Wessex Archaeology

The Boat House, Cobden Avenue Southampton

Geoarchaeological Assessment Report

Ref: 75990.01
SOU1608

June 2011

THE BOAT HOUSE
COBDEN AVENUE
SOUTHAMPTON

Geoarchaeological Assessment Report

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DISCLAIMER

QUALITY ASSURANCE

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Contents

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1 INTRODUCTION

1.1 Project Background

1.1.1 Wessex Archaeology was commissioned by CgMs Consulting Ltd., acting on behalf of McCarthy & Stone Retirement Lifestyles, to undertake a geoarchaeological borehole survey in advance of redevelopment works at the Boat House, Cobden Avenue, Southampton (hereafter, 'the Site'), centred on National Grid Reference (NGR) 443900 114030 (**Figure 1**).

1.1.2 The development of the Site is to comprise the demolition of the existing buildings and, subsequently, the construction of retirement flats, with associated car park and access.

1.1.3 Previous archaeological investigations undertaken within the Site included an archaeological desk-based assessment, undertaken by CgMs Consulting Ltd. in 2007, and historic building recording, carried out by Wessex Archaeology in 2010.

1.1.4 Further project details and the historic background of the Site are included in the desk-based assessment and will not be repeated here.

1.2 Site location

1.2.1 The Site, an area of *c*. 0.4ha, is situated within the Bitterne Park area of north central Southampton, Hampshire. It is bounded to the south by Riverdene Place, to the west by mud flats of the River Itchen, to the north by Cobden Bridge and to the east by Whitworth Crescent (**Figure 1**). The Site comprises a bridge embankment, a Boat House, two terraced properties, a slipway and a car park. Made ground deposited for the construction of the bridge embankment in the late 19th century is likely to have sealed estuarine and peat deposits at depth beneath the Site.

1.3 Scope of document

1.3.1 This assessment report presents the results of the geoarchaeological and palaeoenvironmental work carried out on samples obtained by the geoarchaeological borehole survey.

1.3.2 The geoarchaeological/palaeoenvironmental and archaeological potential of the sedimentary sequence(s) is assessed, and recommendations are made with regard to further work.

2 METHODOLOGY

2.1 Borehole survey

Locations

2.1.1 Four boreholes were drilled on the Site, on an east-west aligned transect to the south of the Boat House (**Figure 1**).

2.1.2 Initially, the fieldwork was to include a total of five boreholes. However, due to on site constraints, there was no access to two borehole locations, situated to the northwest and north of the Boat House. As a result, an additional borehole was added to the east-west transect, to the south of the Boat House.

2.1.3 The final borehole locations were accurately surveyed using Global Positioning System (GPS).

Equipment

2.1.4 The borehole survey was intended to be carried out using a piston sampling rig, which uses a sampling barrel containing a hydraulic piston in order to more effectively retain soft alluvial deposits, such as those expected on Site. However, due to the poor performance of the piston rig, the kit was replaced with a large-diameter window-sampling rig, taking sleeved cores.

2.1.5 The window-sampling rig worked well and good sample retention was achieved.

2.2 Geoarchaeological recording

2.2.1 The sleeved core samples were returned to the offices of Wessex Archaeology, where they were opened and subjected to an initial geoarchaeological assessment, essentially comprising of rapid description and interpretation by a geoarchaeological in order to identify the main units represented and their likely potential.

2.2.2 Subsequently, the sequences judged to have sufficient potential to warrant further investigation were described in detail, following Hodgson (1997) including Munsell colour, the nature of deposit boundaries, inclusions, lamination, calcareous content etc.

3 RESULTS

3.1 Sediments

3.1.1 The sediments from the boreholes are discussed in turn below. The results are also presented in **Figure 2**.

Borehole 1

3.1.2 Borehole 1 (**BH1**) was drilled using the piston corer. Recovery was difficult because of the nature of the deposits, which comprised *c*. 1.5m of made ground overlying a similar depth of sticky grey estuarine silty clays. London Clay geology was reached at *c*. 3m below the ground level, 0.2m above Ordnance Datum (OD). No peats or layered sediments were observed. The samples have not been retained.

Boreholes 2 and 3

3.1.3 The quality of these samples was adequate, but not as good as in **BH4**, probably due to the loose sandy gritty nature of much of the sequence. The rapid descriptions of the observed deposits are presented in **Tables 1** and **2** respectively.

Made ground

3.1.4 Made ground deposits up to 2m thick overlay up to 1.5m of relatively compact brownish grey silty clay alluvium. Modern white glazed porcelain was recorded in this layer, but it might have been intrusive.

Table 1: Sediment descriptions: BH2

Feature:	n/a	**Mono:**		**Comments: BH2**	
Level (top):	2.98m aOD	**Drg:**	n/a		
Depth (m)	**Pollen samples**	**Other samples**	**Sediment description**		**Interpretation**
2.00-2.12			Gap		Gap
2.12-2.84			Dark grey silty clay to silty clay loam alluvium. Clear boundary.		Alluvium
2.84-3.00			Dark greyish brown crumbly silty peat, humified.		Peat (humified)
3.00-3.55			Gap		Gap
3.55-3.70			Very humic silty clay loam, very dark greyish brown upper to brown at base. Woody chunks including round or root wood. Clear boundary.		Humic alluvium
3.70-4.00			Brown silt loam, rapidly oxidises to very dark greyish brown. Quite common coarse pale silt content visible as specks (not sand). Horizontal banding (browner / paler c.1-2cm scale), some recognisable plant remains		Alluvial silts (banded, humic, slightly calcareous)
4.00-4.30			Gap		Gap
4.30-4.70			As 3.70-4.00		Alluvial silts (banded, humic, slightly calcareous)
4.70-5.00			Grey sandy alluvium (fine sandy loam) becoming finer down profile to silty clay / silty clay loam from 4.85m down.		Alluvium
5-7m			No recovery		Gap
7.00-7.84			Grey gritty sandy alluvium, becoming more abundantly gritty down profile onto gravel.		Gritty sandy alluvium.
7.84-8.00			Gravel, 5-40mm sub-rounded		Gravel

Thin humified peat

3.1.5 A thin layer (0.12m thick) of humified peat was recorded at *c*. 0m OD in **BH2**, with a very similar and very probably contemporary layer sloping down towards **BH3** at *c*. 0.5m below OD (bOD).

Table 2: Sediment descriptions: BH3

Feature:	n/a	**Mono:**		**Comments: BH3**	
Level (top):	3.049m aOD	**Drg:**	n/a		
Depth (m)	**Pollen samples**	**Other samples**	**Sediment description**		**Interpretation**
2.00-3.50			Firm silty clay brown to dark greyish brown alluvium with roots – large chunk of fresh wood @ 3.2m (could be root)		Alluvium
3.50-3.60			Crumby black humified peat		Peat (humified)
3.60-4.10			Gap		Gap
4.10-4.26			Mid grey silty clay to clay alluvium with clear to sharp boundary. Dark band at basal 30-40mm		Alluvium
4.26-4.90			Banded brown humic silt, fine chalky inwash, and mid grey gritty inwashes c.5mm-50mm thickness alternating. Wood or root fragments, especially in brown humic silt.		Series of alluvial inwashes
4.90-5.40			Gap		Gap
5.40-7.80			Grey gritty sandy alluvium (very gritty up to 4mm). Non-calcareous		Very gritty sandy alluvium
7.80-8.00			Gravel		Gravel

Banded humic alluvium

3.1.6 In **BH2**, a humic alluvium with horizontal banding was recorded at *c*. 0.5m below to 1.70m bOD, very similar to a deposit observed in **BH4**. A series of layered chalk/humic/grey gritt/alluvial in-washes from 1.3m to 1.9m bOD were recorded in **BH3**.

Grey sandy and grit/alluvium

3.1.7 A fine grey sandy alluvium was located in **BH2** between 1.70m and 2.0m bOD. A significant gap in sample retention occurred below this deposit, but from *c*. 4m to 4.8m bOD, grey sandy alluvium continued to be present, although much grittier at this depth. In **BH3**, the upper alluvium is likely to have been present, but was not retained in the sample tube. The grey gritty alluvium was present from *c*. 2.4 to 4.8m bOD.

Gravel

3.1.8 In both **BH2** and **BH3**, the gritty grey alluvium overlay gravel deposits at *c.* 4.8m bOD (*c*. 7.8m below ground level).

