105-107 TARLING ROAD, LONDON BOROUGH OF NEWHAM (SITE CODE: TAR13): GEOARCHAEOLOGICAL ASSESSMENT REPORT

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INTRODUCTION

This report summarises the findings arising out of the geoarchaeological assessment undertaken by Quaternary Scientific (University of Reading) in connection with the proposed development at 105-107 Tarling Road, London Borough of Newham (site code: TAR13; National Grid Reference: TQ 398 812; Figure 1). The site is in the lower valley of the River Lea, to the east of the river and close to the confluence of the Lea with the River Thames. The western boundary of the site is approximately 400m from the present-day channel of the Lea at a point where the river, known here as Bow Creek, follows a very convoluted meandering course. The mouth of Bow Creek, at its confluence with the Thames, lies *ca*. 500m to the southeast of the site.

The British Geological Survey (1:50,000 Sheet 257 Romford 1996) shows the site underlain by Alluvium, described as comprising mainly sand, silt and clay with some gravel, resting on London Clay bedrock. In fact, the Holocene alluvium of the Lower Thames and its tributaries is almost everywhere underlain by Late Devensian Late Glacial Gravels (in the Thames valley, the Shepperton Gravel of Gibbard, 1985, 1994; in the Lea valley, the Lea Valley Gravel of Gibbard, 1994), and this gravel is widely recorded in boreholes in the vicinity of Canning Town.

Recent geoarchaeological (Young & Batchelor, 2013) and geotechnical (K F Geotechnical, 2013) fieldwork at the site, and investigations from St Luke's Square (Wicks, 2010) reveal a sequence of alluvial and peat deposits overlying Lea Valley Gravel (Figures 2 and 3). The surface of the Gravel lies at -2.86m OD towards the northeast of the Tarling Road site, and slopes upwards to between -2.03 and -1.75m OD beneath the St Luke's Square site (Weale, 2008). Whether the Tarling Road site marks the edge of a much deeper depression due to its position on a sloping Gravel surface is unknown. It is of note however, that in the area of the Tidal Basin Road site *ca*. 300m to the south, the Lea Valley Gravel surface lies at between -2.0 and -4.0m OD, also sloping downwards from west to east (Young & Batchelor, 2013b; Figure 1). On the basis of these combined results, it is possible that a former channel aligned broadly north-south exists within the area, but much more data is required from the

surrounding area to test this hypothesis.

The sediments recorded at Tarling Road are consistent with the findings of Corcoran *et al*. (2011) for this area, whose Landscape Zone LZ1.3 is characterised by a Gravel surface at between *ca*. -2.0 and -4.0m OD and Holocene Alluvium containing 'a single peat bed, likely to be of Neolithic date at its base and Bronze Age at the top… interleaved between alluvial clay units'. At St Luke's Square, the Peat accumulated from 5670-5480 (middle Neolithic) to 3570-3440 cal BP (middle Bronze Age) (Wicks, 2010); it is likely that the Peat at Tarling Road accumulated over a similar time period.

The different stratigraphic units recorded are significant as they represent different environmental conditions that would have existed in a given location. For example, the Peat represents a former semi-terrestrial land-surface, whilst fine to medium-grained sediments such as sands, silts and clays represent periods of inundation/flooding by estuarine or fluvial waters. Thus by studying the sub-surface stratigraphy across a given area (i.e. the site and its surroundings), it is possible to build an understanding of the former landscapes and environmental changes that took place over space and time. Furthermore, the Peats represent potential areas that might have been utilised or even occupied by prehistoric people. Similarly, high areas of Gravel may represent utilised surfaces as they remained elevated above the floodplain during periods of inundation. Indeed, Corcoran *et al.* (2011) consider the archaeological and palaeoenvironmental potential of Landscape Zone LZ1.3 to be high, with evidence for prehistoric communities exploiting the wetland-dryland interface in this area.

In addition to St Luke's Square, this potential has been demonstrated at the following nearby sites (Figure 1): (1) Victoria Dock Road *ca*. 300m to the south (Barnett *et al*., 2010) which contained a sequence of alluvial and peat deposits dating from the early Neolithic to Middle Bronze Age with palaeoenvironmental evidence (including pollen, charcoal and burnt molluscs) for impact on the prehistoric landscape; (2) the A13 Ironbridge-Canning Town route *ca*. 400m to the north (Stafford, 2013) at which peat and alluvial deposits were recorded dating from the middle Neolithic to middle Bronze Age; (3) Fords Park Road *ca*. 300m to the northeast (Eastbury *et al*., 2009) at which a sand island was recorded with a large flint assemblage, including local and imported flint, flint waste and burnt flint dating to the Mesolithic and Bronze Age, and (4) the Pitts Head (Batchelor *et al*., 2013) *ca*. 300m to the northeast (Batchelor *et al*., 2013) at which a sequence of peat deposits dating from the middle Neolithic to middle Bronze Age was recorded adjacent to a high gravel surface containing charcoal and palynological evidence for prehistoric impact on the prehistoric

landscape.

As a consequence of the findings from Tarling Road, and due to the poor concentration and preservation of palaeoecological remains at the St Luke's Square site, an assessment of one borehole sequence was recommended. The aims of this assessment were as follows: (1) to enable the precise chronological relationship of Peat formation at Tarling Road to be compared with other nearby sites; (2) to provide a provisional reconstruction of the environmental history of the site, (3) to highlight evidence of human activity, and (4) to make recommendations for further analysis (if required). In order to achieve this aim, the following methods are proposed: (1) rangefinder radiocarbon dating, to provide an age for the onset and cessation of peat formation; (2) organic matter determinations to aid identification of the sedimentary units; (3) assessment of the palaeobotanical remains (pollen, waterlogged wood and seeds) to provide a provisional reconstruction of the vegetation history; (4) assessment of the diatoms to provide an indication of the palaeohydrology (e.g. marine, brackish or freshwater), and (5) assessment of the zooarchaeological remains (insects and Mollusca) to provide information on the general environmental conditions, climatic change and hydrology of the site.

