Denton Relief Road Near Gravesend Kent

Archaeological Investigation Report

Oxford Archaeology

6th June 2003

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Gravesham Borough Council

Denton Relief Road, Near Gravesend, Kent

NGR TQ 6650 7390

ARCHAEOLOGICAL INVESTIGATION REPORT

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SUMMARY

Oxford Archaeology (OA), between August 2002 and February 2003, carried out an archaeological monitoring and recording action and palaeo-environmental borehole survey on behalf of Gravesham Borough Council in advance of, and during, the construction of the new Denton Relief Road, Near Gravesend, Kent (NGR TQ 6650 7390). A total of four boreholes were drilled at the north-western extent of the development area and these have provided additional information regarding the depositional sequence of the stratified deposits underlying the site. Archaeological monitoring and recording was further maintained during the period of construction and, with the exception of a single recently infilled drainage ditch, no archaeological features/deposits or finds were recorded.

1 INTRODUCTION

1.1 Location and scope of work

1.1.1 Between August 2002 and February 2003 Oxford Archaeology (OA) was commissioned by Gravesham Borough Council to carry out an archaeological watching brief and palaeo-environmental survey along the route of the new Denton Relief Road, Near Gravesend, Kent (Fig. 1).

1.1.2 Planning permission for the new road scheme was granted in 1998 (GR/98/0197) with a condition attached requiring the implementation of an archaeological programme of works to be undertaken within the development area in order to ensure that features of archaeological interest were properly examined and recorded. In 1999 archaeological evaluation and geo-technical trial pitting was undertaken along the route of the proposed Relief Road by Archaeology South East (ASE 1999 Project No. 1043). No significant or extensive archaeological remains were located during the evaluation and so no further archaeological fieldwork prior to construction was considered necessary. An archaeological watching brief and palaeo-environmental survey to be undertaken immediately prior to, and maintained during the period of the Relief Road's construction, however, was deemed appropriate. This recommendation was based on the several features noted during evaluation within Trench 3, possibly associated with several sherds of Late Iron Age and Roman pottery, and the potential for significant archaeological deposits to survive between c. +1 m OD and -1 m OD, suggested by the results of the geo-technical trial pitting.

1.1.3 The archaeological works were undertaken in accordance with a specification of works produced by the Kent County Council Heritage Conservation Group, on behalf of, and issued by, Gravesham Borough Council Engineering Services Department, in February 2001.

1.2 Geology and topography

1.2.1 The site lies in an area of low lying marsh, approximate ground levels of 1.8 m and 2.9 m OD, that forms part of the River Thames flood plain. The underlying geology

is Alluvium and Flood Plain Gravel overlying Upper Chalk (British Geological Survey (BGS) 1997). Previous geo-technical survey work has been carried out in the area in 1997 and 1999, and a more detailed description and analysis of the results of these surveys and the site's geology is discussed in section 3.1 below.

1.2.2 The site is situated to the east of Gravesend town centre and the new *c* 560 m long relief road extends from the existing Dering Way across Denton Marshes on an embankment to a point approximately 100 m north-west of the existing Waste Water Treatment Works access road (Fig. 1). Unauthorised tipping is known to have occurred within the development area.

1.3 Archaeological and historical background

1.3.1 The archaeological background to the investigations has been described in the specification of works produced by Kent County Council Heritage Conservation Group, on behalf of Gravesham Borough Council (Gravesham Borough Council 2001), an account of which is detailed below.

1.3.2 The primary background information regarding the archaeological resource along the route of the new Denton Relief Road is derived from the County Sites and Monuments Record. A wide range of archaeological remains are known in the area surrounding the site. These include Mesolithic flintwork (SMR No: TQ 67 SE 41) at the north end of the road scheme, probable prehistoric ring ditches or enclosures (SMR No: TQ 67 SE 89) about 200 m to the east of the new roundabout, Roman pottery (SMR No: TQ 67 SE 36) at the waste treatment works about 400 m to the north of the road scheme, the post-medieval manor of West Court about 100 m east of the southern part of the scheme, and the post-medieval canal basin (SMR No: TQ 67 SE 46) about 200 m to the north of the scheme.

1.3.3 A recent programme of archaeological work has been undertaken by Wessex Archaeology in 2000 to the north of the new relief road in connection with environmental improvements at the Waste Water Treatment Works, from which further Roman pottery sherds were recovered from probable dumped deposits.

1.3.4 Archaeological evaluation has also been carried out along the proposed route of the new relief road by ASE in February 1999. Six trenches were excavated and these recorded an undated linear feature in Trench 1, and several features in Trench 3, that were possibly associated with several sherds of Late Iron Age and Roman pottery (ASE 1999).

1.3.5 Geo-archaeological test pitting was implemented as part of the scope of these earlier works which further identified the potential for significant archaeological deposits to be impacted between +1 m OD and -1 m OD. An alluvial sequence of clay silt overlying gravel, overlying chalk, has been recorded along the route and is deeper in the north-west, probably indicating the presence of a buried stream channel. The top of the chalk bedrock varies from about 4 m below the existing ground surface to about 13 m below existing ground surface in the north west. The peat layer was also recorded at a depth of about -3.0 m to -4.0 m OD within the probable stream channel.

A more detailed description of the results of these previous geo-technical works is given below (see Section 3).

1.3.6 It has further been noted that the route of the new relief road also passes within *c* 10 m of a former World War II heavy anti-aircraft battery (Victor Smith pers. com).

2 PROJECT AIMS AND METHODOLOGY

2.1 Aims

2.1.1 To identify and record the presence/absence, extent, condition, quality and date of archaeological remains in the areas affected by the development.

2.1.2 Through archaeological borehole survey to locate and map the development area's underlying stratigraphic sequence and acquire appropriate samples of deposits at key locations, including the peat layer, to enable palaeo-environmental interpretation.

2.1.3 To make available the results of the archaeological investigation.

2.2 Methodology

2.2.1 A specification regarding the methodology and siting of the boreholes was submitted to, and approved by, Ms Kate Evans of Kent County Council Environmental Management. The archaeological borehole survey was implemented by Soil Mechanics, under OA supervision, using light cable percussive methods at 150/200 mm diameter.

2.2.2 The easement strip for the new road was undertaken using a 360° excavator equipped with a toothed bucket followed by a D6 machine that bladed the ground. A 360° excavator fitted with a flat bladed ditching bucket was further used to excavate associated drainage culverts/ditches and balancing pond.

2.2.3 Sections of trenches containing archaeological features were drawn at scales of 1:20 and plans at 1:50. All excavated features were photographed using colour slide and black and white print film. A photographic record of the borehole samples was also made. Recording followed procedures detailed in the OAU Fieldwork Manual (OAU 1992).