Borehole 4

3.1.9 Sample retention was significantly better in **BH4** than in the other boreholes, and, in addition, the deposits in the sequence were of higher potential. For this reason **BH4** was selected for detailed geoarchaeological description (**Table 3**).

Made ground

3.1.10 Made ground was present to 2.33m below ground level (0.22m aOD), although the bottom section of this deposit comprised alluvium into which modern debris (bricks, ceramic) had intruded.

Estuarine alluvium with reeds

3.1.11 A 0.7m thick soft sticky grey alluvium with common inclusions of well preserved waterlogged *Phragmites* reeds underlay the made ground, from 0.22m aOD to 0.45m bOD.

Peat

3.1.12 A thin layer of very dark brown peat with recognisable plant remains was recorded at 0.8-0.9m bOD. This deposit may be equivalent to the more humified peat layers recorded in the other boreholes and its lower humification occurred due to its lower position in the sequence, which ensured waterlogging.

Banded alluvium

3.1.13 Humic alluvial silts of substantial thickness were recorded from 0.9m to 4m bOD. Several variations within these deposits were observed: from 0.9m to 1.45m bOD, the silts were quite calcareous, contained recognisable plant remains and alternated between sandy and non-sandy texture. This possibly reflects a seasonal change in channel levels/energies.

3.1.14 From 1.85m to 4m bOD, the banded silts were much less calcareous, and alternated between humic and mineralogenic sediments. Despite the reducing environment (evidenced by the rapid colour changes in the humic sediments on exposure), fewer plant remains were observed, with the exception of an organic alluvium over thin peat at 3.37m to 3.45m bOD.

3.1.15 At 3.73m to 3.98m bOD, a pale mineralogenic silt layer was recorded which closely resembled marl, but on testing with 10% HCl was found to be only very weakly calcareous.

Buried soil

3.1.16 Just above the base of the retrieved sequence, from 3.98m to 4.39m bOD, a dark grey/brown silt deposit was recorded, with a darker upper surface and occasional plant remains at the very top. No lamination or banding was recorded. This would have been interpreted as a probable alluvial silt, were it not for occasional small white inclusions (< 1mm), which were examined at x100-x400 and identified as worm granules. These small sub-spherical balls of calcite crystals a excreted by earthworms, particularly at the soil surface, and their presence can, therefore, help identify a buried land surface. It is possible that the deposit contains quantities of eroded-in soil material from which these granules originate; however, they appear fresh and unabraded. It is therefore likely that this layer represents a relatively dry and well-developed terrestrial soil, which has subsequently been inundated by rising water levels.

3.1.17 The depth of this horizon indicated that, if it represents a well-developed dryland soil, the deposit would be of a very early date (?Early Holocene / Mesolithic). This has now been confirmed by radiocarbon dating (see below).

Gravels

3.1.18 Gravel deposits were observed at 7.0m below ground level (4.45m bOD), but were not retained in the sample chamber. A thin layer of alluvial silt at 4.39-4.45m bOD was the lowest deposit recorded.

Discussion

3.1.19 The sub-surface geology slopes sharply downwards from the location of **BH1**, where London Clay geology was recorded at around 0m OD, to the surface of a gravel deposit (presumably Pleistocene in date) approximately 5m bOD in **BH2**, only twelve metres to the west. A previous borehole survey on the Site (WSP Geotechnical Report 2007) indicates the gravels are around 2.8m thick at this point, so 'solid' London Clay geology may be around 8m bOD. This steeply dropping profile would have been cut by the Itchen during the Pleistocene.

3.1.20 The gravel surface level is maintained in **BH3**, a further 12m to the west, but rises slightly to 4.45m bOD in **BH4**. These raised basal gravel levels in **BH4** may indicate the presence of a gravel island, possibly a relict landform left by the late Pleistocene braided channel activity. The potential early soil / land surface in **BH4** overlay this raised gravel area.

3.1.21 The alluvial deposits clearly become thicker and more complex towards the east and **BH4**, with the majority of the lower sequence in **BH2** and **BH3** being dominated by a grey gritty sandy alluvium of low palaeoenvironmental potential. The precise nature of this deposit is not fully understood.

Table 3: Sediment descriptions: BH4

Feature:	n/a	**Mono:**		**Comments:** BH4 – interesting sequence, all waterlogged, rapid oxidation colour changes through much of the sequence on exposure to air		
Level (top):	2.546m aOD	**Drg:**	n/a			
Depth Mbg & *OD*	**Pollen Samples (Mbg)**	**Other Samples (mbg)**	**Sediment description**		**Interpretation**	
0-1.40			Made ground with rubble, modern debris, brick etc. Large chunk of thick white glazed ceramic at base blocking barrel (cf. fragment of lavatory bowl)		Made ground	Modern overburden
1.40-2.00			Gap caused by blockage in corer		GAP	
2.00-2.33			Disturbed alluvium / base of made ground		Made ground on/in top of alluvium	
2.33-3.00		D 2.80	2.5Y 5/1 grey silty clay loam, common *Phragmites* (very well preserved), rootlets also. Very soft and sticky, horizontal lamination difficult to observe but present. Still estuarine even though quite a way upstream as definitely still tidal here.		Estuarine alluvium with *Phragmites*	Freshwater tidal silts with plentiful reed growth (*Phragmites*)
3.00-3.35			Disturbed area (artefact of boreholing)		GAP	
3.35-3.43	3.40	PM 3.42 14C 3.42 6480-6390 cal. BC	7.5YR 2.5/1 black peat (slightly browner on initial exposure but oxidises rapidly). Some horizontal plant remains, sparse v small shell fragments. Sharp boundary.		PEAT	
3.43-3.49			10YR 4/2 dark greyish brown silt loam, browner and paler on initial exposure and then oxidising rapidly to very dark greyish brown. Fine white flecks (silt sized) with waterlogged wood fragments at boundary. Moderately to very calcareous with 10% HCl. Sharp boundary.		Alluvium (silt, organic, calcareous)	Alternating sandy / not sandy layers of moderately calcareous waterlogged humic silts
3.49-3.57			10YR 5/1 grey sandy silt loam, moderately to very calcareous (10% HCl) recognisable plant remains (wood / ?bark). Clear to sharp boundary.		Sandy alluvium (calcareous)	
3.57-3.65			10YR 5/3 brown silt loam to silty clay loam, oxidises rapidly to 4/1 dark grey. Silt sized white flecks, waterlogged plant frags (?root / wood). Moderately calcareous. Sharp to clear boundary.		Alluvium (silty, organic, calcareous)	
3.65-3.76		FO 3.70	10YR 5/3 brown sandy silt loam, oxidising rapidly to 4/1 dark grey. Lots of small plant fragments. Sharp to clear boundary.		Sandy alluvium (organic, calcareous)	
3.76-4.00	3.80	PM 3.88	Alternating 10mm or so laminae of above two units (sandy / silty). From 3.91 down is dominated by silty.		Alluvium, banded	
4-4.40			Disturbed area (artefact of boreholing)		GAP	