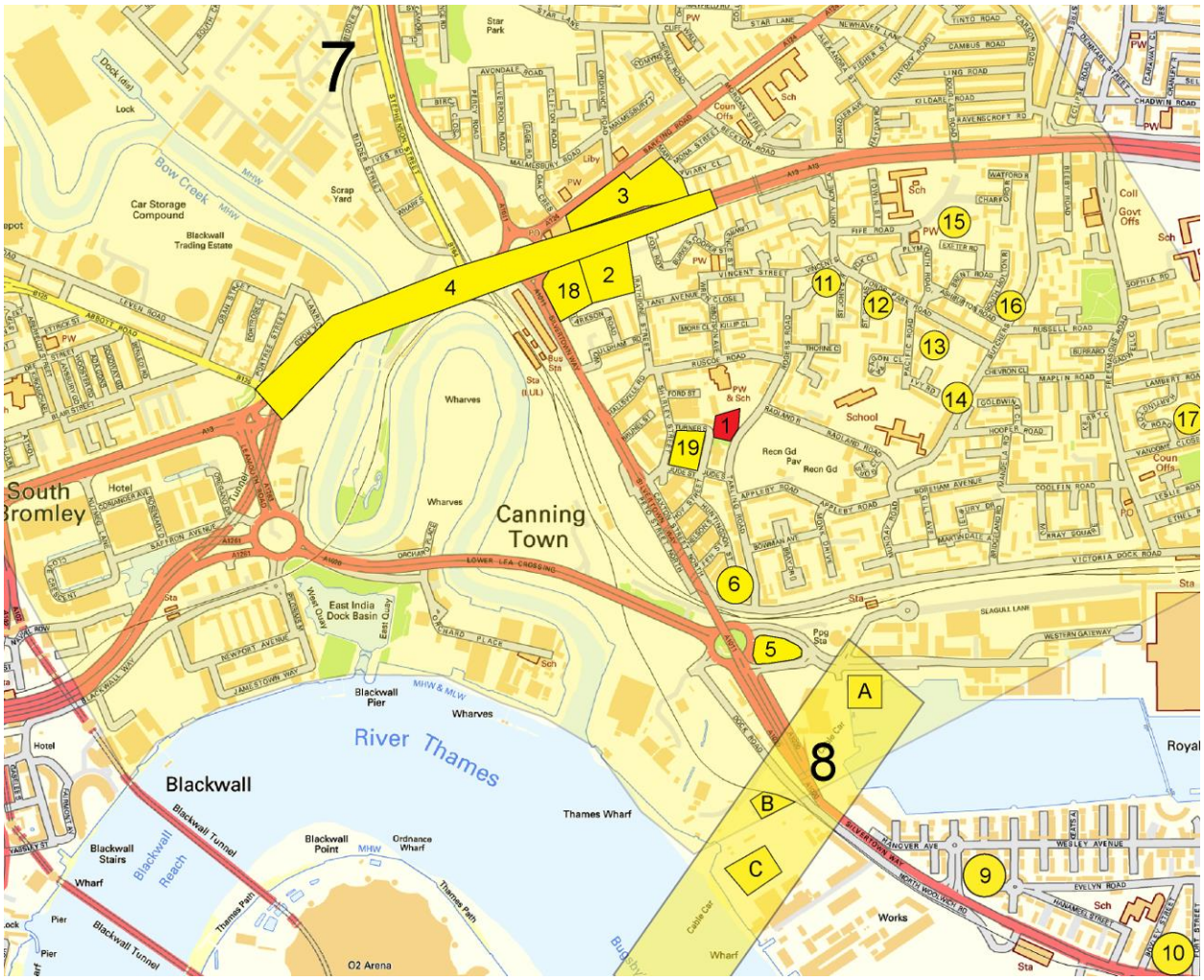

Figure 1: Location of (1) 105-107 Tarling Road, London Borough of Nehwam and other geoarchaeological and archaeological sites nearby: (2) Canning Town Phase 1 (CTR12; Green & Young, 2012); (3) Rathbone Market (RBO10; Young *et al*., 2013); (4) A13 Ironbridge-Canning Town (Stafford, 2012); (5) Tidal Basin Road (Young & Batchelor, 2013b); (6) 118 Victoria Dock Road (Barnett *et al*., 2010); (7) area of the Lower Lea Valley Mapping Project (Corcoran *et al*., 2011); (8) the Cable Car route ((A) North Station; (B) North Intermediate Tower; (C) North Tower (Batchelor *et al*., 2012); (9) Silvertown (BWC96; Wilkinson *et al*., 2000); (10) Fort Street (HW-FO94; Wessex Archaeology, 2000); (11) The Pitts Head (PHD12; Batchelor *et al*., 2013); (12) Fords Park Road (FDP07; Eastbury *et al*., 2009); (13) Crediton Road (CDZ07; Eastbury *et al*., 2009); (14) Butchers Road (BUZ07; Eastbury *et al*., 2009); (15) Fife Road (FIH12; Killock, 2012); (16) Butchers Road Garages (BCQ97; Eastbury *et al*., 2009); (17) Vandome Close (VAD07; Eastbury *et al*., 2009) and (18) Canning Town Phase 2 (Young, in prep.); (19) St Luke's Square (LUC07; Weale, 2008; Wicks, 2010) *Contains Ordnance Survey data © Crown copyright and database right [2013]*