3 RESULTS

3.1 Borehole Survey *by Martin Bates* (Plates 3 and 4)

3.1.1 The site lies in the lower Thames valley at the point in the estuarine part of the river where the inner estuary starts to open into the outer estuary. Today the estuary is characterised as a tide dominated estuary (*sensu* Dalrymple *et al.* 1992) in which major sand bars occur within the outer estuary area (marine dominated zone) and tidal meanders in an inner mixed energy zone. Holocene sediments within the site area are part of a continuum forming a wedge thickening downstream from less than 2 m at Tower Bridge to reach a maximum thickness of 35 m east of the study area at Canvey Island (Marsland 1986).

3.1.2 Our current understanding of the sedimentary sequences of the area is derived from work undertaken by Gibbard (1994) and Devoy (1977; 1979) who have previously considered the main sediment sequences present within our study area. However, in contrast to the relatively well known sequences of Pleistocene age that typically flank the modern floodplain (Gibbard 1994) the nature of the Holocene sediments resting on bedrock or pre-Holocene sand and gravel deposits is poorly understood and has only, with few exceptions, been described superficially (Devoy 1977; 1979). The basis for subdivision of these deposits was established by Devoy during the early 1970s (1979; 1982) using borehole stratigraphies integrated with biostratigraphic studies to infer successive phases of marine transgressions (typified by clay-silt deposition) and regressions (typified by peat formation). Devoy's work has resulted in a view of sediment accumulation being controlled within the area by a combination of factors dominated by sea-level change and tectonic depression of southern England. Most recently regional models for sequence development have been described by Long *et al.* (2000) and Bates and Whittaker (in press) which begin to address the range of factors responsible for sequence accumulation.

3.1.3 In order to fully understand the distribution of likely archaeological sites in the lower estuary area and the reasons behind major changes in settlement patterns in the past it is necessary to understand the changing nature of the estuary. These changes have been summarised recently by Bates and Whittaker (in press) for the inner estuary but presently little is known of the nature and significance of the deeper areas close to the inland edge of the outer estuary. This is particularly problematic for the site under investigation as the site lies within the transitional zone from inner to outer parts of the estuary. This transition is likely to be accompanied by changes in both the nature of depositional environments, and consequently sediment types produced and preserved, as well as changes in ecology influencing human activities within the floodplain area.

3.1.4 ***Site setting***

3.1.5 Previous ground investigations in the area have been undertaken as part of archaeological investigations by both ASE (1999) and Wessex Archaeology (Firth 2000). However, no known detailed palaeo-environmental investigations of these sequences have been undertaken. Consequently, the prime source of information remains the work of Devoy (1977; 1979) who examined sequences both up-estuary in the vicinity of Tilbury and downstream at the Isle of Grain. Devoy's work indicated that a series of five major peat units could be identified in places within the estuary. These peats were noted to rise in altitude in an upstream direction.

3.1.6 Geological mapping of the site area indicates that the site is underlain by Chalk with gravels correlated with the Shepperton Member of late Devensian age overlying the Chalk (BGS 1997). Sediments adjacent to the site area include undifferentiated Head and River Terrace Deposits to the west of the site area.

3.1.7 To summarise, the previous work has suggested that:

- The site lies close to the margins of the modern floodplain within an area of the Thames underlain by Chalk bedrock (BGS 1997; ASE 1999).

- A complex topography of both Chalk bedrock profiles and overlying gravel surface elevations exist within the area to the south of the present site investigation area (ASE 1999).

- The ASE investigation suggested that two altitudinally discrete gravel bodies exist to the south of the present site area.

- A thick sequence of fine grained sediments including peats, organic silts and clay-silts occur both to the south (ASE 1999) and to the east (Firth 2000). Extensive peat bodies were identified to the east between –3 m and –5.5 m OD (Firth 2000). The majority of these sediment bodies appear to have formed in developing wetland environments (either organic or minerogenic dominated sediments) during the Holocene.

- The organic sequences present in the area are superficially similar to those proposed previously by Devoy (1977; 1979) and consequently it is likely that the main peat body should be of broadly Neolithic date (a conclusion also reached by Firth 2000).

3.1.8 ***Site stratigraphic sequences***

3.1.9 Four boreholes were drilled to a maximum depth of 12.5 m (BH 2)(Fig. 2). Drilling was monitored in the field by OA site staff with geo-archaeological expertise and field notes recorded. Samples were recovered in the form of U4/U100 logs and integrated borehole logs prepared using the combined field and laboratory observations. The stratigraphy present within the four boreholes has been described (see Appendix 2; Tables 1 to 4) and can be seen to consist of a number of clearly defined units (see Fig. 4). Borehole information taken from Firth (2000) and the ASE report are shown in this figure for comparative purposes.

3.1.10 ***Basal Gravel/Sand units***

3.1.11 Gravels, sandy-gravels or sands were encountered at the base of all boreholes, but the character of these units varied. Gravel units were encountered in BH 1 below 5.6 m depth (-3.073 m OD) and continued to a depth of 9.35 m. These deposits varied from chalk rich diamicts to sandy-gravels with thin sand-silt units. The lowermost unit consisted of clay-silt. This sequence contrasted with the more typical flint gravels in BH 2 lying below 7.9 m (-5.453 m OD). In boreholes BH 3 and BH 4 gravel or sand was only penetrated minimally in order to prove these deposits. Comparisons with the information from other studies shows that the surface of these gravels undulates from just below –1 m OD in the south to nearly –6 m OD in the north (Fig. 4). An anomalous deposit is also noted in BH 1 and BH 2 where silt was penetrated below the gravel at the base of the boreholes. BGS mapping suggests that the whole of the site area is underlain by Chalk, but the silt penetrated appeared similar to the London Clay in other areas of the Thames. Consequently either the BGS mapping for the area is erroneous or an important silt unit, of probable Pleistocene age, exists at the base of the gravels in this area.

3.1.12 ***Fine grained minerogenic and organic rich sequences***

3.1.13 These were encountered in all boreholes but the nature of the sequences varied between boreholes. BH 1 contained a thin peat unit between depths of 4.13 m and 4.9 m (-1.643 m and –2.413 m OD) that was both overlain and underlain by organic sediments. Minerogenic clay-silts were present immediately above the basal gravels and beneath the ground surface. Peat was also present in BH 2 between 5.37 m and 7.0 m depth (-2.923 m and –4.553 m OD). The peat rested on minerogenic clay-silts and was overlain by intercalated layers of minerogenic and organic dominated sediments. A very similar sequence was present in BH 3 where the main peat lay between 4.5 m and 5.87 m depth (-2.202 m and –3.572 m OD). A thinner sequence of sediments was penetrated in BH 4 where a complex of peats were noted between 5 m and 6.72 m depth (-0.655 m and –2.375 m OD). Equivalent sediments were noted by Firth (2000) at the site adjacent to this location.