Feature:	n/a	**Mono:**		**Comments:** BH4 – interesting sequence, all waterlogged, rapid oxidation colour changes through much of the sequence on exposure to air		
Level (top):	2.546m aOD	**Drg:**	n/a			
Depth Mbg & *OD*	**Pollen Samples (Mbg)**	**Other Samples (mbg)**	**Sediment description**		**Interpretation**	
4.40-5.00	4.58	D 4.65 FO 4.72 4.65-4.70 Molluscs	10YR 5/3 brown silt loam, rapidly oxidises to 10YR 3/2 very dark greyish brown. Some quite coarse pale silt content visible as specks (not sand). Horizontal banding (browner / paler c.1-2cm scale), some recognisable plant remains (inc ?roundwood @4.76m). Rare shell fragments. Weakly to moderately calcareous.		Alluvial silts (banded, humic, slightly calcareous)	Alluvial silts, alternating humic and pale non-humic, all waterlogged & oxidising on exposure, only weakly calcareous
5-5.36			Disturbed sample (artefact of coring), but composed of material similar to that above and below.		GAP	
5.36-5.57	5.40		10YR 4/3 brown silt loam, oxidised to very dark grey. No plant remains observed. Some lamination but no banding as above. At the base is thin continuous layer of paler 2.5Y 5/4 light olive brown @ 5.55-5.56 sharply overlying a thin dark lamina of very dark brown to black silty clay loam @ 5.56-5.57. Non- or weakly-calcareous. Sharp boundary.		Alluvial silt (humic)	
5.57-5.81		5.60-5.65 Molluscs	2.5Y 5/2 greyish brown silt loam, no inclusions, possible slight structure. Although very pale is only weakly calcareous. Sharp to clear boundary (2cm).		Pale inorganic alluvial silt	
5.81-5.86			10YR 3/2 very dark greyish brown silty clay loam, occasional woody plant remains. Sharp boundary.		Alluvium, organic	
5.86-5.92			2.5Y 5/3 light olive brown silt loam to silty clay loam, ?oxidises slightly greyer, some interdigitation with above. Clear boundary.		Pale inorganic alluvial silt	
5.92-6.00	5.95		Very dark greyish brown silty clay loam, becoming peat from 5.96 down which is quite compact and has recognisable plant remains		Organic alluvium over thin peat	
6-6.10			Disturbed sediment (artefact of coring)		GAP	
6.10-6.28		D 6.15 FO6.12	10YR 4/2 dark greyish brown silt loam, slight coarseness but not gritty, product of coarse silt content. Also gives a speckled appearance (pale specks). Clear boundary.		Alluvial silt	
6.28-6.53	6.36	D 6.35	2.5Y 5/2 greyish brown silt loam, no inclusions. Although very pale is only very weakly calcareous. Sharp boundary, deformed by coring.		Pale inorganic alluvial silt	

Feature:	n/a	**Mono:**		**Comments:** BH4 – interesting sequence, all waterlogged, rapid oxidation colour changes through much of the sequence on exposure to air		
Level (top):	2.546m aOD	**Drg:**	n/a			
Depth Mbg & *OD*	**Pollen Samples (Mbg)**	**Other Samples (mbg)**	**Sediment description**		**Interpretation**	
6.53-6.94	6.68	PM 6.68 PM 6.80 6.15-6.20 molluscs C14 6.68 9150-8790 cal. BC	10yr 4/2 dark greyish brown silt loam. Dark at top interface (vdgb/black), c.10-15mm with few plant remains, no plant remains below top 15mm. Occasional v small white inclusions (c.1mm) observed, on inspection at x100+ they are worm granules – indicates a relatively dry established soil. Is possible that this could be eroded in material. Sharp boundary		Probable soil formed in alluvial silt	Buried soil (terrestrial)
6.94-7.0		FO 6.96 PM6.98	10YR 4/2 dark greyish brown silt loam, slight coarseness but not gritty, product of coarse silt content. Also gives a speckled appearance (pale specks). NB gravel noted during coring but not present in core.		Alluvial silt	Alluvial silt
7.0+			Gravel (not in core but noted on site)		Gravel (?Pleistocene)	

3.2 Dating

Introduction

3.2.1 Suitable material from two waterlogged samples within Borehole BH4 located at 3.42m (-0.9m aOD) and 6.68m (-4.10m aOD) was extracted for radiocarbon dating. The uppermost material at -0.9m aOD comprised of cones of alder (*Alnus glutinosa*), while buds and twig wood was submitted from the lower sample located at -4.10m aOD.

3.2.2 The samples were identified and submitted to the Scottish Universities Environmental Research Centre, East Kilbride (SUERC) for radiocarbon dating.

Results

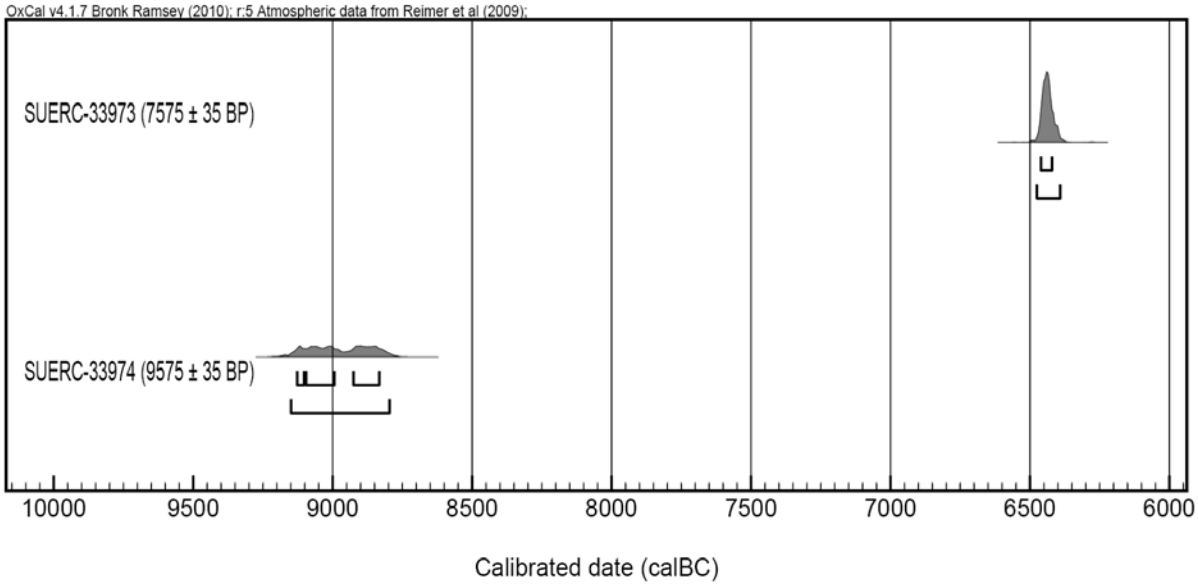
3.2.3 The radiocarbon determinations were calibrated using OxCal 4.1.7 (Bronk Ramsey 2001; 2009) and the IntCal09 calibration curve (Reimer *et al.* 2009) and are quoted in the form recommended by Mook (1986) with the end points rounded outward to 10 years. (**Table 4; Figure 3**).

3.2.4 The results indicated that the three to four metres of deposit had accumulated between the early post-glacial period around 9150-8790 cal. BC (9575±35 BP, SUERC-33974) to the late Mesolithic period c. 6480-6390 cal. BC (7575±35 BP, SUERC-33973).

Table 4: Radiocarbon determination from material within BH 4

Depth aOD	Identification	Laboratory Code	$\delta^{13}C$	Date BP	calibration BC (2 sig. 95.4%)
-0.9m	Alder cones	SUERC-33973	-27.6‰	7575±35	6480-6390 cal. BC
-4.1m	Buds and twig wood	SUERC-33974	-28.4‰	9575±35	9150-8790 cal. BC

Figure 3 Probability distribution for dates of from Borehole 4



3.3 Waterlogged plant remains and insects

3.3.1 Five samples were examined from peaty and organic sediments within borehole BH4 for waterlogged material. The samples were examined to provide information both on changing local vegetation during the formation of the sediments, as well as for extracting possible material suitable for radiocarbon dating.

3.3.2 The samples were all of around 50ml in volume and taken from around 1cm slices of the core at specified depths. The samples were wet-sieved within the laboratory using a 0.25mm mesh. The resultant flots/samples were then visually inspected under a x10 to x40 stereo-binocular microscope to determine if waterlogged material occurred. Where waterlogged material was present, preliminary identifications of dominant taxa, were conducted and are presented below (**Table 5**). Nomenclature follows that of Stace (1997).

3.3.3 The uppermost samples showed a clear dominance of alder (*Alnus glutinosa*) carr within the Late Mesolithic. Evidence for dominant alder carr was seen on slightly earlier dated deposits (again of alder macrofossils) recovered from Testwood Lakes about 6 miles to west on the River Test. These showed an alder dominance around 6810-6450 cal. BC (7770±70 BP; UB-4259).

3.3.4 The earlier deposits had less material within them, and it is possible that the immediate environment surrounding the area of sediment deposition was more open in nature, with species of marsh generally better represented, including gypsywort (*Lycopus europaeus*), sedges (*Carex* sp.), mint (*Mentha* sp.), common club-rush (*Schoenoplectus lacustris*) and branched bur-reed (*Sparganium erectum*). Seeds of nettle were also reasonably well represented at 6.80m,

although nettle can also grow in areas of disturbance on shaded riverbanks at the edge of woodland. The more direct indication of woodland was a single seed of birch (*Betula* sp.) and few buds and twigs from either trees or woody scrub.