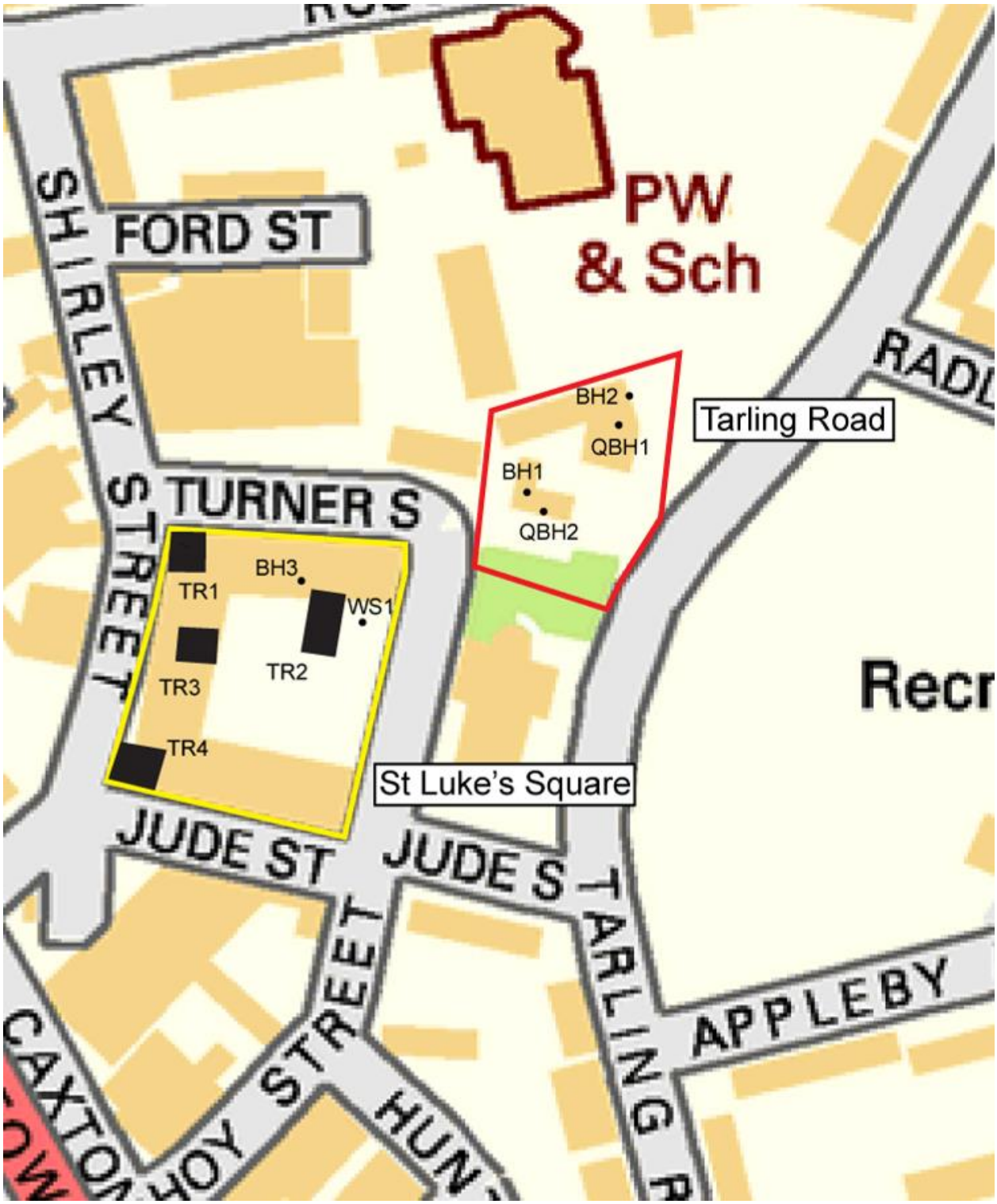

Figure 2: Location of boreholes QBH1 and QBH2 at 105-107 Tarling Road, and previous geotechnical boreholes/archaeological trenches at St Luke's Square (Weale, 2008; Wicks, 2010), London Borough of Newham.

METHODS

Field investigations

Two boreholes (boreholes QBH1 and QBH2) were put down at the site in September 2013 (Figure 2). Borehole core samples were recovered using an Eijkelkamp window sampler and gouge set using an Atlas Copco TT 2-stroke percussion engine. This coring technique is a suitable method for the recovery of continuous, undisturbed core samples and provides sub-samples suitable for not only sedimentary and microfossil assessment and analysis, but also macrofossil analysis. The recovered core samples were wrapped in clear plastic to prevent moisture loss, labelled with the depth (metres from ground surface) and orientation (top and base) and returned to Quaternary Scientific for storage in a purpose built facility at 2^0C. This temperature prevents fungal growth on the core surface, which may lead to anomalous radiocarbon dates, and moisture loss. The spatial attributes of each borehole were recorded using a Leica Differential GPS (Table 1 and Figure 2).

Table 1: Spatial data for the new geoarchaeological boreholes at Tarling Road, London Borough of Newham

Borehole	Easting	Northing	Surface elevation (m OD)
QBH1	539857.1	181216.9	0.79
QBH2	539838.0	181194.8	0.66

Lithostratigraphic descriptions

The lithostratigraphy of boreholes QBH1 and QBH2 was described in the laboratory using standard procedures for recording unconsolidated sediment and organic sediments, noting the physical properties (colour), composition (gravel, sand, clay, silt and organic matter) and inclusions (e.g. artefacts) (Tröels-Smith, 1955). The procedure involved: (1) cleaning the samples with a spatula or scalpel blade and distilled water to remove surface contaminants; (2) recording the physical properties, most notably colour using a Munsell Soil Colour Chart; (3) recording the composition; gravel (Grana glareosa; Gg), fine sand (Grana arenosa; Ga), silt (Argilla granosa; Ag) and clay (Argilla steatoides); (4) recording the degree of peat humification and (5) recording the unit boundaries e.g. sharp or diffuse. The results are displayed in Tables 2 and 3.

Organic matter determinations

Twenty-four sub-samples from borehole QBH2 were taken for determination of the organic matter content (Table 4; Figure 3). These records were important as they can identify increases in organic matter possibly associated with more terrestrial conditions. The organic matter content was determined by standard procedures involving: (1) drying the sub-sample at 110^0C for 12 hours to remove excess moisture; (2) placing the sub-sample in a muffle

furnace at 550°C for 2 hours to remove organic matter (thermal oxidation), and (3) re-weighing the sub-sample obtain the 'loss-on-ignition' value (see Bengtsson and Enell, 1986).

Radiocarbon dating

Sub-samples of hazelnut (*Corylus avellana*) and twig wood were extracted towards the top and base of the peat in borehole QBH2 for radiocarbon dating. Both samples were submitted for AMS radiocarbon dating to the Scottish Universities Environmental Research Centre (SUERC). The results have been calibrated using OxCal v4.2 Bronk Ramsey (1995, 2001) and IntCal04 atmospheric curve (Reimer *et al*., 2013). The results are displayed in Table 5 and Figure 3.

Pollen assessment

Eight sub-samples were extracted from borehole QBH2 for an assessment of pollen content. The pollen was extracted as follows: (1) sampling a standard volume of sediment (1ml); (2) adding two tablets of the exotic clubmoss *Lycopodium clavatum* to provide a measure of pollen concentration in each sample; (3) deflocculation of the sample in 1% Sodium pyrophosphate; (4) sieving of the sample to remove coarse mineral and organic fractions (>125µ); (5) acetolysis; (6) removal of finer minerogenic fraction using Sodium polytungstate (specific gravity of 2.0g/cm^3); (7) mounting of the sample in glycerol jelly. Each stage of the procedure was preceded and followed by thorough sample cleaning in filtered distilled water. Quality control is maintained by periodic checking of residues, and assembling sample batches from various depths to test for systematic laboratory effects. Pollen grains and spores were identified using the University of Reading pollen type collection and the following sources of keys and photographs: Moore *et al* (1991); Reille (1992). The assessment procedure consisted of scanning the prepared slides, and recording the concentration and preservation of pollen grains and spores, and the principal taxa on 4 transects (10% of the slide; Table 6).