3.2 Archaeological monitoring and Recording (Plates 1 and 2)

3.2.1 A series of archaeological monitoring and recording visits were made to the site during the period of construction. These visits were targeted so as to examine and record evidence of potential surviving archaeological features/deposits in areas of the site that were thought to have been previously undisturbed by known fly-tipping.

3.2.2 The monitoring visits were therefore concentrated on easement stripping and associated drainage and pond works (Fig. 2), the recorded results of which are described separately below.

3.2.3 ***Road easement***

3.2.4 The road easement was stripped initially by a 360° excavator using a toothed bucket followed by a D6 machine that bladed the roughly stripped surface (Fig. 2, E). In many instances the full depth of existing topsoil/made ground was not fully removed, but where it had been removed, a grey alluvial clay was recorded.

3.2.5 In those areas along the length of the easement strip where the alluvium was visible no archaeological features or deposits were recorded. The excavated spoil from the strip was monitored for artefacts, an exercise that can often indicate the potential presence of archaeological features/deposits, but no finds were recorded.

3.2.6 ***Drainage culverts/ditches***

3.2.7 A series of associated drainage culverts/ditches were excavated as part of the supporting infrastructure to the works (Fig 2, D)(Plate 1). In contrast with the poor visibility encountered during the stripping of the easement, visibility of deposits along their length was good. The ditches varied in excavated depth from *c* 0.70 m to *c* 1.30 m below ground level (bgl). The ditches were excavated through topsoil/made ground into grey alluvial clays. With the exception of a single linear feature described below, no archaeological features/deposits or finds were recorded

3.2.8 A single linear feature (100) measuring *c* 5 m wide by 1.20 m deep was recorded orientated approximately east to west (Appendix 1, Fig. 3)(Plate 2). Feature 100 cut

the alluvium and contained a sequence of fills comprising primary and secondary silt clays (103 and 104) with a localised tertiary lense of organic material (102) overlain by a lime rich? clay silt deposit (101)(Fig. 3). Examination of the exposed south facing section of feature 100 produced only two fragmentary sherds of modern glass from fill 103. Feature 100 is believed to represent the infilled remains of a former drainage channel running across the marsh.

3.2.9 ***Balancing pond***

3.2.10 The balancing pond and its associated drainage channel located at the southern extent of the site were monitored (Fig. 2, BP). The balancing pond measured approximately 25 m long by 20 m wide and was excavated to a maximum depth of 2 m bgl, its associated drainage channel was excavated to a depth of 1.70 m bgl.

3.2.11 The balancing pond was excavated through a stratigraphic sequence comprising topsoil overlaying grey clayey alluvium onto sandy gravels. No archaeological features/deposits were observed and examination of the associated spoil heap produced no evidence of artefactual material.

3.3 Finds

3.3.1 Two fragmentary sherds of modern glass were the only finds recorded during the archaeological monitoring works and these were regarded to be of sufficiently modern date not to be retained.

3.4 Palaeo-environmental remains

3.4.1 Environmental samples were recovered from Boreholes 1 to 4. These are currently being retained at OA should further recommended analysis be required (see Section 5 below).

4 Discussion And Conclusions

4.1.1 ***Borehole Survey***

4.1.2 The presence of gravels or sands at the base of all boreholes drilled in this study suggests that high energy environments of deposition during the later stages of the last cold episode (the Devensian) are recorded here. Elsewhere in the lower Thames these deposits are known as the Shepperton Member and date to 10-15ka BP (Gibbard 1999). The presence of chalk rich units in some of these boreholes (BH 1) indicates proximity to the Chalk bedrock and the possibility that some of these deposits are solifluction deposits derived from slope de-stabilisation and cold climate colluviation rather than fluvial activity. Some difficulties exist in the interpretation of the lower parts of some boreholes (e.g. BH 1 and 2). BGS mapping (1997) as well as data inferred from the ASE (1999) report indicate bedrock to be Chalk within the area. However, fine grained sediments have been noted at the base of both BH 1 and BH 2 that appear to have shared characteristics with either the London Clay or Thanet Sand. The origin of these sediments remains equivocal.

4.1.3 The finer grained sediments overlying the basal gravels are all ascribed here to the Holocene. The stacked appearance of the sediments with interbedded clay-silt, organic silt and peat units is similar to those sequences described by Devoy. The stratigraphy present clearly has parallels with the deposits recorded by Wessex Archaeology (Firth 2000) to the east where thick peat and organic rich sediments were present (see Fig. 4). It is also worth noting that similarity with the models produced by Devoy (1977; 1979), in which organic rich units occur between –3 m and –5 m OD, is striking. However, it is clear from this and other studies (ASE 1999) that the sequences in this part of the Thames are over simplified.

4.1.4 ***Archaeological monitoring and recording***

4.1.5 With the exception of a single infilled drainage ditch of probable modern date, the monitoring works have recorded no further evidence of surviving archaeological features/deposits or finds across the site that could shed further light on the limited archaeological deposits recorded in the previous evaluation works undertaken by ASE in 1999 and Wessex Archaeology in 2000.

4.1.6 The recorded results of the monitoring works must, however, be qualified with regard to the poor levels of visibility for observing potential archaeological features/deposits experienced along the length of the easement strip due to the manner in which stripping works were executed. It is also possible, given the generally poor observation conditions, that potential features/deposits may not have been identified due to the similar nature of their fills to that of the alluvium as highlighted by the recorded description of linear feature 3 in Trench 1 of the earlier evaluation (ASE 1999).

4.1.7 The single recorded feature, ditch (100), is believed to represent a former drainage channel crossing the marsh that has been backfilled in modern times. It could be expected that further similar drainage features are likely to be present across the marshland area of the site, and perhaps the undated linear features recorded during evaluation in 1999 (feature 3, Trench 1 and feature 21, Trench 3; ASE 1999) reflect further evidence relating to this activity.

4.1.8 The presence of sandy gravel deposits noted beneath the topsoil within the associated drainage ditch of the balancing pond may be significant, possibly suggesting the presence of a topographical high point with gravel out-cropping representing the edge of the floodplain and gravel terrace, indicated on the BGS mapping to be present to the south-west of the development area (BGS 1974). The presence of the gravel in this location is significant when considering the results of the earlier evaluation works conducted by ASE that recorded the only positively identified presence of surviving archaeological deposits adjacent to this area of the site (Trench 3; ASE 1999). The limited nature of the archaeological deposits recorded by this previous work could reflect peripheral evidence of more intensive occupation activity situated on an area of drier high ground lying further to the south and west of the development area.

