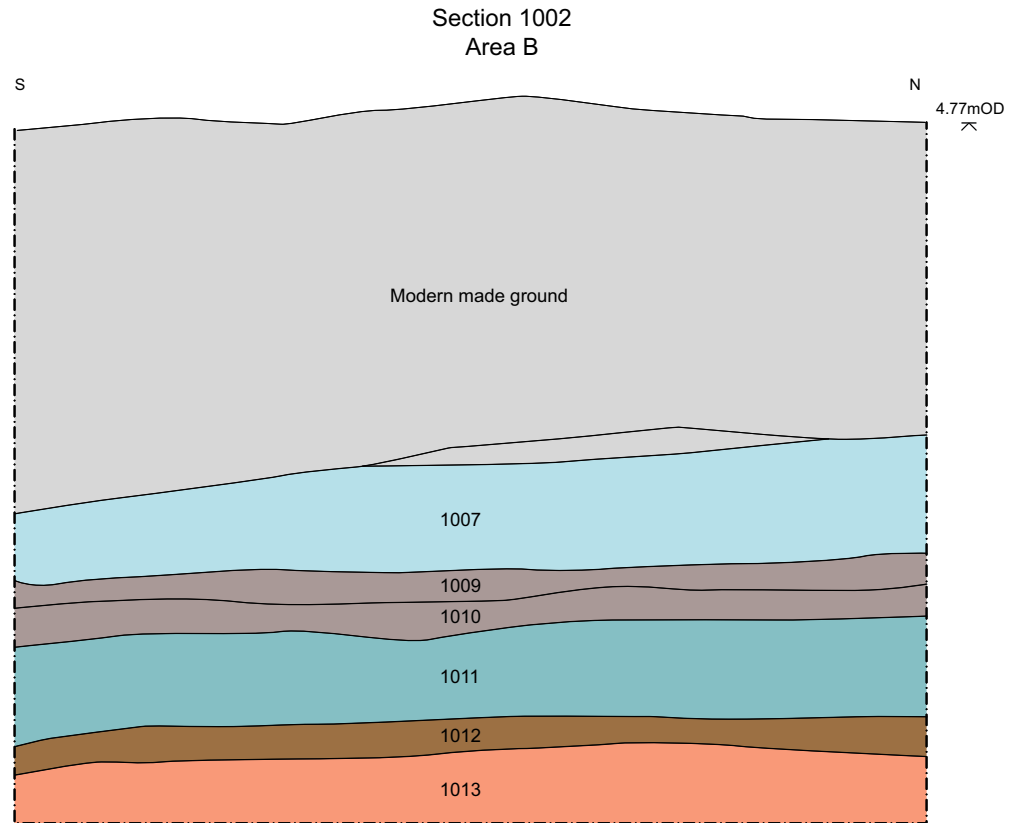
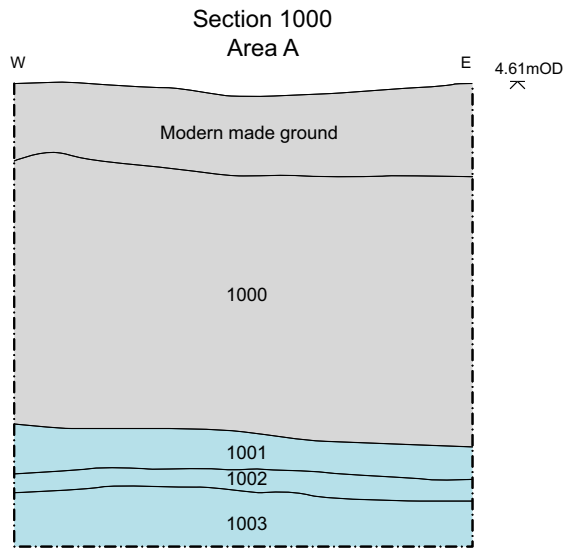


Figure 6: Watching brief sections



Plate 1: Photo of the borehole sampling - terrier percussion rig

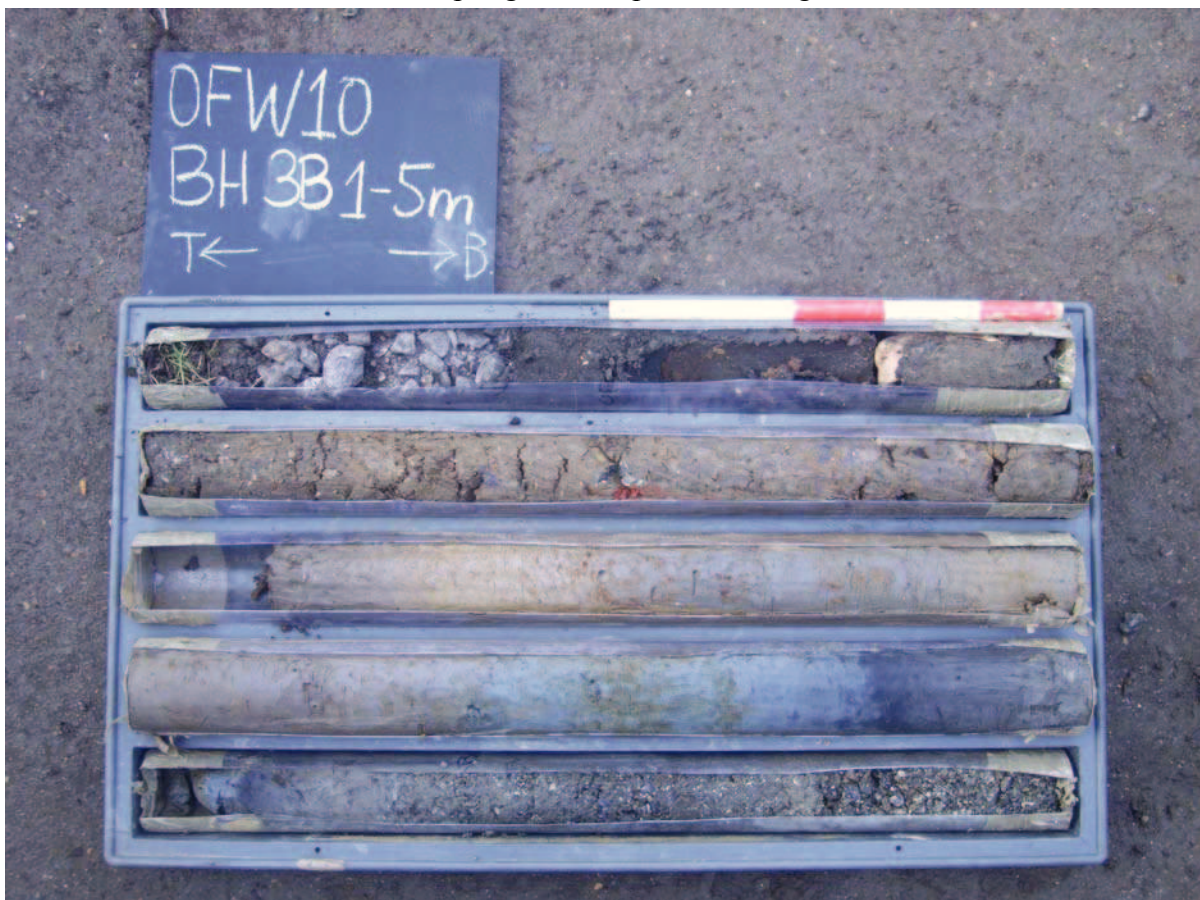


Plate 2: Photo of borehole sample OABH3



Plate 3: Excavation and section through Areas B



Plate 4: Site conditions within Area B



Plate 5: Site conditions within Area A



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