Diatom assessment

Four sub-samples from borehole QBH2 were extracted for the assessment of diatoms. The diatom extraction involved the following procedures (Battarbee *et al.,* 2001):

1. Treatment of the sub-sample (0.2g) with Hydrogen peroxide (30%) to remove organic material and Hydrochloric acid (50%) to remove remaining carbonates
2. Centrifuging the sub-sample at 1200 for 5 minutes and washing with distilled water (4 washes)
3. Removal of clay from the sub-samples in the last wash by adding a few drops of Ammonia (1%)

4. Two slides prepared, each of a different concentration of the cleaned solution, were fixed in mounting medium of suitable refractive index for diatoms (Naphrax)

Duplicate slides each having two coverslips were made from each sample and fixed in Naphrax for diatom microscopy. The coverslip with the most suitable concentration of the sample preparation was selected for diatom evaluation. A large area of this coverslip was scanned for diatoms at magnifications of x400 and x1000 under phase contrast illumination using a Leica microscope. The results are displayed in Table 7.

Macrofossil assessment

A total of four small bulk samples from borehole QBH2 were extracted for the recovery of macrofossil remains including waterlogged plant macrofossils, waterlogged wood, insects and Mollusca. The extraction process involved the following procedures: (1) removing a sample up to 10cm in thickness; (2) measuring the sample volume by water displacement, and (3) processing the sample by wet sieving using 300µm and 1mm mesh sizes. Each sample was scanned under a stereozoom microscope at x7-45 magnifications, and sorted into the different macrofossil classes. The concentration and preservation of remains was estimated for each class of macrofossil (Table 8). Preliminary identifications of the waterlogged seeds have been made using modern comparative material and reference atlases (Cappers *et al.* 2006, Schoch *et al*. 2004). Nomenclature used follows Stace (2005) (Table 9).

RESULTS AND INTERPRETATION OF THE LITHOSTRATIGRAPHIC DESCRIPTIONS, ORGANIC MATTER DETERMINATIONS AND RADIOCARBON DATING

The results of the lithostratigraphic descriptions, organic matter determinations and radiocarbon dating are displayed in Tables 2 to 5, and in Figure 3.

The lowermost unit recorded is a horizon of sandy gravel (the Lea Valley Gravel) laid down on the valley floor within a high energy braided river system at the end of the Late Glacial period (Marine Isotope Stage 2, Late Devensian, *ca*. 16,000-11,500 cal BP). The borehole records indicate that the Gravel surface lies at -2.86m OD towards the northeast of the site (QBH1), and at -2.29m OD towards the southwest (QBH2; Figure 3). At St Luke's Square immediately to the southwest, the Gravel surface was recorded at approximately -1.75m OD in Trenches 1, 2 and 4, and -2.03m OD in Trench 3 (Figure 2; Weale, 2008). Thus, the results of the geoarchaeological fieldwork confirm that the Gravel surface slopes downwards from southwest to northeast across the Tarling Road and St Luke's Square sites.

The Lea Valley Gravel at Tarling Road is overlain in both boreholes by a unit of variably sandy silt 0.3 in QBH2 and 0.95m thick in QBH1. In QBH2 this unit also contains detrital plant remains, but in the main is very low in organic matter content (<5%). These sediments most likely represent alluvial deposition during the early to mid-Holocene. The alluvial sediments are overlain in both boreholes by a silty and in borehole QBH2 woody Peat horizon, between -1.56 and -1.91m OD (0.35m thickness) in borehole QBH1 and between -1.27 and -1.99m OD in QBH2 (0.72m thickness) (Figure 3). The accumulation of Peat is indicative of a transition from an alluvial to semi-terrestrial environment, most likely supporting the growth of wetland vegetation. In both boreholes the Peat is silty, indicating frequent flooding during the period of accumulation; this is confirmed by the results of the organic matter determinations which indicate the Peat is generally only 60% organic-rich. The Peat is diffusely overlain in both boreholes by silty clay containing frequent detrital organic material between -0.72 and -1.30m OD (QBH1) and -0.34 and -1.27m OD (QBH2), indicative of a gradual return to alluvial conditions. In both boreholes the uppermost Unit was Made Ground, 1.51m thick in borehole QBH1 and 1.00m thick in QBH2.

The program of recent geotechnical investigations previously carried out at the site (K F Geotechnical Ltd, 2013) indicate different thicknesses of Peat and Alluvium to those recorded within the geoarchaeological boreholes (despite their close proximity). This is likely to be the result of different descriptive terms and differing technical constraints in terms of recorded detail of the geotechnical investigations. Thus, the geoarchaeological borehole descriptions are considered to represent the most accurate record of sedimentary sequence.

The alluvial sequence at Tarling Road is similar to that recorded at St Luke's Square, although there are some differences. Detailed description of the St Luke's Square Trench 3 sequence reveals that Peat immediately overlies the Lea Valley Gravels at -2.03m OD (Wicks, 2010), whilst at Tarling Road, a period of sediment accumulation in an alluvial environment took place prior to Peat formation. In addition, in the St Luke's Square sequence, the Peat measured 1.42m in thickness, forming between -2.03m OD and -0.61m OD, whilst the Peat recorded in the Tarling Road boreholes is much thinner, spanning a maximum of 0.72m, between -1.99 and -1.27m OD. However, organic-rich sediments accumulated above the Peat in <QBH2> to a similar elevation to the top of the Peat in St Luke's Square Trench 3.

On the basis of elevation, it is likely that the date of the Peat at Tarling Road is within the same range as that recorded at St Luke's Square. Indeed, the results of the radiocarbon dating confirm that Peat initiation occurred near-synchronously during the middle Neolithic at

both sites: within the Tarling Road <QBH2> sequence, accumulation commenced 5730-5600 cal BP, and in the St Luke's Square Trench 3 it commenced from 5670-5480 cal BP, equating to the middle Neolithic. Peat cessation occurred during the Bronze Age, around 3570-3440 cal BP in St Luke's Square Trench 3 sequence. In the Tarling Road <QBH2> sequence, Peat cessation clearly occurred earlier, but organic-rich deposits continued to accumulate until 3630-3460 cal BP.

