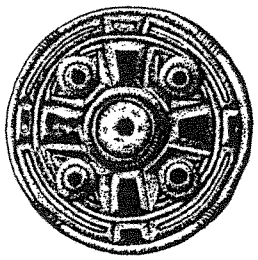


Archaeological Field Unit

Car Dyke, Waterbeach, Cambridgeshire
Post-Excavation Assessment & Updated Project Design

Stephen Macaulay

July 1999

Cambridgeshire County Council

Report No. PXA 13

Commissioned by English Heritage, South Cambridgeshire District Council & Cambridgeshire County Council

Car Dyke, Waterbeach, Cambridgeshire
Post-Excavation Assessment & Updated Project Design

Stephen Macaulay

July 1999

With Contributions by J. Evans, M. Ward, I.L. Baxter, P. Murphy, J. Greig, M.G. Canti,

Report No. PXA 13

Cambridgeshire County Council
Fulbourn Community Centre
Haggis Gap, Fulbourn
Cambridgeshire CB1 5HD
Tel (01223) 881614
Fax (01223) 880946

Arch.Field.Unit@libraries.camcnty.gov.uk
http://www.camcnty.gov.uk/library/afu/index.htm

CAR DYKE, ROMAN CANAL, WATERBEACH, CAMBRIDGESHIRE - POST-EXCAVATION ASSESSMENT AND UPDATED PROJECT DESIGN

1 INTRODUCTION

During August and September 1997 an archaeological investigation was carried out at Waterbeach, Cambridgeshire, on the Roman Car Dyke Canal, at the point where it connected with the River Cam, near to Clayhithe and the village of Horningsea (TL 49616420). The project was jointly funded by Cambridgeshire County Council (Property Department), English Heritage and South Cambridgeshire District Council (Conservation Committee).

The circumstance of the project arose as a result of the County Council's intention to sell the land (including adjacent fields). The area is one of known archaeological potential, however the southernmost section of the Car Dyke Canal, its start and connection with the River Cam, is not protected by *Scheduling* (Protection under the Ancient Monuments and Archaeological Areas Act 1979), nor is there any *covenant* on the land to ensure its future preservation, chiefly by protection from ploughing. In addition, the potential of archaeological remains, other than the Car Dyke Canal itself, was unknown. The surrounding area is a rich archaeological landscape, mostly visible from aerial photographs, however there has been no clear evidence of archaeology in the field in question. Nearby investigations (Guttman & Robinson 1996) would suggest that archaeology survives in the field, but that it may have been covered by a thick layer of peat or alluvium, thus masking these remains from the air.

The site lies the edge of the 1st Terrace river gravels and the alluvium of the flood plain of the River Cam. To the north and west lie Gault Clay, through which the Car Dyke canal is cut, the entire area is over Oxford Clays. The site is a narrow rectangular strip of land which runs parallel to the present course of the River Cam running from Cambridge in the south towards Ely to the north and east. There is a clearly define topography of the higher gravel terrace which dips away to the east towards the river. The alluvium and alluvial cover has not significantly overlain the gravel terrace.

A summary of the excavation results are presented in this report, in addition a post-excavation assessment is included and an updated project design which details the further work to be undertaken. This assessment broadly follows the guidelines set out by English Heritage (1991) for MAP2.

2 AIMS & OBJECTIVES

The original research framework (Macaulay 1996) for the project and excavation at Clayhithe, Waterbeach, was based upon the results of previous investigations (Macaulay and Reynolds 1996) and owed much to recent nearby work (Robinson & Guttman 1996). The project was part of the on-going work of evaluating and managing the archaeology on the Cambridgeshire County Farms Estate and was not a PPG 16 project. The research design was design in consultation with English Heritage, although the County Archaeology Office (CAO) were kept informed and also consulted throughout the project.

The specific project aims were to:-

(1) Investigate the relationship of the River Cam and the Car Dyke, with the potential to confirm its function as a canal.

(2) Determine the extent of plough damage on archaeological features surviving in the land parcel. The field is presently grassland managed for hay, but has been in arable cultivation in the past.

(3) Record archaeology associated with the Car Dyke and River Cam, including docks etc., industrial (in particular pottery kilns) and storage facilities, as well as any settlement evidence.

(4) Examine the present water levels and waterlogging of archaeological deposits, with particular reference to the impact of the proposed Rowing Lake from Milton to Waterbeach.

(5) Investigate the creation of a pocket park which would incorporate significant archaeological remains into displays, interpretation and access.

The key purpose of the Car Dyke project was to ensure the future protection of the site by having a fuller understanding of the archaeological remains, and if these were of a sufficiently high quality to include in any land sale a *covenant* to ensure the site would remain in pasture at the very least. Once the land was sold and no longer owned by the County Council, the opportunity to put such control on sales would have been lost forever.