3.3.5 Here, as at the nearby Testwood Lakes (Wessex Archaeology 2000), the pollen and plant macrofossil evidence appear to disagree. An open environment was indicated by the macro-fossils, although the general indications from the pollen at this date contradict this, with pine forest and some birch along with willow/poplar on the floodplain dominating the landscape, with little indication of open environments. As such it is probable that the waterlogged macrofossils only represent habitation in the immediate vicinity of the channel/cut off chute in which the deposits are likely to have accumulated.

3.3.6 As might be expected given the early date of the deposits there is no indication of tidal influence or salt marsh from the macrofossils.

Table 5: Waterlogged remains from Borehore BH4.

	Depth OD	-0.9	-1.334	-4.1	-4	-4.43
	Depth m	3.42	3.88	6.68	6.80	6.98
	Description	Peat	alluvium	soil in alluvial silt		alluvial silt
	Date (cal. BC)	6480-6390 BC		9150-8790 BC		
Species	**Common Name**					
Bryophyta (leaf stem)	mosses	-	-	-	-	+++
Urtica dioica	common nettle	-	-	3	10+	-
Betula sp.(seed)	birch	-	-	-	-	1
Alnus glutinosa (fruits)	alder fruits	10	-	-	-	-
Alnus glutinosa (female catkins/cones)	female catkins/cones	3	-	-	-	-
Alnus glutinosa(male catkins)	alder male catkins	+	-	-	-	-
Viola sp.	violet	-	-	-	-	1f.
Menyanthes trifoliata	bogbean	-	cf.1f	-	-	-
Lycopus europaeus	gypsywort	-	-	-	-	1+1cf.2f .
Mentha sp.	mint	-	3	-	-	2
Potamogeton sp.	pondweeds	-	-	-	-	1f.
Carex sp. (trigonous)	sedge (trigonous)	-	-	-	-	3
Schoenoplectus lacustris	common club-rush	-	-	-	-	1
Sparganium erectum (inner seed/embryo)	branched bur-reed	-	-	-	-	5
Typha latifolia/angustifolia	bulrush	-	1	-	-	-
Insects		-	-	-	+	+
Bud indet.	unidentified bud	-	-	2	-	3f.
Indet. twigs	unidentified twigs	-	-	1	-	1
Roots indet.	woody roots	+	-	+	-	+
Charcoal	charred wood indet.	+	-	+	-	+
Worm cocoons		-	+	-	-	+
Molluscs and Ostracods						
Bithynia opercula	Bithynia	-	+	-	-	-
Limacinae	slug plate	-	-	-	+	-
Ostradcods		-	-	-	-	-

Insect and Annelid remains

3.3.7 The samples contained very few insect remains, although occasional fragments of for example, wing cases were noted in the earliest post-glacial deposits from the lowest deposits in the core.

3.3.8 Worm cocoons were noticed in two of the samples from both 3.88m and 6.98m and indicate either some soil formation, or at least the input of soil material into the sediments.

Land and fresh/brackish water molluscs

3.3.9 Almost no mollusc remains were seen in the waterlogged samples although a few opercula of *Bithynia* were noted from 3.88m. A single slug plate was also noted within the early Post-glacial deposit from 6.68m.

3.4 Molluscs

3.4.1 Five samples were examined from a possible soil and alluvial silts within borehole **BH4** for the presence of land and fresh-water molluscs. The samples were examined to provide information on the changing local vegetation and the nature of any aquatic environment during the formation of the sediments.

3.4.2 The samples were between 200 and 400ml in volume and taken from 5cm slices of the core at the specified depths. The samples were wet-sieved within the laboratory using a 0.5mm mesh. The resultant flots/samples were then visually inspected under a x10 to x40 stereo-binocular microscope to determine if molluscs occurred. Where molluscs were present, preliminary identifications of dominant taxa, were conducted and are presented below (**Table 6**). Nomenclature and habitat data follows that of Kerney (1997).

3.4.3 Molluscs were generally only recovered in low numbers with the exception of the sample from 3.60-3.65m where the assemblage was richer. No molluscs favouring brackish water were recorded.

3.4.4 The small mollusc assemblage retrieved from the probable soil at 6.70-6.75m only comprised Limacidae, with no fresh-water element present. The assemblage from 6.15-6.20m was mixed with a small quantity of *Bithynia* opercula, possibly indicative of the presence of a moving water environment, together with a small terrestrial component. Only a single Limacidae was observed within the sample from 5.60-5.65m. The assemblage from 4.65-4.70m also contained a few land snails and fresh-water species.

3.4.5 A richer mollusc assemblage was recovered from 3.60-3.65m. The land snail element comprised 25% of the assemblage and was dominated by the shade-loving species. *Carychium minimum* is common in wet places such as marshes, whereas the other shade-loving and intermediate species can be found in long grassland. *Valvata piscinalis*, a species which thrives in larger bodies of slowly flowing or still water, was predominant together with *Valvata cristata* and *Bithynia* spp., which are found in well-oxygenated, slowing flowing or still water. This assemblage may indicate a slow-flowing, well vegetated water environment with areas of long grass and possible marsh in the vicinity.

3.4.6 The limited mollusc data appears to indicate a fluctuating level of fresh-water environments with intermittent periods of drying.

Table 6: Waterlogged remains from BH4.

BOREHOLE	**BH4**	**BH4**	**BH4**	**BH4**	**BH4**
DEPTH	6.70-6.75	6.15-6.20	5.60-5.65	4.65-4.70	3.60-3.65
VOLUME	200 ml	300 ml	300 ml	400 ml	400 ml
Open country species					
Pupilla muscorum	-	-	-	-	1
Vertigo spp.	-	-	-	-	1
Intermediate species					
Trichia hispida	-	-	-	-	1
Cochlicopa spp.	-	-	-	1	-
Cepaea spp	-	+	-	-	1
Limacidae	6	5	1	1	3
Shade-loving species					
Carychium c.f. minimum	-	-	-	-	1
Carychium tridentatum	-	-	-	-	1
Carychium spp.	-	-	-	-	2
Aegopinella pura	-	-	-	-	1
Aegopinella nitidula	-	-	-	-	4
Fresh water species					
Valvata cristata	-	-	-	-	7
Valvata piscinalis	-	-	-	-	15
Bithynia spp.	-	-	-	1	6
Bithynia opercula	-	6	-	4	18
Lymnaea palustris	-	-	-	-	2
Lymnaea peregra	-	-	-	-	1
Lymnaea spp.	-	-	-	-	4
Gyraulus albus	-	-	-	-	3
Gyraulus crista	-	-	-	1	2
Ancylus fluviatilis	-	-	-	-	1
Acroloxus lacustris	-	-	-	-	2
Pisidium spp.	-	-	-	1	4
totals (excluding opercula)	6	5	1	5	63

Key: + = present.

3.5 Pollen

3.5.1 Standard preparation procedures were used (Moore *et al*. 1991). 2cm^3 of sediment was sampled, with a *Lycopodium* spike (2 tablets from batch 177745) added to allow the calculation of pollen concentrations. All samples received the following treatment: 20 mls of 10% KOH (80°C for 30 minutes); 20mls of 60% HF (80°C for 120 minutes); 15 mls of acetolysis mix (80°C for 3 minutes); stained in 0.2%

aqueous solution of safranin and mounted in silicone oil following dehydration with tert-butyl alcohol.

3.5.2 Pollen counting was done at a magnification of x400 using a Nikon SE transmitted light microscope. Determinable pollen and spore types were identified to the lowest possible taxonomic level with the aid of a reference collection kept at Wessex Archaeology. The pollen and spore types used are those defined by Bennett (1994; Bennett *et al*., 1994) with the exceptions given below, with plant nomenclature ordered according to Stace (1997).

3.5.3 The frequent absences of the outer perine (the essential feature for identification) prevented the consistent separation of monoaperturate spores (with the exception of *Polypodium*) and so these are classed as Pteropsida (monolete) indet.