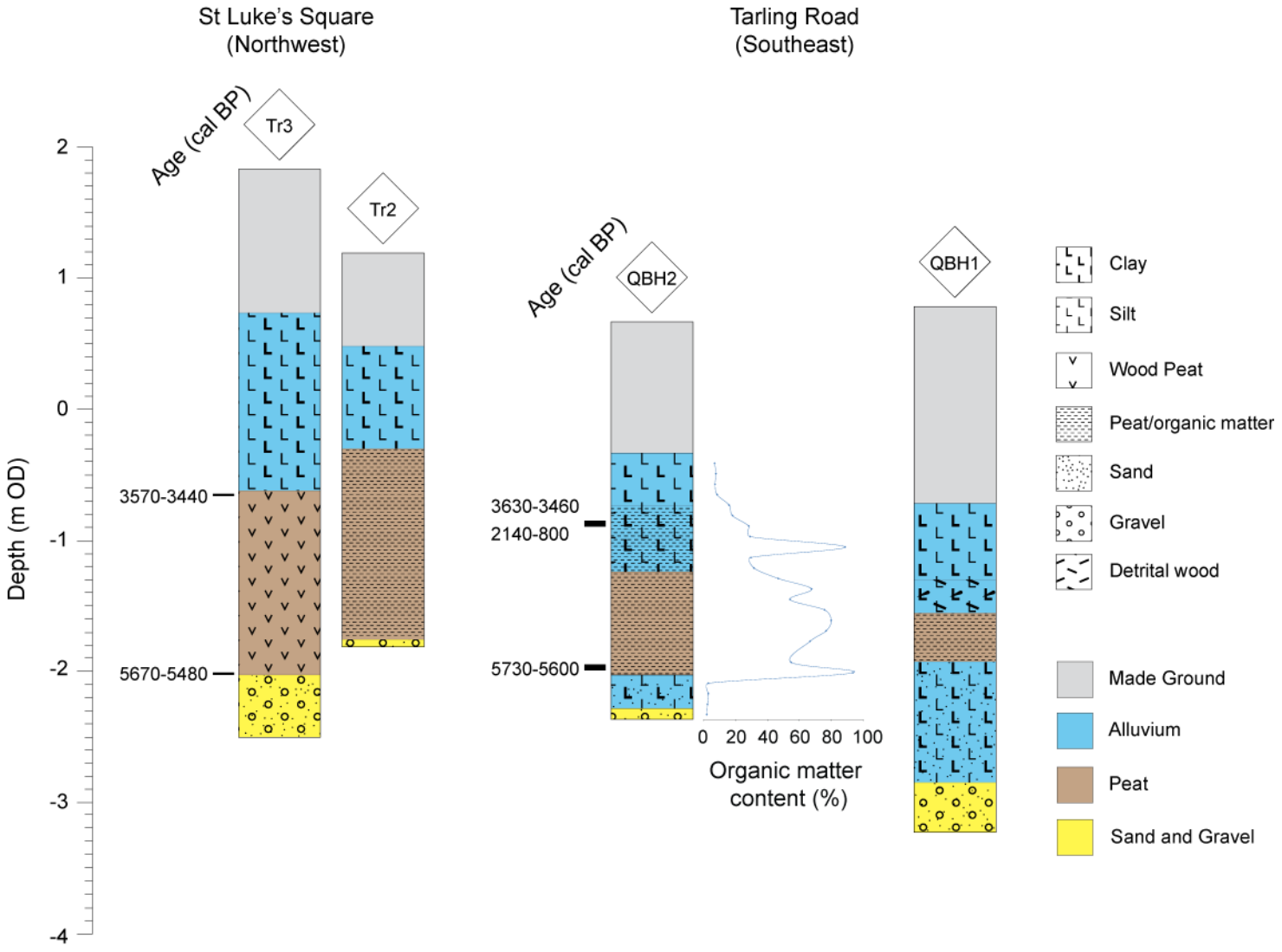

Figure 3: Results of the lithostratigraphic description of boreholes QBH1 to QBH2 at Tarling Road, London Borough of Newham. The results of the organic matter determinations and radiocarbon dating are also displayed for borehole QBH2

Table 2: Lithostratigraphic description of borehole QBH1, Tarling Road, London Borough of Newham

Depth (m OD)	Depth (m bgs)	Description
0.79 to -0.72	0.00 to 1.51	Made Ground/disturbed Alluvium; sharp contact in to:
-0.72 to -1.30	1.51 to 2.09	10YR 4/1; Ag2 As2 Dh+ Dl+; dark grey silt and clay with traces of detrital herbaceous material and detrital wood. Diffuse contact in to:
-1.30 to -1.56	2.09 to 2.35	10YR 3/1; As2 Ag1 Dl1 Dh+; very dark grey silty clay with detrital wood and traces of detrital herbaceous material. Sharp contact in to:
-1.56 to -1.91	2.35 to 2.70	10YR 2/1; Sh3 Ag1 Th+; humo. 3/4; black well humified silty peat with traces of herbaceous material. Diffuse contact in to:
-1.91 to -2.86	2.70 to 3.65	Gley1 5/10Y; Ga2 Ag1 As1; greenish grey silty clayey sand. Sharp contact in to:
-2.86 to -3.21	3.65 to 4.00	Gg3 Ga1; sandy gravel. Mainly flint clasts 3-25mm in diameter.

Table 3: Lithostratigraphic description of borehole QBH2, Tarling Road, London Borough of Newham

Depth (m OD)	Depth (m bgs)	Description
0.66 to -0.34	0.00 to 1.00	Made Ground
-0.34 to -0.73	1.00 to 1.39	10YR 4/1; As3 Ag1; dark greyish brown silty clay with occasional ?calcareous nodules. Diffuse contact in to:
-0.73 to -1.27	1.39 to 1.93	10YR 3/1; As2 Ag1 Sh1 Dl+ Dh+; very dark grey organic silty clay with traces of detrital herbaceous material and detrital wood. Sharp contact in to:
-1.27 to -1.34	1.93 to 2.00	10YR 2/1; Sh3 Ag1 Th+; humo. 3/4; black well humified silty peat with traces of herbaceous material.
-1.34 to -1.99	2.00 to 2.65	10YR 2/1; Sh2 Ag1 $Tl^2$1 Th+; humo. 3; black well humified silty wood peat with traces of herbaceous material. Sharp contact in to:
-1.99 to -2.29	2.65 to 2.95	Gley1 4/N; Ag2 Ga1 As1 Dh+; dark grey clayey sandy silt with traces of detrital herbaceous material. Diffuse contact in to:
-2.29 to -2.34	2.95 to 3.00	Gley1 4/N; Gg2 Ga1 Ag1; dark grey silty sandy gravel. Mainly flint clasts 2-30mm in diameter.