5 RECOMMENDATIONS FOR FURTHER PALAEO-ENVIRONMENTAL WORK

5.1.1 Stratified sequences of peat and clay silts are common within the Thames Estuary area. However, the majority of sites that have been investigated for contained palaeo-environmental material (that may provide important information on the nature of the human environments during later Prehistoric and Historic periods) lie within the parts of the estuary upstream of Gravesend. Furthermore important changes in the nature of the estuary occur in the vicinity of the Gravesend area and consequently those sequences investigated in the upstream areas of the estuary may exhibit properties that vary considerably from those of the study area. Thus the sediments preserved in Boreholes 1 to 4 may contain unique evidence for this stretch of the estuary for which little comparative investigation has occurred.

5.1.2 It should also be noted that in addition to the chalk input to the gravel units in BH 1 silt dominated units exist at the base of both BH 1 and BH 2. At present there are considerable problems with understanding the nature of the sediments in both boreholes and the presence of these silt units may indicate that complex sequences of Pleistocene age may occur within the area. These sediments, if determined to be of Pleistocene age, would be of considerable significance.

5.1.3 A number of avenues for further investigation may be suggested:

- Examination of the silt units at the base of BH1 and BH 2 (using pollen, diatom, foram and ostracod investigation).
- Assessment of the nature of the minerogenic units in the overlying Holocene alluvial stack (using pollen, diatom, foram and ostracod investigation).
- Assessment of the nature of the organic horizons (using pollen investigation).
- Dating of the organic horizons using radio-carbon dating.

APPENDICES

APPENDIX 1 ARCHAEOLOGICAL CONTEXT INVENTORY

Context	*Type*	*Depth/ Height*	*Width*	*Length*	*Comments*	*Finds*
100	Cut	1.25 m	5 m	-	Linear	Glass
101	Fill of 100	0.10 m	c. 7 m	-	Fourth fill	
102	Fill of 100	0.10 m	c. 2.8 m	-	Third, organic lense, fill	
103	Fill of 100	0.50 m	c. 7 m	-	Secondary fill	Glass
104	Fill of 100	0.60 m	c. 5.7 m	-	Primary fill	
105	Made Ground	1 m	-	-	Made Ground	
106	Alluvium	-	-	-	(Natural)	

APPENDIX 2 BOREHOLE STRATIGRAPHY

Table 1. Borehole 1 (BH1)

OD TOP	OD BOTT	BGL TOP	BGL BOTT	THICKNESS	Description	Lower contact	Unit
2.487	-0.713	0.00	3.20	3.20	Mixed orangey brown and grey silty clay with pockets of dark brown loam and chalk and gravel clasts. Fragments of CBM, mortar.	not seen	fill
-0.713	-0.843	3.20	3.33	0.13	Mid greyish orangey brown silty clay. Very soft and tenacious, occasional fine rootlets and rare very small woody detritus. Massive and structureless.	clear	Minerogenic silt-clay
-0.843	-1.113	3.33	3.60	0.27	Mid bluish grey silty clay. Very soft and tenacious. Frequent fine rootlets, plant fibres and brown organic detritus. Concentration of detritus between 3.50-3.60m BGL. Massive and structureless	clear	
-1.113	-1.263	3.60	3.75	0.15	Mid orangey brown and grey mottled silty clay. Very soft and tenacious, occasional fine rootlets and rare very small woody detritus. Massive and structureless.	not seen	
-1.263	-1.553	3.75	4.04	0.29	Mid bluish grey silty clay. Very soft and tenacious. Very frequent fine rootlets, plant fibres and brown organic detritus. Massive and structureless.	diffuse	
-1.553	-1.643	4.04	4.13	0.09	Mid-dark greyish brown organic silty clay mixed with mid pockets of bluish grey silty clay. Abundant organic detritus.	sharp, irregular	Organic silt-clay
-1.643	-2.413	4.13	4.9	0.77	Very dark brown/black reed peat, humified, dry and crumbly with abundant plant fibres.	not seen	peat
-2.413	-2.723	4.9	5.21	0.31	Mid greyish brown organic silty clay becoming siltier down profile with moderate amount of organic detritus. Mottled with lighter brown clay in top 0.10m where there is evidence of rooting from above peat with sub-vertical voids filled with peat.	clear	Organic silt-clay
-2.723	-2.913	5.21	5.4	0.19	Very light greyish brown coarse silt/fine sand, dry and crumbly. Occasional fine rootlets. No clasts. Massive		sand
-2.913	-3.073	5.4	5.56	0.16	Very soft mid, slightly greenish grey , tenacious clayey silt, slightly sandy. Small amount of Fe staining with occasional organic flecks/detritus and Mn flecking.	clear	Minerogenic silt-clay
-3.073	-3.293	5.6	5.82	0.22	Very pale grey/white sandy silt-clay. Soft, slightly tenacious with 3% chalk pellets (1-4mm) subangular to subrounded, and occasional very large flint clasts (>50mm)	clear	Chalk diamict
-3.293	-4.473	5.82	7	1.18	Loose, matrix supported gravel. Coarse sand, mid brownish grey, with gravel clasts poorly sorted, subrounded to subangular	not seen	sandy gravel

-4.473	-5.273	7	7.8	0.80	Soft sandy chalk	not seen	soft sandy chalk
-5.273	-5.473	7.8	8	0.20	Sandy gravel	not seen	sandy gravel
-5.473	-6.673	8	9.2	1.20	Firm greenish brown silty sand clay and gravel	not seen	sand-silt
-6.673	-6.823	9.2	9.35	0.15	Sandy gravel	not seen	sandy gravel
-6.823	-7.473	9.35	10	0.65	Stiff brown and grey mottled silty sandy clay		Minerogenic silt-clay

Table 2. Borehole 2 (BH2)