3.5.4 A total land pollen (TLP) sum has been adopted in this study with selected taxa excluded which are likely to be over represented due to their local abundance. These exclusions are *Alnus glutinosa* (alder), Cyperaceae (sedge), obligate aquatics, pteridophytes (includes club moss, horsetails and ferns) and bryophyta (mosses). The desired TLP sum during assessment was 100 grains. The pollen diagrams were drawn using Tilia v1.5.12 (Grimm, 1991) (**Figure 1)**

3.5.5 The pollen sequence has been divided into Local Pollen Assemblage Zones (LPAZ) using the statistical method CONISS (constrained incremental sum of squares clustering) (Grimm, 1987). This method works by searching the dataset for the two most similar, stratigraphically-adjacent, samples, and combining them. The combination is then treated as a single sample, and the search repeated. The designated LPAZ are described in **Table 7** and shown on the pollen diagrams (**Figures 1**).

3.5.6 Radiocarbon dates were obtained from stratified identifiable plant macrofossils. All radiocarbon dates quoted are calibrated against the IntCal09 Northern Hemisphere radiocarbon curve (Reimer *et al*., 2009) using the program OxCal 4.1 (Bronk Ramsey, 1995; 2001). Calibrated dates are quoted as calibrated years AD/ BC. Date ranges are quoted using the 2σ calibrated range (95.4%) with the end point rounded outwards to 10 years (Bayliss *et al*., 2008, xii).

Results

3.5.7 Results of the assessment are shown in **Figure 1** with zone descriptions given in **Table 7**. The pollen assemblage is contemporary with period indicated by the radiocarbon date from the base of the sequence of 9150-8790 cal. BC (SUERC-33974). At the base of the sequence (LPAZ CoB-1) an early Holocene environment is demonstrated dominated by *Pinus sylvestris* (pine) with *Salix* (willow) an important woodland component. *Betula* (birch) is also likely to have been locally present. Occurrences of *Corylus avellana*-type (hazel) and other deciduous woodland taxa imply that they are beginning to migrate into the southern UK from their glacial refugia. High amounts of Cyperaceae and Poaceae (grasses) are likely to be derived from the local wetland vegetation, as are the high amounts of Pteropsida (monolete) indet. (fern spores).

3.5.8 LPAZ CoB-2 shows the expansion of deciduous woodland taxa during the Mesolithic with *Quercus* (oak), *Ulmus* (elm) and *Corylus avellana*-type most notable. Compared to the previous pollen zone, *Pinus sylvestris* values are lower suggesting it might be being out-competed by the arriving deciduous taxa upon dryland areas. *Salix* continues to be present in low amounts throughout the zone

along with occurrences of other wetland / dryland shrub and climber taxa including *Frangula alnus* (alder buckthorn), *Sambucus nigra* (elder) and *Viburnum opulus* (guilder-rose). The continued high amounts of Poaceae, Cyperaceae and Pteropsida (monolete) indet. are likely to still be derived from the local wetland vegetation.

3.5.9 LPAZ CoB-3 is only based upon a single sample but shows the expansion of *Alnus glutinosa* onsite, most likely through the establishment of alder carr woodland on site, attested by the presence of *Alnus* cones within the sediments from this level. The radiocarbon date for the top of the sequence of 6480-6390 cal. BC (SUERC-33973) is contemporary with other sequences from southern Britain showing the expansion of *Alnus glutinosa* (e.g. Birks, 1989).

Table 7: Local Pollen Assemblage Zones (LPAZ) descriptions from BH4

Zone	Depth (mbGL)	Description
CoB-1	6.68-5.675	Dominated by *Pinus* (18-65%), *Salix* (2-41% TLP), Cyperaceae (5-23% + Cyperaceae), Poaceae (13-43%) and Pteropsida (monolete) indet. (12-21% TLP + pteridophytes). *Quercus* (up to 3%), *Betula* (2-3%), *Alnus glutinosa* (up to 5% TLP + *Alnus glutinosa*), *Corylus avellana*-type (1-20%) and *Sambucus nigra* (1-5%) are present throughout the zone. Dwarf shrub and herb taxa are only sporadically represented, the most notable being *Solidago virgaurea*-type (up to 6%). *Sparganium emersum*-type (1-3% TLP + aquatics) and *Dryopteris filix-mas* type (up to 4% TLP + pteridophytes) are also present. Pollen concentrations range between 35186 and 87153 grains cm^{-3}.
CoB-2	5.675-3.60	Dominated by *Pinus* (13-25%), *Quercus* (8-17% TLP), *Corylus avellana*-type (25-31%), Cyperaceae (13-19% + Cyperaceae), Poaceae (23-39%) and Pteropsida (monolete) indet. (27-34% TLP + pteridophytes). *Ulmus* (1-2%), *Betula* (up to 1%) and *Salix* (4-7%) are present throughout much of the zone with occurrences of *Alnus glutinosa* (up to 3% TLP + *Alnus glutinosa*), *Frangula alnus* (up to 2%), *Hedera helix* (up to 1%), *Sambucus nigra* (up to 3%) and *Viburnum opulus* (up to 1%) also recorded. Dwarf shrub and herb taxa are only sporadically represented, along with low amounts of *Sparganium emersum*-type (up to 4% TLP + aquatics). Pollen concentrations range between 24270 and 65448 grains cm^{-3}.
CoB-3	3.60-3.40	Dominated by *Quercus* (24% TLP), *Alnus glutinosa* (59% TLP + *Alnus glutinosa*), *Corylus avellana*-type (25%), Cyperaceae (17% + Cyperaceae), Poaceae (28%) and Pteropsida (monolete) indet. (22% TLP + pteridophytes). *Ulmus* (2%), *Betula* (3%), *Populus* (1%) and *Salix* (3%) are present. Dwarf shrub and herb taxa are only represented by *Filipendula* (2%) and *Solidago virgaurea*-type (3%). Pollen concentration was 84754 grains cm^{-3}.

3.6 Ostracods & foraminifera

3.6.1 Four samples taken from **BH4** have been assessed for presence, preservation and environmental significance of their foraminifera and ostracod content. Samples assessed were taken from 6.96, 6.12, 4.72 and 3.70m below Ground Level (mbGL).

3.6.2 Sediment samples of approximately $10cm^3$ were treated with a weak solution of Hydrogen peroxide and wet sieved through a 63µm sieve. The sediment was dried and sieved to fractions of 500µm, 250µm and 125µm. Ostracods were picked out under 10-60x magnification and transmitted and incident light using a Vickers microscope. Where possible fifty specimens per sample were picked out and kept in card slides. Identification and interpretation of ecology of non-marine taxa follows Meisch (2000).

Results

3.6.3 The full results of the microfaunal content of the four samples are given in **Table 8**. No foraminifera were recovered in any of the samples. Ostracods were recovered from the three upper samples at 6.12, 4.72 and 3.70mbGL.

3.6.4 At 6.96mbGL, whilst no foraminifera or ostracods were recovered, monocotyledonous plant remains were frequent within the sample. One small charred plant stem was also noticed within the sample.

3.6.5 At 6.12mbGL Candoniid ostracods including *Candona candida* and *Candona neglecta* were recovered. The ostracods were well preserved although some were broken. In addition molluscs (*Bithynia* and *Pisidium*) and monocotyledonous plant remains were recovered.

3.6.6 At 4.72mbGL the largest fauna of Candoniid ostracods including *Candona candida* and *Candona neglecta* were recovered with occasional other species including *Cyridopsis vidua*. The ostracods were generally well preserved. Molluscs (*Bithynia,* Planorbids and *Pisidium*) were also recovered. Very frequent monocotyledonous plant remains were recovered with occasional well preserved seeds and charcoal noted.

3.6.7 At 3.70mbGL some Candoniid ostracods including *Candona candida* and *Candona neglecta* were recovered. The ostracods were well preserved although some were broken. Molluscs were frequent within the sample, particularly the opercula of *Bithynia.* Monocotyledonous plant remains were also frequent including identifiable seeds.

Discussion

3.6.8 The Candoniid ostracods within the sample the assemblages at 6.12, 4.72 and 3.70mbGL (*Candona candida* and *Candona neglegta*) are known to inhabit a wide range of environments including springs, brooks, wells, ponds ditches and the littoral and profundal zones of lakes (Meisch 2000). Although both are also known to be tolerant of slightly brackish waters. (*Candona candida* and *Candona neglegta* are not uncommon in the Baltic Sea), the lack of any foraminifera and brackish water indicative ostracods confirms a non-marine "freshwater" environment for these ostracods.

3.6.9 The other remains within these samples including frequent monocotyledonous plant remains and mollusc remains including the opercula of *Bithynia* confirm a non-marine "freshwater" depositional environment at these levels.