Table 4: Results of the organic matter determinations, borehole QBH2, Tarling Road, London Borough of Newham

Depth (m OD)	Organic matter content (%)
-0.41	6.82
-0.49	7.70
-0.57	7.11
-0.65	8.40
-0.73	15.94
-0.81	18.07
-0.89	28.24
-0.97	29.11
-1.05	88.73
-1.13	29.57
-1.21	31.51
-1.29	46.75
-1.37	67.63
-1.45	54.09
-1.53	75.74
-1.61	79.93
-1.69	76.77
-1.77	66.68
-1.93	54.75
-2.01	93.57
-2.09	2.96
-2.17	2.92
-2.25	2.38
-2.33	1.97

Table 5: Results of the radiocarbon dating from borehole QBH2, Tarling Road, London Borough of Newham

Laboratory code / Method	Material and location	Depth (m OD)	Uncalibrated radiocarbon years before present (yr BP)	Calibrated age BC/AD (BP) (2-sigma, 95.4% probability)	δ13C (‰)
SUERC-51166 (GU33470) AMS	Bark wood	-0.84 to -0.89	3316 ± 35	1680-1510 cal BC (3630-3460 cal BP)	-28.2
SUERC-50752 (GU33054) AMS	Twig wood	-0.84 to -0.89	3150 ± 267	2140-800 cal BC (4080-2750 cal BP)	-27.9
SUERC-50751 (GU33053) AMS	*Corylus avellana* nutshell (hazelnut)	-1.94 to -1.99	4939 ± 28	3780-3650 cal BC (5730-5600 cal BP)	-25.6

RESULTS AND INTERPRETATION OF THE POLLEN ASSESSMENT

The results of the assessment indicate a variable concentration and preservation of pollen through the Tarling Road <QBH2> sequence (Table 7). In five samples, the concentration is high-very high (-0.73, -0.97, -1.69, -1.93 & -2.17m OD); these are mainly located towards the top and base of the Peat. In the remaining three samples, the concentration of pollen is very low (-1.21, -1.45 & -2.09m OD); these are mainly located towards the centre of the Peat. This is a similar pattern to that recorded in the St Luke's Square sequence.

Samples -2.17 to -1.69m OD all contain a similar assemblage of pollen. *Alnus* (alder) dominates with *Quercus* (oak), *Corylus* type (e.g. hazel) and *Tilia* (lime). Minimal herbaceous taxa were recorded, including Poaceae (grasses), *Artemisia* (mugwort) and *Plantago lanceolata* (ribwort plantain). This assemblage is indicative of the growth of alder carr woodland on the floodplain and mixed deciduous woodland dominated by oak, lime and hazel growing on the surrounding dryland.

The limited and declining presence of *Ulmus* pollen at the base of the sequence, in combination with the chronology (pre 5730-5600 cal BP), may suggest that the sequence contains evidence of the early Neolithic elm decline, which is recorded across the British Isles between 6347 and 5281 cal BP (Parker *et al*., 2002). Multiple theories have been proposed for potential cause of the decline, including: (1) climate change to cooler conditions (e.g. Smith, 1981); (2) soil deterioration (Peglar and Birks, 1993), (3) competitive exclusion (e.g. Huntley and Birks, 1983; Peglar and Birks, 1993); (4) human interference with natural vegetation (e.g. Scaife, 1988; Lamb and Thompson, 2005), (5) disease (e.g. Perry and Moore, 1987; Girling, 1988), and (6) a combination of factors (Peglar and Birks, 1993; Parker *et al*., 2002; Lamb and Thompson, 2005; Batchelor *et al*., in prep). At Tarling Road, it is of note that the potential decline occurs around the time of a transition from alluvial deposits to peat formation; a process of changing soil conditions (paludification) which would have negatively impacted upon elm populations growing towards the wetland-dryland interface. In addition, the presence of ribwort plantain at -2.17m OD is often used as an indicator of agricultural activities, particularly when combined with the occurrence of other herbaceous taxa.

The occurrence of *Taxus* (yew) pollen at the base of the sequence, prior to 5730-5600 cal BP) is also of potential interest as it tends not to increase across the Lower Thames Valley until *ca*. 5000 cal BP.

The absence of *Tilia* pollen at -1.69m OD in comparison to previous relatively high values is

suggestive of a decline in lime populations on the dryland. The decline of lime is another well-documented change in woodland composition, this time recorded during the late Neolithic / early Bronze Age, and is most often associated with clearance for agricultural or settlement purposes (e.g. Turner, 1962; Grant *et al*., 2011) and/or paludification (e.g. Waller, 1994; Grant *et al*., 2011). The results do not provide evidence to support either hypothesis, although this is most likely due to the limited counts at the assessment stage.

In the uppermost two samples (-0.97 and -0.73m OD), and lower counts of alder and oak pollen are recorded, and higher values of herbaceous taxa. This is suggestive of a more open environment on both the wetland and dryland. The presence of *Hordeum* / *Triticum* / *Avena* type (barley / wheat / oats) and ribwort plantain is strongly suggestive of an anthropogenic influence at or nearby to the site, and is most likely the cause of the reduction in woodland on the dryland. The pollen record also provides persuasive evidence of a saline influence at the site (e.g. *Armeria* type – thrift). Thus the results of the pollen assessment suggest complex interactions between vegetation succession, hydrological change and human activity during this period. These results are similar to those recorded within the St Luke's Square sequence, with the exception of a lack of definitive evidence for a saline influence.