Research Priorities of the Car Dyke

Examination of the function for Car Dyke needs to be undertaken to understand its changing character in different locations. No exclusive single function should be ascribed for its full length and indeed it may have fulfilled more than one function for each section. Even if it did function as a canal, the seasonal run-off would be a factor that the engineers would have had to cope with. Excavations of channel-side settlements is needed to clarify their nature, certainly cereal processing and pottery manufacture were important activities between the Cam and the Old West River. Supplementary information about who was responsible for the channel's upkeep and associated sites may also derive from such additional excavations.

The proposal for the Summer 1997 excavation centred on the investigation of the Car Dyke and River Cam junction. This is potentially the single most important section of the southern Car Dyke. The discovery of docks, jetties, locks or other data indicating the relationship between the Car Dyke and River Cam would reveal conclusively the function of the monument. Additionally, there is likely to be the presence of warehouses, kilns, settlement and industrial activity linked not only to the Car Dyke but to the extensive Romano-British landscape which includes two inhumation cemeteries, Horningsea Ware pottery kilns and settlement sites identified by the remains of substantial cropmarks (Cambridgeshire County Council SMR ; Guttmann & Robinson 1996).

The dating for disuse of the monument is also obscure over most of the route, parts seem to have continued in use whilst others seemingly silted up during the Roman period. This is demonstrable even within the short stretch of the southern section of the Dyke, where Bullock's Haste excavations show the channel blocked and silted up by the end of the fourth century, grubenhausen at Waterbeach of early Saxon date, show it was fully silted by the fifth/sixth centuries. Whilst medieval channels running into it at Landbeach show a possible re-use by water traffic as late as this date. Place name evidence during Anglo-Saxon times suggests it was an active waterway and also suggests water traffic present in the Waterbeach/Landbeach areas in the medieval period. The various local factors contributing to its disuse or cleaning need to be identified in each local context.

There is a need for further dating to establish construction of the monument, particularly in Lincolnshire where direct artefactual associations are still lacking. The southern, Cambridgeshire, section also needs confirmation of the dating evidence, particularly a review of the pottery recovered by Clark, as Iron Age, Roman and Romano-British ceramic studies have developed further since the excavations at Bullock's Haste. Clearly associated assemblages of artefacts are needed to assist such re-examination of the dating evidence.

In addition to the Roman archaeology of the Car Dyke, the Cambridgeshire SMR records the recovery of a Bronze rapier and daggers (SMR No. 05423 in 1932) at Clayhithe, in the immediate vicinity of the proposed excavation.

The original investigation was designed to recover a sample record of Romano-British activity.

Specifically, English Heritage (1991) identify the following themes which provide the framework for this investigation.

'Processes of change'

Briton into Roman (c300 BC-AD 200)
A high level of continuity in settlement and land use and, by implication, in social and economic organisation, between the Late Iron Age and Romano-British periods is becoming increasingly apparent, as are contemporary regional variations. Increasing awareness of the complexity of the transition, combined with issues of ethnicity, and social and economic dislocation, would seem to offer great potential for exploiting complex data sets.

Empire to Kingdom (c200-700 AD)
The nature of the change in Romano-British society in the 3rd and 4th centuries is not well understood.....

In addition the investigation conforms to the following nationally defined objectives:

'The investigation of wetland archaeology, and of wetlands immediate environs' (English Heritage 1991, 44).

'The characterisation of the nature of Romano-British society during the late Roman period (English Heritage 1997, 44).

And following regional research objectives:

'Industry and potteries.....require attention in order to assist in dating sites within .....in Cambridgeshire the Horningsea complex, which supplied much of the Fen region....' (Going in Glazebrook 1997).

'Examination of Roman coastal agricultural regimes, and of character and regional diversity of rural life generally (Going in Glazebrook 1997).

'Examination of rural diet and economy. (Going & Murphy in Glazebrook 1997).

Finally, localised site specific objectives were:

'Is the site representative only of domestic activity or is it associated with industrial processes'

'What is the full period span of Roman activity on the site?'

'What was the character of the local environment and how did this influence the diet and economy of the settlement?'

'Are there any indications of exotic contact which relate to the site's proximity to what is assumed to be a major access to the region from the coast (and therefore continent)?'

The results of the excavation and assessment, together with updated project aims and objectives and presented below.

3 EXCAVATION METHODS

The format for excavation was based upon the need to *assess* the archaeological remains, rather than conduct a full excavation. The programme of work was agreed with English Heritage based upon a trenching regime, however these trenches were enlarged, to create open areas, over the more complex archaeology. This technique was, in part, adopted to accommodate both local volunteers and students as part of the excavation. Trenching over the canal itself, was widened due to the need for *stepping* for safety purposes during deep excavation (4m+).