Table 8: Microfaunal content of samples from BH4

Depth(m)	6.96	6.12	4.72	3.7
Ostracods				
Candona candida		xx	xx	x
Candona neglecta		x	x	
Candona sp.		x	xx	x
Candoniid		x	xx	x
Cypridopsis vidua			x	
Other remains				
Molluscs		xx	xx	xx
Bithynia opercula		xx	xx	xx
Bithynia apices		x	x	
Pisidium		x	x	
Planorbid			x	
Plant remains	xxx	xxx	xxx	xxx
Charophyte oogonia		x		
Seeds			x	x
Charcoal	x		x	

x: 1 to 9 specimens; xx: 10 to 50 specimens; xxx: over 50 specimens

3.7 Diatoms

3.7.1 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 x400 and x1000 under phase contrast illumination.

3.7.2 Diatom floras and taxonomic publications were consulted to assist with diatom identification; these include Hendey (1964), Werff & Huls (1957-1974), Hartley *et al.* (1996) and Krammer & Lange-Bertalot (1986-1991). Diatom species' salinity preferences are discussed in part using 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 g l^{-1}
2. Mesohalobian: 0.2-30 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.

Table 9: Samples selected for diatom evaluation

UCL Lab Diatom Sample Number	Sample Depth (m) below ground level
D13	2.80
D14	4.65
D15	6.15
D16	6.35

3.7.3 The diatom laboratory sample numbers and sample depth are shown in **Table 9** above. The results of the diatom evaluation for the Cobden Street samples are summarised in **Table 10** and the diatom species recorded are shown in **Table 11** along with their halobian classifications.

Table 10: Summary of diatom evaluation results

Diatom Sample No.	Diatoms	Diatom numbers	Quality of preservation	Diversity	Assemblage type	Potential for % count
D13	+	mod	mod to poor	mod	bk mar aero	mod good
D14	-	-	-	-	-	none
D15	±0	v low	poor	v low	bk mar aero halo	none
D16	-	-	-	-	-	none

(+ present, - absent, mod – moderately high, fw – freshwater, halo – halophilous, bk – brackish, mar – marine, aero - aerophilous)

3.7.4 With the exception of an indeterminate diatom valve edge fragment in D16, diatoms are absent from samples D14 and D16. Diatoms are rare in D15 where a single valve of the halophilous, aerophile *Navicula mutica* was identified and the

central area of a *Diploneis* species, probably *Diploneis smithii*, a marine-brackish species, is also present. The overall poor preservation of the diatom assemblages at this site may be the result of a number of factors, for example silica dissolution as a result of unfavourable water quality or because of the exposure of diatom valves to physical damage (Flower 1993, Ryves et al. 2001). There is no potential for percentage diatom analysis of the three samples lying between 4.65 m and 6.35 m depth.

3.7.5 Only in the top sample D13 (2.80 m) is there a moderately well preserved diatom assemblage that is of sufficient quality and diversity for percentage diatom counting to be carried out. The assemblage in D13 is dominated by the brackish marine species *Diploneis interrupta. Diploneis interrupta* is a benthic species and it is tolerant of long periods of desiccation.

3.7.6 The mesohalobous benthic species *Nitzschia navicularis* is common in D13. Other mesohalobous benthic diatoms present in D13 include *Diploneis didyma, Nitzschia punctata,* cf. *Navicula peregrina* and cf. *Caloneis westii.* Polyhalobous diatoms, notably planktonic species (with the exception of the polyhalobous to mesohalobous taxon cf. *Pseudopodosira westii*), are absent from the assemblage. A single valve of the freshwater aerophile (often associated with soils) *Pinnularia major*, is present. Oligohalobous indifferent (freshwater) diatoms are otherwise absent. The dominance of benthic mesohalobous diatoms indicates a shallow, brackish water habitat. The dominance of *Diploneis interrupta* suggests that there were prolonged periods of exposure or drying out of the habitat, and along with the absence of marine plankton is consistent with a tidal but upstream or upper shore environment (The presence of *Phragmites* and lithological interpretation are also consistent with the character of the diatom assemblage at 2.80 m depth).

Table 11: Diatom species and their halobian classifications

Halobian Group & Taxon/Sample	D13 (2.80)	D15 (6.15)
Polyhalobous to Mesohalobous		
Diploneis smithii		cf
Pseudopodosira westii	cf	
Mesohalobous		
Achnanthes brevipes	cf	
Caloneis westii	cf	
Diploneis didyma	1	
Diploneis interrupta	3	
Navicula peregrina	cf	
Nitzschia compressa (=punctata)	1	
Nitzschia navicularis	2	
Oligohalobous Halophilous		
Navicula mutica		1
Oligohalobous Indifferent		
Pinnularia major	1	
Unknown Salinity Group		
Diploneis sp.	2	

Conclusions

3.7.7 Diatoms are absent from two (D14 and D16) of the four samples assessed from the borehole sequence taken at Cobden Street. Diatoms are present only in very low numbers in D15. In the top sample D13 there is a moderately well preserved diatom assemblage with moderately good potential for percentage diatom analysis.

3.7.8 The diatom assemblage in D13 (2.80 m) is dominated by benthic (shallow water) mesohalobous species and in particular species tolerant of prolonged periods of desiccation. The absence of marine plankton along with plant macrofossil and lithological evidence support the idea that the sedimentary environment was tidal, but an upstream or upper shore habitat. Freshwater diatoms are absent with the exception of a single aerophilous species associated with soils.

3.8 Magnetic susceptibly

3.8.1 The magnetic susceptibility of a soil or sediment can be enhanced by various activities, including burning and soil development (pedogenesis).

3.8.2 The contents of **BH4** were scanned using a Bartington MS2 magnetic susceptibility meter, in conjunction with a high stability surface scanning sensor, the MS2K.

Results

3.8.3 The results are presented in **Table 12**.

3.8.4 Slightly elevated levels of magnetic susceptibly support the interpretation of the buried soil at the base of the sequence, particularly at the top of the soil.

3.8.5 Elevated levels in the upper part of the tidal silts at 2.40-2.60m below ground level are most likely a result of incorporation of eroded soil material.

Table 12: Results of magnetic susceptibility testing from BH4

Depth	Magnetic susceptibility (unitless, $x10^{-6}$)	Context
2.40	15	Freshwater tidal silts with plentiful reed growth (*Phragmites*)
2.50	13	
2.60	9	
2.70	7	
2.80	7	
2.90	7	
3.36	1	Peat
3.42	1	
3.45	0	Alternating sandy / not sandy layers of moderately calcareous waterlogged humic silts
3.50	1	
3.60	2	
3.70	1	
3.80	1	
3.90	1	
4.00	1	
4.40	3	Alluvial silts, alternating humic and pale non-humic, all waterlogged & oxidising on exposure, only weakly calcareous
4.50	0	
4.60	1	
4.70	3	
4.80	3	
4.90	3	
50	1	
5.40	3	
5.50	9	
5.60	9	
5.70	7	
5.80	9	
5.90	6	
6.10	0	
6.20	2	
6.30	11	
6.40	7	
6.50	12	Buried soil (terrestrial)
6.55	6	
6.60	9	
6.65	6	

6.70	3	
6.75	3	
6.80	3	
6.85	1	
6.90	1	

4 SUMMARY OF RESULTS

4.1.1 The results from the sequence examined in **BH4** can be summarised as follows:

4.2 Early Post-glacial soil

4.2.1 The lower/earlier part of the sampled sequence, around 6.5-7m below ground level (bgl) consists of a relatively thick terrestrial soil (0.4m) of early Post-glacial date (9150-8790 cal. BC), which developed on an a slight gravel high, which is a likely relic of a Devensian braided channel system.

4.2.2 The interpretation of the layer as a terrestrial soil is supported by the absence of freshwater molluscs, the presence of plentiful earthworm granules and terrestrial slug plates, and slightly elevated levels of magnetic susceptibly. Some small charcoal pieces were noted, but these could equally well originate from natural 'forest fires' as from human activity.

4.2.3 The general wider environment seen from the pollen samples associated with this soil indicates pine forest, with willow probably upon the wetter ground.

4.3 Post-glacial to late Mesolithic Alluvium

4.3.1 As water levels in the adjacent channel rose (in response to relative sea-level rise), this terrestrial surface was buried beneath several metres of alluvial deposits. These alluvial deposits alternated between organic-rich and mineralogenic silts, representing well-vegetated channel margins and more open (although slow-moving) aquatic environments. These changes could be due to either fluctuations in water level or slight channel migration.