Table 7: Results of the pollen assessment from borehole QBH2, Tarling Road, London Borough of Newham

	Depth (m OD)	**-0.73**	**-0.97**	**-1.21**	**-1.45**	**-1.69**	**-1.93**	**-2.09**	**-2.17**
Latin name	**Common name**								
Trees									
Alnus	alder	20	15	1	3	21	8		31
Quercus	oak	5	1		1	6	4		11
Pinus	pine	1							2
Ulmus	elm		1				1		2
Tilia	lime	1	2	1			6	1	4
Taxus	yew								1
Betula	birch	1							
Shrubs									
Corylus type	e.g. hazel	3		1	1	7	4		5
Hedera	ivy			1					
Herbs									
Cyperaceae	sedge family	15	4						3
Poaceae	grass family	6				1			
Hordeum / *Triticum* / *Avena* type	barley / wheat /oats	2							
Artemisia	mugwort								1
Asteraceae	daisy family	1	1						
Plantago lanceolata	ribwort plantain	1							1
Chenopodium type	goosefoot family		1						
cf Armeria type	thrift	2							
Spores									
Pteridium aquilinum	bracken	6							
Filicales	ferns	3	2		2				1
Polypodium vulgare	polypody		1			2	2		1
Unknown			1			1	3		2

Total Land Pollen (grains counted)	59	25	4	5	35	23	1	61
Concentration*	5	4	1	1	5	4	1	5
Preservation**	3	3	2	2	4	3	2	4
Microcharcoal Concentration***	2	2	0	0	0	3	3	0
Suitable for analysis	**YES**	**YES**	**NO**	**NO**	**YES**	**YES**	**NO**	**YES**

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

RESULTS AND INTERPRETATION OF THE DIATOM ASSESSMENT

Four sub-samples were extracted from borehole QBH2 for the assessment of diatoms (Table 8). Diatoms were only preserved in very low concentrations in one sample. A number of factors influence diatom preservation, and it is probable that in the sediments examined here diatom concentrations were always low and that post-depositional destruction of the frustules has occurred due to drying-out, abrasion and possibly unfavourable chemical conditions. Dissolution of the diatom silica, for example, can occur as a response to the ambient dissolved silica concentration, the pH in open water, and the interstitial water in sediments. Using both fossil and modern diatoms, these and other environmental factors have been shown to affect the quality of preservation of assemblages.

Table 8: Results of the diatom assessment from borehole QBH2, Tarling Road, London Borough of Newham

Depth (m OD)	Concentration	Preservation
-0.89	0	0
-1.13	1	1-2
-2.09	0	0
-2.25	0	0

Key:
**Concentration: 0 = 0, 1 =1-75, 2 = 76-150, 3 =151-225, 4 = 226-300, 5 =300+ frustules per slide*
***Preservation: 0 = absent; 1 = very poor; 2 = poor; 3 = moderate; 4 = good; 5 = excellent*

RESULTS AND INTERPRETATION OF THE MACROFOSSIL ASSESSMENT

A total of four small bulk samples were extracted from borehole QBH2 for the recovery of macrofossil remains including waterlogged plant macrofossils, waterlogged wood, insects and Mollusca (Table 9). The results of the macrofossil rapid assessment indicate that no charcoal, Mollusca or bone was present in the samples. Insects, the majority of which were preserved as fragments, were present in low quantities in one sample (-1.61 to -1.65m OD). Waterlogged wood was present in moderate to high quantities in all samples except from -0.84 to -0.89m OD, in which waterlogged wood was present in low quantities.

The results of the macrofossil rapid assessment indicated that waterlogged seeds were present in low quantities in two samples (-1.29 to -1.34 and -1.94 to -1.99m OD); these samples thus underwent a more detailed assessment (Table 10). The seed assemblage is limited to two specimens, including *Cornus* sp. (e.g. dogwood) and cf. *Corylus avellana* (hazel). Whilst the limited concentration of remains prevents any further interpretation of the assemblage, the taxa recorded are typical of wetland fen environments.

Table 9: Results of the macrofossil assessment of borehole QBH2, Tarling Road, London Borough of Newham

				Charred					Waterlogged		Mollusca		Bone			
Depth (m OD)	Volume sampled (l)	Volume processed (l)	Fraction	Charcoal (>4mm)	Charcoal (2-4mm)	Charcoal (<2mm)	Seeds	Chaff	Wood	Seeds	Whole	Fragments	Large	Small	Fragments	Insects
-0.84 to -0.89	0.025	0.025	>300µm	-	-	-	-	-	1	-	-	-	-	-	-	-
-1.29 to -1.34	0.025	0.025	>300µm	-	-	-	-	-	3	1	-	-	-	-	-	-
-1.61 to -1.65	0.025	0.025	>300µm	-	-	-	-	-	4	-	-	-	-	-	-	1
-1.94 to -1.99	0.025	0.025	>300µm	-	-	-	-	-	2	1	-	-	-	-	-	-

Key: 0 = Estimated Minimum Number of Specimens (MNS) = 0; 1 = 1 to 25; 2 = 26 to 50; 3 = 51 to 75; 4 = 76 to 100; 5 = 101+

Table 10: Results of the waterlogged plant macrofossil (seeds) assessment of borehole <QBH2>, Tarling Road, London Borough of Newham

Depth (m OD)	Waterlogged seeds		
	Latin name	Common name	Number
-0.84 to -0.89	-	-	-
-1.29 to -1.34	*Cornus* sp.	e.g. dogwood	1
-1.61 to -1.65	-	-	-
-1.94 to -1.99	cf. *Corylus avellana* nut shell	hazel	1

DISCUSSION

The surface of the Late Devensian Lea Valley Gravel at Tarling Road and St Luke's Square is the platform upon which Holocene Alluvial sediments, including Peat, have accumulated. Elsewhere in the valley of the Middle and Lower Thames, the surface of the Late Devensian Lea Valley/Shepperton Gravel is often uneven (Gibbard, 1985; 1994) with relief features that can be identified as longitudinal gravel bars and palaeochannels with a relief amplitude commonly of 3-4m and in some places up to 6m. The new geoarchaeological boreholes indicate that the Gravel surface lies at -2.86m OD towards the northeast of the site, and slopes upwards to between -2.03 and -1.75m OD beneath the St Luke's Square site (Weale, 2008).

Corcoran *et al.'s* (2011) investigations indicate that the Gravel surface in Landscape Zone 1.3 (within which Tarling Road lies) generally ranges between -2.0 and -4.0m OD. The surface at St Luke's Square is therefore clearly above this range, whilst Tarling Road is located within the upper limits. Whether the downward slope of the Gravel surface beneath the Tarling Road site marks the edge of a much deeper depression is unknown due to a lack of stratigraphic data from the immediate vicinity of the site. It is of note however, that in the area of the Tidal Basin Road site *ca*. 300m to the south, the Lea Valley Gravel surface was recorded at between -2.0 and -4.0m OD, also sloping downwards from west to east (Young & Batchelor, 2013b; Figure 1). It might be postulated on the basis of the results from these sites, that a former channel aligned broadly north-south exists within this area.