OD TOP	OD BOTT	BGL TOP	BGL BOTT	THICKNESS	Description	Lower contact	Unit
2.297	1.297	0.00	1.00	1.00	Modern disturbed ground	not seen	Fill
1.297	1.027	1.00	1.27	0.27	Mid orangey brown silty clay. Soft, tenacious, occasional fine rootlets becoming softer and greyer down profile, bioturbated, massive and structureless. Clear contact with grey silty clay below.	clear	Minerogenic silt clay
1.027	0.797	1.27	1.50	0.23	Mid grey silty clay. Soft, tenacious, occasional fine rootlets becoming softer and greyer down profile, bioturbated, massive and structureless.	not seen	
0.797	0.297	1.50	2.00	0.50	Mid orangey brown silty clay. Soft, tenacious, occasional fine rootlets becoming softer and greyer down profile, bioturbated, massive and structureless.	diffuse	
0.297	-0.033	2.00	2.33	0.33	Mid grey silty clay mottled with orangey brown. Soft, tenacious, occasional fine rootlets becoming softer and greyer down profile, bioturbated, massive and structureless.	diffuse	
-0.033	-0.303	2.33	2.60	0.27	Mid grey silty clay. Soft, tenacious, occasional fine rootlets becoming softer and greyer down profile, bioturbated, massive and structureless.	not seen	
-0.303	-0.353	2.60	2.65	0.05	Mid-dark brown organic/peaty silty clay. Evidence of rooting into deposit below.	diffuse	organic silt-clay
-0.353	-0.703	2.65	3.00	0.35	Mid greyish brown silty clay with frequent organic detritus, slightly humic.	diffuse	
-0.703	-2.103	3.00	4.40	1.40	Minerogenic, mid green-bluish grey silty clay with frequent organic detritus, soft, tenacious, massive and structureless	not seen	Minerogenic silt clay
-2.103	-2.783	4.40	5.08	0.68	Mid orangey brown and bluish grey mixed silty clay. Soft, tenacious, occasional fine rootlet and very occasional organic detritus.	clear	
-2.783	-2.883	5.08	5.18	0.10	Same as above with more fine woody detritus	clear	Minerogenic silt clay

-2.883	-3.073	5.18	5.37	0.19	Bedded organic mud and peat	clear	organic silt-clay
-3.073	-4.053	5.37	6.35	0.98	Very dark brown/black reed peat, humified, dry and crumbly with abundant plant fibres.	clear	peat
-4.053	-4.703	6.35	7.00	0.65	Dark brown very slightly silt-clay reed peat. Horizontally finely laminated with lenses of light brown organic silty clay	not seen	
-4.703	-5.153	7.00	7.45	0.45	Mid greyish brown silty-clay. Firm much siltier than upper clays. Some fine fibres, no clasts or bedding, grades into light-mid grey silty clay over 25 cm	not seen	Minerogenic silt clay
-5.153	-5.603	7.45	7.90	0.45	Mid greyish brown silty-clay. Firm much siltier than upper clays. Some fine fibres, no clasts or bedding, grades into light-mid grey silty clay over 25 cm	not seen	
-5.603	-6.703	7.90	9.00	1.10	Clast supported gravel. Flint clasts very poorly sorted angular to subangular (3mm-60mm) within a mid yellowish brown coarse sand.	not seen	gravel
-6.703	-8.203	9.00	10.50	1.50	Similar to above but with higher % of sand to gravel. Flint clasts very poorly sorted angular to subangular (3mm-60mm) within a mid yellowish brown coarse sand.	not seen	sandy gravel
-8.203	-9.703	10.50	12.00	1.50	Mid slightly greenish grey, oxidising to grey- brown, slightly clayey, fine sand/coarse silt. Very soft with occasional small gravel (2mm-4mm) subangular to subrounded.	not seen	sand/silt
-9.703	-10.203	12.00	12.50	0.50	Sandy clay		sand/clay
				12.50			

Table 3. Borehole 3 (BH3)

OD TOP	OD BOTT	BGL TOP	BGL BOTT	THICKNESS	Description	Lower contact	Unit
2.298	1.108	0.00	1.19	1.19	Mixed orangey brown silty clay and grey silty clay with pockets of dark brown loam and chalk and gravel clasts. Fragments of CBM, mortar.	not seen	fill
1.108	0.798	1.19	1.5	0.31	Mid greyish brown silty clay, firm tenacious. 5% decomposing yellow reedy/material. Sub-vertical rootlets with Fe staining. Massive and structureless.	not seen	minerogenic silt-clay

0.798	0.518	1.5	1.78	0.28	Mid orangey brown silty clay. Soft, tenacious, occasional fine rootlets becoming softer and greyer down profile, bioturbated, massive and structureless.	clear	minerogenic silt-clay
0.518	0.248	1.78	2.05	0.27	Soft, tenacious mid greenish grey silty clay. Massive. Mn flecking.	clear	
0.248	0.058	2.05	2.24	0.19	Soft, tenacious light to mid brownish grey silty clay. Massive. Mn flecking. Occasional organic detritus.	clear	
0.058	-0.322	2.24	2.62	0.38	Soft, very tenacious mid grey brown mottled silty clay. Massive. Mn flecking. Frequent organic detritus.	diffuse	
-0.322	-1.842	2.62	4.14	1.52	Soft, very tenacious mid-dark grey brown mottled silty clay. Massive. Mn flecking. Frequent organic detritus. Sub-vertical fissures and rootlets.	clear	organic silt-clay
-1.842	-1.952	4.14	4.25	0.11	Soft, tenacious light to mid grey brown clay silt. Massive. Mn flecking. Frequent organic detritus.	clear	Intercalated beds of minerogenic and organic silty clay and peat
-1.952	-2.052	4.25	4.35	0.10	Mid brownish grey organic clay silt. Soft, tenacious Massive. Mn flecking. Frequent organic detritus.	clear	
-2.052	-2.082	4.35	4.38	0.03	Very dark brown/black reed peat, humified, dry and crumbly with abundant plant fibres.	clear	
-2.082	-2.132	4.38	4.43	0.05	Soft, tenacious light to mid grey brown clay silt. Massive. Mn flecking. Frequent organic detritus.	clear	
-2.132	-2.202	4.43	4.5	0.07	Mid brownish grey organic clay silt. Soft, tenacious Massive. Mn flecking. Frequent organic detritus.	not seen	
-2.202	-2.972	4.5	5.27	0.77	Very dark brown/black reed peat, humified, dry and crumbly with abundant plant fibres. Upper contact exhibits desiccation cracking filled with clay from above.	clear	peat
-2.972	-3.312	5.27	5.61	0.34	Mid brownish grey organic clay silt. Soft, tenacious Massive. Mn flecking. Frequent organic detritus.	very sharp	organic mud
-3.312	-3.572	5.61	5.87	0.26	Very dark brown/black reed peat, humified, dry and crumbly with abundant plant fibres. Upper contact exhibits desiccation cracking filled with clay from above.	very sharp	peat
-3.572	-3.702	5.87	6	0.13	Mid bluish grey silt with some fine sand. Soft, occasional plant fibres and Mn staining.	not seen	minerogenic silt
-3.702	-3.922	6	6.22	0.22	Mid greenish grey silty sand. Soft, occasional plant fibres and Mn staining. Becoming sandier down profile.	diffuse	sand
-3.922	-4.152	6.22	6.45	0.23	Pale blusih grey and pale yellowish brown mottled medium sand with some small shell fragments and occasional very large gravel clasts (>100mm)		sandy gravel