4.3.2 As might be expected given the early date (and therefore much lower sea level) of these deposits, there is no indication of tidal influence or salt marsh from the plant macrofossils at these levels. This freshwater environment is confirmed by the absence of any foraminifera or brackish water indicative ostracods. The plant macrofossils suggest that immediate environment surrounding the area of sediment deposition was quite open in nature, with species of marsh generally better represented than woodland. As well as the freshwater snails, a significant component of terrestrial snails were also present - together the molluscs indicate a slow-flowing, well vegetated aquatic environment with areas of long grass and possible marsh in the vicinity.

4.3.3 The pollen results indicate an expansion of deciduous woodland into the Itchen valley along the drier slopes, with oak, elm and hazel all present and gradually replacing the antecedent pine forest. Probably situated at the woodland edge and along the drier parts of the channel edge were short-lived shrubs such as elder, alder buckthorn, and guilder-rose.

4.4 Late Mesolithic peat

4.4.1 Above these 3m of alluvial deposits, a thin peat layer (0.08m) at 3.4m bgl was dated to the late Mesolithic (6480-6390 cal. BC). Plant remains and pollen indicate that this formed within a alder carr wetland environment, similar to slightly earlier dated deposits at Testwood Lakes 6 miles to the west. Pollen shows that oak and hazel forests continue to dominate the drier parts of the valley.

4.5 Estuarine alluvium with reed beds

4.5.1 Sealing the thin late Mesolithic peat were around one metre of soft sticky alluvial deposits with abundant horizontal waterlogged reed remains (*Phragmites*).

4.5.2 The structure of the deposits suggested that these are tidally deposited, which is supported by the diatom evidence which demonstrated a shallow, brackish water habitat: tidal, but an upstream or upper shore habitat with no marine plankton.

4.5.3 Although no radiocarbon dating was undertaken for this layer, an approximate date can be surmised. A brackish tidal environment at this ordnance datum height would have to be significantly later than the late Mesolithic peat it seals; looking at local sea level data (Long *et al* 2000), a late prehistoric date is inferred, most probably in the Middle to Late Bronze Age and Early Iron Age range.

4.5.4 These deposits were sealed by dumps of modern made ground.

5 POTENTIAL

5.1.1 The potential for further palaeoenvironmental work material is discussed below by material type.

5.2 Waterlogged plant remains

5.2.1 The waterlogged material has the potential to elucidate the nature of immediate environment during the formation of the deposit.

5.2.2 The material is generally consistent with the alder carr dominated environment seen within the later Mesolithic and also with wetland species associated with more open channel edges in the early post-glacial/Early Mesolithic period.

5.2.3 Given the small amount of material present, especially within the earlier deposits, the potential of further analysis is very limited.

5.3 Insect remains

5.3.1 Insect remains, where present within reasonable quantities, have a greater potential to indicate the degree of openness, providing an intermediate picture between the very localised nature of plant macrofossils and the sometimes wider evidence provided by pollen. They can also provide information on the presence of large grazing animals.

5.3.2 Given the small amount of material recovered, such potential is likely to be very limited.

5.4 Land and freshwater molluscs

5.4.1 The mollusc assemblages are generally too small to provide any detailed information on the immediate environment.

5.5 Pollen

5.5.1 The samples from **BH4** at this site have clearly demonstrated the existence of a long Early Holocene palaeoenvironmental record. The sequence from this site is likely to be contemporary the palaeoenvironmental sequence contained within the River Test Valley at Testwood (Wessex Archaeology, 2000). However, the sequence from Cobden Bridge appears more complete, without any notable breaks within the stratigraphy. The Cobden Bridge sequence is also contemporary with a number of sequences further south in Southampton (e.g. Kent Road (Scaife, 1992), Mountbatten Centre (Scaife, 1998a), Western Esplanade (Scaife, 1997), West Quay Road (Nicholls & Scaife, 2008) and The New Swimming Pool and Diving Centre (Scaife, 1998b).

5.5.2 The Cobden Bridge sequence therefore has provided a better understanding of the early Mesolithic environment further up the River Itchen Valley and complements existing studies from the south in Southampton and west in the River Test Valley.

5.6 Micro-charcoal

5.6.1 Micro-charcoal analysis would potentially be useful in helping to identify whether local episodes of burning were occurring in the area which could be attributed to Mesolithic activity. Though these may also be contributable to naturally occurring events.

5.6.2 This has already been investigated areas of Southern Britain such as the New Forest (Grant *et al.*, 2009) and Romney Marsh (Grant & Waller, 2010) and could possibly help to provide a greater understanding of early Mesolithic activity within the local area (see Hosfield *et al*., 2009).

5.7 Ostracods and foraminifera

5.7.1 Analysis of non-marine ostracods has the potential to inform further upon climate and hydrology of the aquatic habitats investigated in this study.

5.8 Diatoms

5.8.1 Diatoms are absent from two (D14 and D16) of the four samples assessed from the borehole sequence taken at Cobden Street. Diatoms are present only in very low numbers in D15. In the top sample D13 there is a moderately well preserved diatom assemblage with moderately good potential for percentage diatom analysis.

6 PROPOSALS

6.1.1 On balance, because of the limited nature of some of the environmental data and the level of information already provided by the pollen allied to the C14 dating, no further work is proposed, since the results have already clearly helped define the developing environment on the Site from the Post-glacial period onwards.

6.1.2 However the results will be posted on the internet for researchers and the public to access and consider. The cores will be retained for the medium term to allow academic institutions (with whom Wessex has links, such as Southampton University) the opportunity to undertake their own student based research, should they wish to do so.

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OASIS ID: wessexar1-130228

Project details

Project name	BOAT HOUSE SITE FORMER, COBDEN STREET
Short description of the project	Wessex Archaeology was commissioned by CgMs Consulting Ltd., acting on behalf of McCarthy and Stone Retirement Lifestyles, to undertake a geoarchaeological borehole survey in advance of redevelopment works at the Boat House, Cobden Avenue, Southampton, centred on National Grid Reference (NGR) 443900 114030. Four boreholes were drilled on the Site, on an east-west aligned transect to the south of the Boat House. The lower/earlier part of the sampled sequence, around 6.5-7m below ground level (bgl) consists of a relatively thick terrestrial soil (0.4m) of early Post-glacial date (9150-8790 cal. BC), which developed on an a slight gravel high, which is a likely relic of a Devensian braided channel system.The post-glacial to late Mesolithic alluvial deposits alternated between organic-rich and mineralogenic silts, representing well-vegetated channel margins and more open (although slowmoving) aquatic environments. These changes could be due to either fluctuations in water level or slight channel migration. Above these 3m of alluvial deposits, a thin peat layer (0.08m) at 3.4m bgl was dated to the late Mesolithic (6480-6390 cal. BC). Plant remains and pollen indicate that this formed within a alder carr wetland environment, similar to slightly earlier dated deposits at Testwood Lakes 6 miles to the west. Pollen shows that oak and hazel forests continue to dominate the drier parts of the valley. Sealing the thin late Mesolithic peat were around one metre of soft sticky alluvial deposits with abundant horizontal waterlogged reed remains (Phragmites).
Project dates	Start: 12-10-2010 End: 06-07-2011
Previous/future work	Yes / Not known
Any associated project reference codes	75990 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Residential 1 - General Residential
Monument type	NONE None
Significant Finds	NONE None

Project location

Country	England
Site location	HAMPSHIRE SOUTHAMPTON SOUTHAMPTON BOAT HOUSE SITE FORMER, COBDEN STREET
Postcode	SO18 1FZ
Study area	0.4 Hectares

Site coordinates	SU 439 140 50 -1 50 55 23 N 001 22 31 W Point
Height OD / Depth	Min: 0m Max: 0.2m

Project creators

Name of Organisation	Wessex Archaeology
Project brief originator	Consultant
Project design originator	Wessex Archaeology
Project director/manager	R Greatorex
Project supervisor	D Norcott
Type of sponsor/funding body	Developer