Prior to the excavation the site was surveyed using a combination of techniques, which follows previous County farms Evaluations (e.g. Foxton, Harston). These were; Geophysical Techniques (Resistivity and Magnetometer), assessment of aerial photographs and an experimental Metal Detector Survey, using a grid plotting system. The geophysical prospecting produced a poor definition of results. This technique identified the end of the canal, already mostly visible from ground observation, but the quality of responses (differential between signals) was poor, suggesting that the nature of the wet soils interfered with the survey.

A metal detecting survey produced useful results. In addition this survey doubled as field walking, and covered the entire gravel terrace, rather than the limited areas covered by geophysical plots. This resulted in artefacts (coins & pottery) being recovered and a fuller understanding of the site's topography. A distinct area of pottery and coins located on a high point was recorded and as a result this area was selected for machine stripping (Trench IV). The study of aerial photographs confirmed the poor quality of available material. However, several features, notably the peat formation against a gravel bank, were noted and the widening of the Car Dyke at its junction with the River Cam could be seen, if only faintly.

Four areas were identified for investigation by machine stripping. Trench I: positioned at the end of the visible Car Dyke canal and the intersection with the River Cam/flood plain, which was predicted to lie to the west of its present course. Trenches II and III: covered the areas of geophysical survey. These were opened to test the negative results and also to confirm the few features predicted. These areas also traversed the existing gravel terrace onto the alluvial flood plain. Finally Trench IV, positioned on a natural high point, over an area rich in pottery and coins, coming in a location where archaeology identified from aerial photography would logically continue into the field from the west (Robinson & Guttman 1996).

4 SUMMARY OF RESULTS

The significant period represented at Car Dyke, Waterbeach is of Romano-British date, some later features, of unsure dating, may be Post-Medieval in date.

Trench I

The Car Dyke canal was located and a machine dug section was opened, to reveal its complete profile. The canal was 24m wide and mirrored the profile of the section excavated a few hundred meters to the north in 1993. The canal banks were surviving in the 1997 investigation (and were not fully investigated in 1993), and these were broad and flat (approx. 7m wide). The Roman canal deposits had not been heavily disturbed by Post-Medieval activity, as they had in the previous excavation to the north (Macaulay & Reynolds 1993). In addition a complete section of deposits underlying the bank (pre-Car Dyke) was sampled along with the basal deposits of the canal (recording its main period of use c.mid 2nd century), right through to the disuse, probably in the late Roman period (c.late 3rd-early 4th centuries). Samples were taken for soils, pollen and macrofossil analysis for palaeoenvironmental reconstruction. These will be compared with samples and results obtained from the 1993 section. The basal deposits were waterlogged, unlike the northern Waterbeach section (Macaulay & Reynolds 1993). Preserved leather (including a sandal),

worked wood (stakes and a possible fishing harpoon) as well as bone and pottery was recovered from these basal fills. The investigation also identified limited later post-medieval deposition and confirmed that this section has not been heavily dug for later drainage or catch water usage. The Roman deposits were undisturbed.

The investigation proved that the Car Dyke canal ran *directly* into the River Cam at this juncture and that during the Roman period the river was located further to the west than it is today (Fig 2). However there must have been some form of water control (lock?) between the canal and the river. Within the trench the height of the base of the canal was c.1m OD, whereas the height to the north was 1.5m OD (Macaulay & Reynolds 1993). It is likely that any lock would be away from the wider entrance point. It was also indicated that the eastern bank stops before its counterpart on the western side, which suggests that there was some form of widening, possible for barge turning etc. Non-intrusive survey techniques could be used to confirm that there is indeed a docking area at that point. The eastern bank appears in the south-east facing section, but did not continue through to the north-west facing section of Trench I.

In addition to the canal itself, on the western bank, within 20m of the river, a Horningsea-style pottery kiln was discovered. The kiln survived in extremely good condition, with two other kilns nearby. As many as 8 kilns may be present within the field (3 clearly identified and 5 others suggested from surface remains on the banks of the Car Dyke) and this would take the total number of known Horningsea kilns up to 18, 12 of which are on the Waterbeach side of the river. The kiln contained rubbish material dumped once it was abandoned, and included pottery, tile and the fired clay roof or vent tiles, which may have collapsed into the kiln. The fired clay lining and support pilasters survived intact. The basal deposits of its final firing were identified and samples from this layer and the clay lining were taken by the English Heritage Ancient Monuments Laboratory for archaeomagnetic dating. This was to provide independent dating for the supposed mid-2nd century date for these type of kilns. The results of this survey however have been negative. No evidence for a superstructure (bricks or tiles etc.) was recovered and it is likely that the kiln had a turf roof, with clay plates (e.g. roof tiles) covering the flue and vents.