Table 4. Borehole 4 (BH4)

OD TOP	OD BOTT	BGL TOP	BGL BOTT	THICKNESS	Description	Lower contact	Unit
2.345	0.345	0.00	2.00	2.00	Mixed orangey brown and greyish blue silty clay, firm with clasts of dark brown loam and gravel (10-20mm) chalk and flint with frequent roots and CBM flecks	not seen	Fill
2.345	2.095	2	2.25	0.25	Mid orangey brown silty clay slightly mottled with grey. Firm tenacious, occasional fine rootlets with fe staining around them, bioturbated, massive and structureless.	clear	minerogenic silty clay
2.095	1.105	2.25	3.24	0.99	Mid grey silty clay. Soft, tenacious, occasional fine rootlets , bioturbated, massive and structureless. Mixed/mottled with a small amount of orangey brown silty clay. Mn flecking.	diffuse	
1.105	0.845	3.24	3.5	0.26	Mid orangey brown silty clay . Soft tenacious, occasional fine rootlets , massive and structureless.	not seen	
0.845	-0.655	3.5	5	1.50	Light-mid blue grey silty clay. Very soft, tenacious, occasional fine rootlets/ organic detritus massive and structureless. Mn flecking.	not seen	
-0.655	-1.295	5	5.64	0.64	Very dark brown/black reed peat, humified, dry and crumbly with abundant plant fibres.	diffuse	peat
-1.295	-1.395	5.64	5.74	0.10	Dark grey brown silty peat	diffuse	
-1.395	-1.655	5.74	6	0.26	Firm mid grey brown silt,rare and very small shell fragments, occasional organic flecks.	not seen	minerogenic clay-silt
-1.655	-1.955	6	6.3	0.30	Pale very soft and tenacious clay	clear	
-1.955	-2.375	6.3	6.72	0.42	Very dark brown/black reed peat, humified, dry and crumbly with abundant plant fibres.	clear	peat
-2.375	-2.655	6.72	7	0.28	Very firm mid bluish grey slightly clayey fine sand/coarse silt, rare small shell fragments, Mn staining	not seen	minerogenic clay-silt
-2.655	-2.975	7	7.32	0.32	Very soft tenacious silt. Mid bluish grey with Mn flecking. Mottled with mid yellowish grey.	clear	silt
-2.975	-4.155	7.32	8.5	1.18	Medium sand slightly greenish grey with some small shell fragments and Mn staining.		sand

APPENDIX 3 BIBLIOGRAPHY AND REFERENCES

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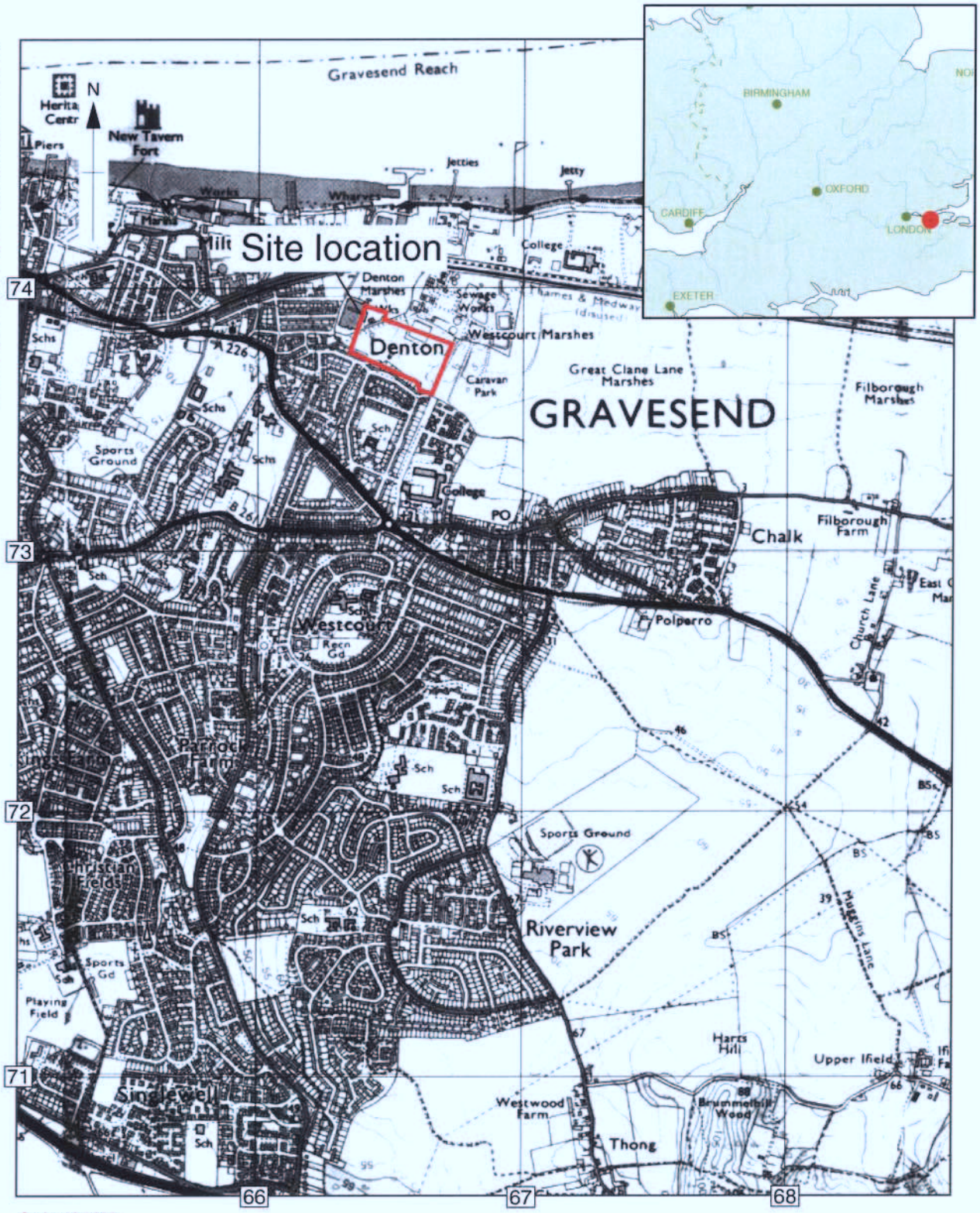
APPENDIX 4 SUMMARY OF SITE DETAILS