Further variations in the height of the Lea Valley Gravel surface, potentially indicative of former channels have been identified *ca*. 300m to the north in Landscape Zone 1.1a during geoarchaeological investigation of the Canning Town Regeneration Program (Phases 1 & 2; Green & Young, 2012; Young, in prep), Rathbone Market (Young *et al*., 2013), and the A13 Ironbridge-Canning Town route (Stafford, 2012). It is unclear at this stage how any of these potential channels might relate to one another, and demonstrates the complexity of the sub-surface stratigraphy in this region of the Thames/Lower Lea Valley.

At Tarling Road, the Gravel surface is overlain by Alluvium prior to the formation of Peat; whilst at St Luke's Square, Peat immediately overlies the Gravel surface. This difference is most likely a reflection of the topography of the Lea Valley Gravel, which is higher at St Luke's Square and thus less susceptible to inundation. Whilst higher Gravel surfaces are considered to contain a greater potential for prehistoric archaeology, excavation of the trenches at St Luke's Square revealed no such evidence (Weale, 2008).

The Peat/organic-rich sediments overlying both the Tarling Road and St Luke's Square sites accumulated contemporaneously between 5750-5600 (middle Neolithic) and 3570-3450 cal BP (middle Bronze Age). This is also similar to the age of the peat at other nearby sites such as Victoria Dock Road (Barnett *et al*., 2010), the A13 Ironbridge-Canning Town route (Stafford, 2013) and the Pitts Head (Batchelor *et al*., 2013) (Figure 1).

The transition to Peat formation is significant, as it represents the development of a semi-terrestrial surface supporting the growth of fen vegetation, and which may have been utilised by prehistoric people. Indeed, many of the sites outlined above contain archaeological and/or palaeoenvironmental evidence for prehistoric impact on the landscape (e.g. *in situ* burning and woodland disturbance) during the period of Peat formation. At both Tarling Road and St Luke's Square, assessment of the pollen and plant macrofossils indicates the growth of alder dominated fen woodland on the Peat surface, with an understorey of grasses, sedges and ferns, whilst the dryland was occupied by tree and shrub taxa including oak, lime and hazel. Pollen concentration and preservation is poor towards the centre of the Peat which may be a reflection of a change in environmental conditions (e.g. a shift towards a drier peat surface). At Tarling Road, potential evidence of human activity has been recorded in conjunction with a potential decline in elm populations towards the base of the sequence (possible evidence of the early Neolithic elm decline); a decline in lime is recorded towards the centre, and, persuasive evidence of human activity and a saline influence are recorded towards the top of the Peat.

CONCLUSIONS AND RECOMMENDATIONS

The aims of the geoarchaeological assessment were as follows: (1) to enable the precise chronological relationship of Peat formation at Tarling Road to be compared with other nearby sites; (2) to provide a provisional reconstruction of the environmental history of the site, (3) to highlight evidence of human activity, and (4) to make recommendations for further analysis (if required).

The results of the assessment have revealed that the peat at both Tarling Road and St Luke's Square accumulated contemporaneously during the middle Neolithic to middle Bronze Age. During this period, the wetland was colonised by alder dominated fen woodland on the Peat surface, with an understorey of grasses, sedges and ferns, whilst the dryland was occupied by tree and shrub taxa including oak, lime and hazel. Potential palynological evidence of human activity is recorded towards the base of the sequence, and more conclusive evidence is recorded towards the top.

The Tarling Road sequence has good potential for providing a detailed reconstruction of the environmental history of the site and its environs, and for elucidating the existing geoarchaeological evidence for human activity. This potential is greatest towards the top and base of the Peat; low pollen counts towards the centre suggest limited potential in this part of the sequence. Such analysis would also fill a void in our knowledge and understanding of the environmental history of this particular area of Newham, where no other palaeoenvironmental reconstructions have been attempted.

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APPENDIX 1: OASIS

Project details

Project name	THE GEOARCHAEOLOGICAL FIELD INVESTIGATIONS AT 105-107 TARLING ROAD, LONDON BOROUGH OF NEWHAM (SITE CODE: TAR13)
Short description of the project	Two geoarchaeological boreholes were put down at the site. When compared with other nearby records, the results revealed a gravel surface that sloped downwards from south-west to north-east, overlain by Holocene alluvial and peat deposits. The peat deposits accumulated between the middle Neolithic and middle Bronze Age, contemporaneously with that recorded at the nearby St Luke's Square site. Assessment of the micro and macrofossil remains indicated a wetland environment dominated by alder carr, and a dryland occupied by mixed-deciduous woodland of oak, hazel and lime. Potential indicators of human activity and saline conditions were also recorded towards the top and base of the peat.
Project dates	Start: 06-09-2013 End: 14-04-2014
Previous/future work	No / Not known
Any associated project reference codes	TAR13 - Sitecode
Type of project	Environmental assessment
Site status	None
Current Land use	Industry and Commerce 1 - Industrial
Monument type	PEAT Neolithic
Monument type	PEAT Bronze Age
Survey techniques	Archaeology

Project location

Country	England
Site location	GREATER LONDON NEWHAM CANNING TOWN 105-107 Tarling Road
Postcode	E16 1HN
Study area	0 Hectares
Site coordinates	TQ 3984 8120 51 0 51 30 42 N 000 00 55 E Point

Project creators

Name of Organisation	Quaternary Scientific (QUEST)
Project brief	CgMs Consulting

originator	
Project design originator	D.S. Young
Project director/manager	C.R. Batchelor
Project supervisor	C.R. Batchelor
Type of sponsor/funding body	Landowner

Project archives

Physical Archive Exists?	No
Physical Archive recipient	LAARC
Digital Archive Exists?	No
Digital Archive recipient	LAARC
Paper Archive Exists?	No
Paper Archive recipient	LAARC

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	105-107 TARLING ROAD, LONDON BOROUGH OF NEWHAM (SITE CODE: TAR13): GEOARCHAEOLOGICAL ASSESSMENT REPORT
Author(s)/Editor(s)	Batchelor, C.R.
Author(s)/Editor(s)	Young, D.S.
Other bibliographic details	Quaternary Scientific (QUEST) Unpublished Report March 2014; Project Number 206/13
Date	2014
Issuer or publisher	Quaternary Scientific
Place of issue or publication	University of Reading

Project bibliography 2

Publication type	Grey literature (unpublished document/manuscript)
Title	A REPORT ON THE GEOARCHAEOLOGICAL FIELD INVESTIGATIONS AT 105-107 TARLING ROAD, LONDON BOROUGH OF NEWHAM (SITE CODE: TAR13)
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