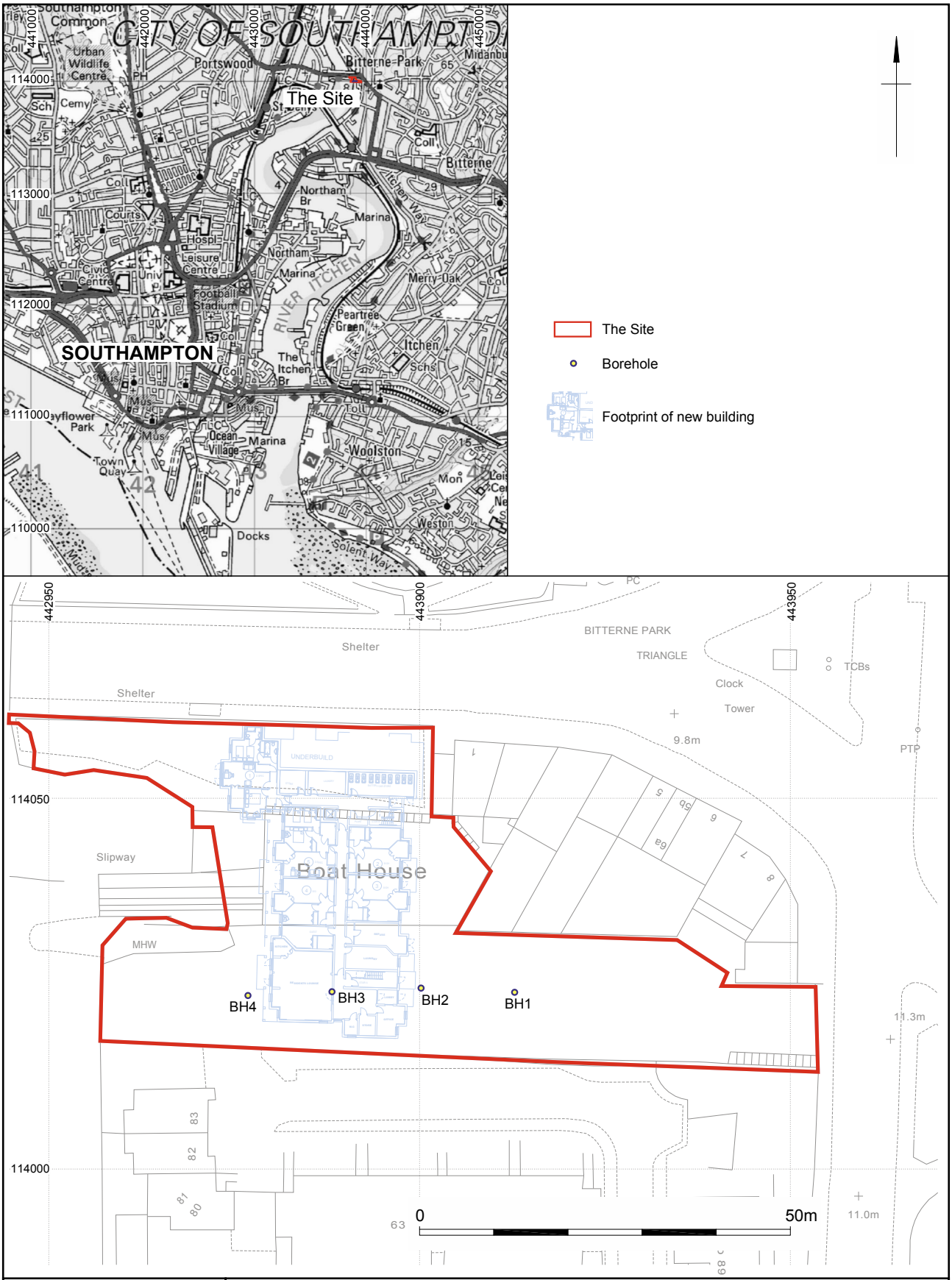
Project archives

Physical Archive recipient	Southampton Museum
Physical Contents	"Environmental"
Digital Archive recipient	Southampton Museum
Digital Contents	"other"
Digital Media available	"Survey","Text"
Paper Archive recipient	Southampton Museum
Paper Contents	"other"
Paper Media available	"Report"

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	The Boat House, Cobden Avenue Southampton Geoarchaeological Assessment Report
Author(s)/Editor(s)	Norcott, D.

Author(s)/Editor(s)	Greatorex, R.
Other bibliographic details	75990.04
Date	2011
Issuer or publisher	Wessex Archaeology
Place of issue or publication	Salisbury
Description	Grey literature client report



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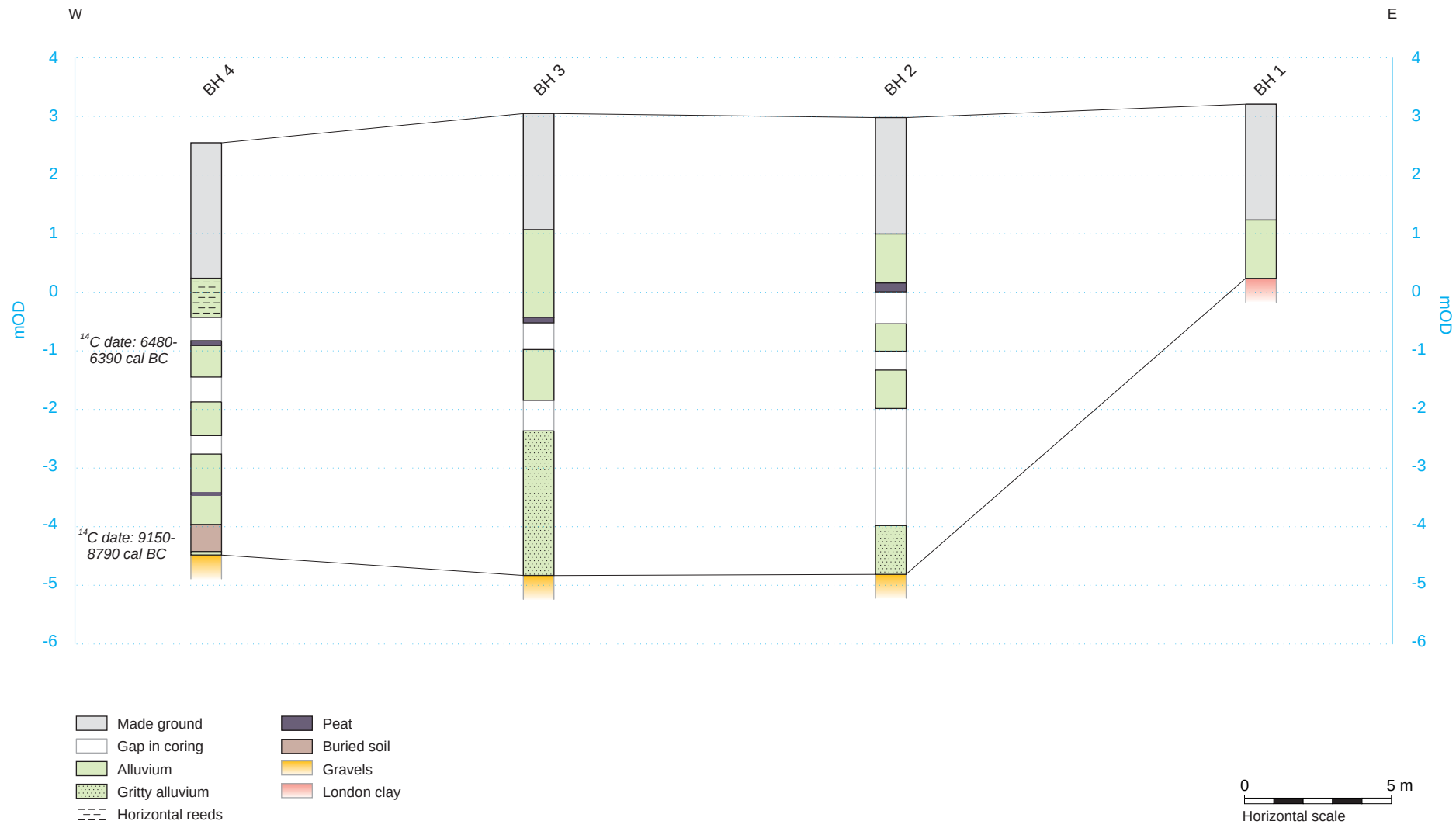
Wessex Archaeology

Site and borehole location plan

Figure 1



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Schematic transect showing borehole results

Figure 2

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