Site name: Denton Relief Road, Gravesend, Kent
Site code: GEDR02
Grid reference: NGR TQ 6650 7390
Type of watching brief: Archaeological watching brief and palaeo-environmental borehole survey.
Date and duration of project: Twelve site visits between August 2002 and February 2003.
Area of site: approx 7.8 hectares
Summary of results: Oxford Archaeology (OA), between August 2002 and February 2003, carried out an archaeological monitoring and recording action and palaeo-environmental borehole survey on behalf of Gravesham Borough Council in advance of, and during, the construction of the new Denton Relief Road, Near Gravesend, Kent (NGR TQ 6650 7390). A total of four boreholes were drilled at the north-western extent of the development area and these have provided further insight into the depositional sequence of the stratified deposits underlying the site. Archaeological monitoring and recording was maintained during the period of construction and, with the exception of a single recently infilled drainage ditch, no archaeological features/deposits or finds were recorded.
Location of archive: The archive is currently held at OA, Janus House, Osney Mead, Oxford, OX2 0ES, and will be deposited with the Gravesend Historical Society in due course.



Scale 1:25,000

Figure 1: Site location

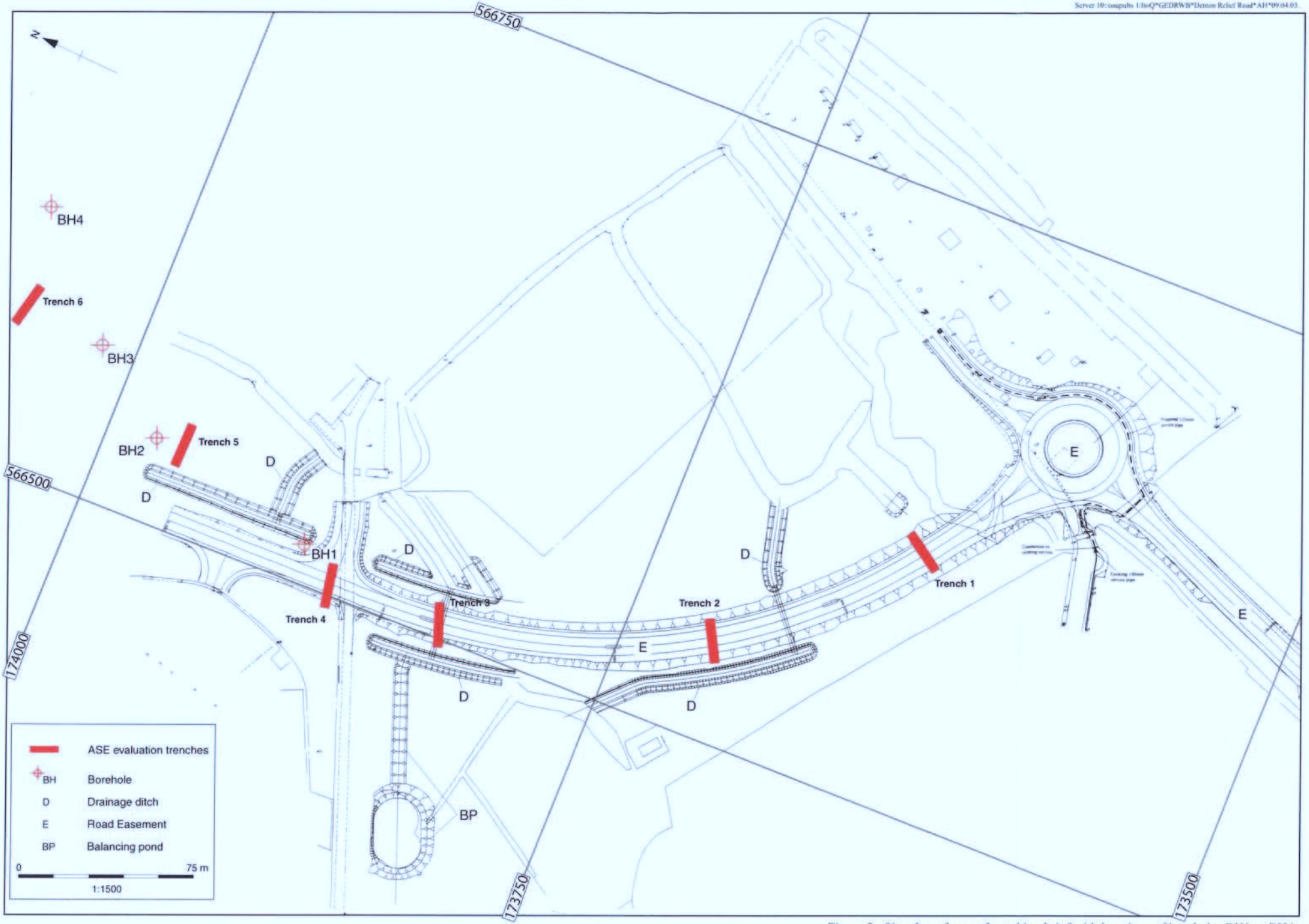


Figure 2: Site plan of area of watching brief with locations of boreholes BH1 to BH4

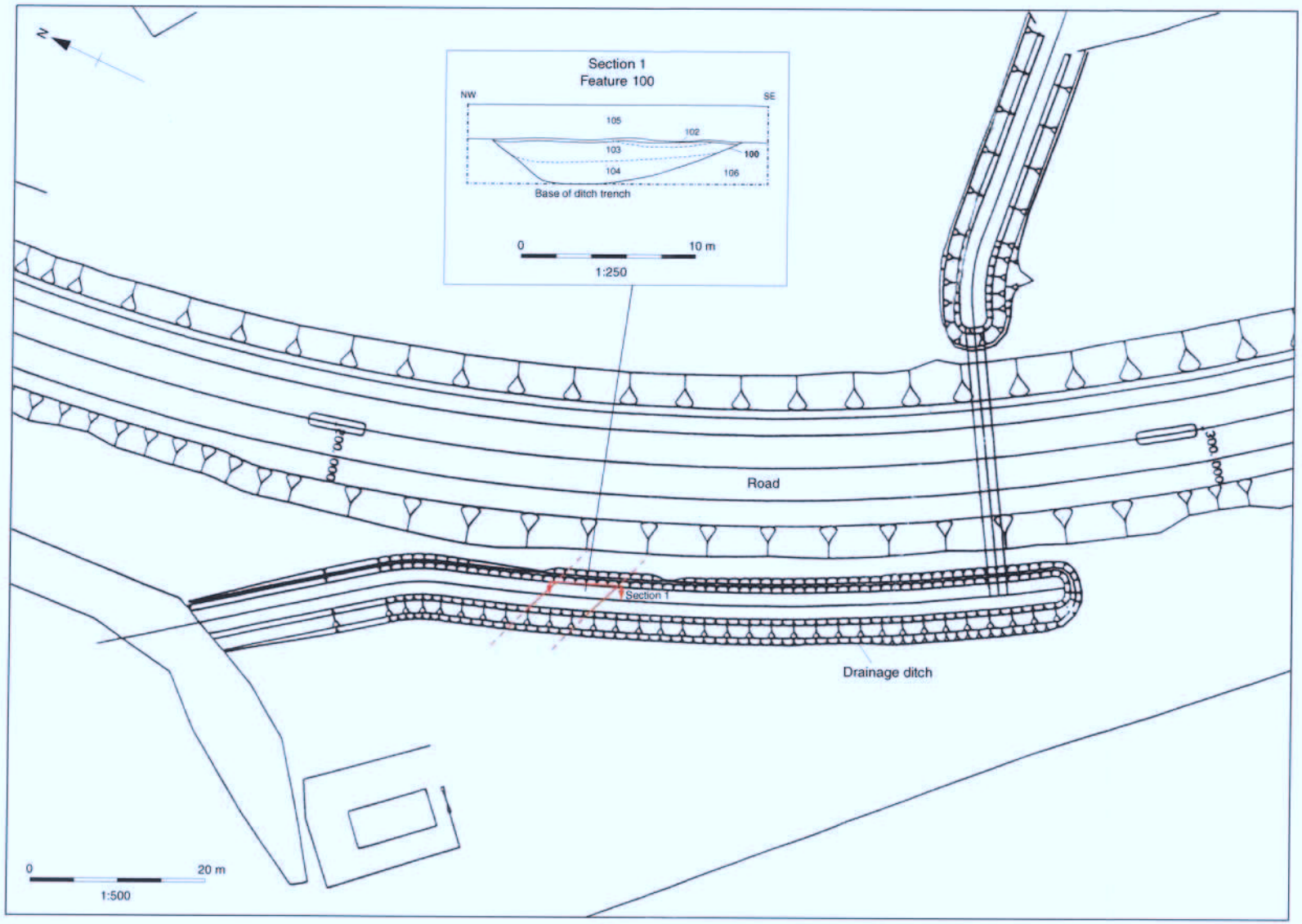


Figure 3: Site plan and section of recorded linear feature 100

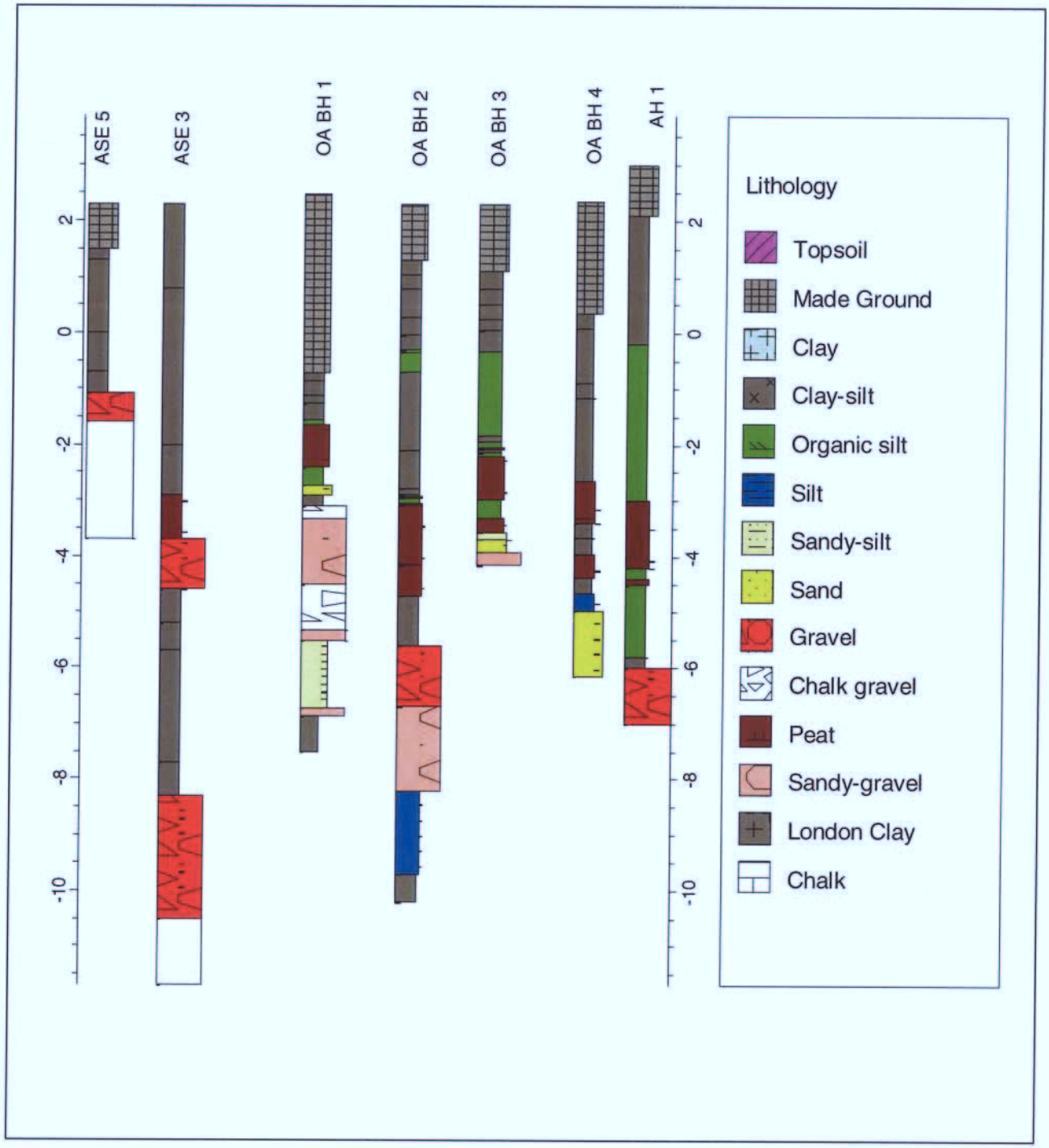


Figure 4: Sediment sequence profile with data incorporated from ASE and Wessex Archaeology results

Plate 1: Drainage ditch excavations. Looking West

Plate 2: Linear feature 100 in South facing section of drainage ditch. Looking North

Borehole 1 Sample no.9

Plate 3: Minerogenic silt clays and chalk diamict deposits

Borehole 2 Sample no.15

Plate 4: Minerogenic silt clays and laminated organic sediments

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