Trench II & III

The negative results from geophysical surveys were confirmed by excavation. The geophysical survey indicated a linear feature, which was confirmed as a gravel bank which runs along the edge of the gravel terrace and alluvial flood plain. The bank has been enlarged as a flood defence, and probably doubled as a track. The bank is likely to be of Roman date, and may well be of late Roman date (3rd-4th centuries). The gravel bank *crosses* the Car Dyke banks, but it is not known whether it blocks the canal or is broadly contemporary with it. Clark (1947) discovered gravel causeways blocking the Car Dyke at Cottenham, dating to the late 4th century. A theory is that the bank was built up in the 4th century as a defence against rising water levels at a time when the canal may have gone out of use (a time of increased flooding and alluvation would have made its maintenance more difficult). The gravel bank is 1.5m wide and over 0.8m high, although this is mostly formed by a natural rise formed by the geology of the 1st terrace gravels. In front of this bank was a small ditch which contained no pottery in the sections excavated. In Trench III a smaller bank was raised, and to the west (not flood side), was a ditch which contained Roman pottery.

Of interest in Trench III was a collection of peat and alluvial filled ditches, which ran both parallel to the gravel terrace (roughly north-south) as well as east-west towards the River Cam, lying beyond the smaller gravel bank. These features were cut into the alluvium of the flood plain. They appear to run for some distance along the site, seemingly crossing the Car Dyke canal itself. The peat is known to have formed in the medieval or Post-Medieval period and these features are thought to be of at least medieval date. Their function is not known, although they seem too closely spaced to be purely for drainage. A more probable function is that of a water meadow or cultivation in the flood plain, for which parallels can be found (Eric Wood in Historical Britain 1997) and there are references to the presence of water

meadows off the Cam in the area (Victoria County History for Cambridgeshire). No artefacts were recovered from any fills to date these features, which is itself important, as all features of Roman date were rich in artefacts, in particular pottery.

Trench IV

On the highest visible point of the field large quantities of Roman pottery and coins were recovered during the metal detector survey. Stripping of this location revealed a dense concentration of Roman pottery both within the plough soil, and from the foundations of beam slots from a substantial Roman timber building, covered by what initially appeared to have been a dumping layer. The site had been heavily truncated by ploughing, with only 0.25m topsoil cover. This ploughing may be responsible for damaging and spreading the fills of the upper layers of the beam slots thus creating the 'dumping' layer, which contained a grey silty fill with large quantities of broken greyware pottery. The building foundations survive as very shallow beam slots running parallel and perpendicular to each other, to form a *raft*, to raise the floor in what would have been probably a damp area. A similar structure was discovered at Southwark during excavations of the Roman waterfront (Excavations at the Courage Brewery and Park Street 1984-1990 - Dillon, Jackson & Jones - London Arch Vol. 6 no. 10 Spring 1991). Very large quantities of pottery were recovered from all deposits, with a probable Late 2nd-3rd century date (contemporary with later use of the Car Dyke). The assemblage not only contains the local Horningsea storage and transport vessels but much high quality imported material (Nene Valley, decorated Samian etc.). The probable function of the building is a warehouse, the artefactual evidence (which includes much industrial waste) combined with the location and proximity to the Car Dyke canal all support such a function.

The building is located *behind* the gravel bank, and probably extends outside the trench to the west beneath the railway. The building forms a rough 20m square (the extent to the north, south and east being determined), and would suggest a building, or at least a large platform.

5 CONCLUSIONS

The excavations at Car Dyke in 1997 have produced some exceptional results and confirm this area of the Cambridgeshire fen edge as important for Roman industrial activity. Outside of the Roman towns of Cambridge, Godmanchester and Durobrivae (Water Newton near Peterborough) the area north of Cambridge, close to Milton, Landbeach, Horningsea and Waterbeach contains some of the most concentrated Roman archaeology in Cambridgeshire. The site at Waterbeach contains a representative sample of much of this activity. For the first time a section of the Car Dyke has been investigated where it connects with a natural waterway. At Clayhithe there is a direct connection, and proof that once a lock existed located further north, possibly beyond the modern railway line. The section of Car Dyke within the investigated field contains some of the best undisturbed deposits, much of which are waterlogged, of any stretch of Car Dyke yet observed. Analysis will provide dates for the construction, main use and disuse of the canal, and a full palaeoenvironmental sequence of the same periods. This information no longer survives north of the railway line (Macaulay & Reynolds 1993). The investigation has now confirmed that the area north of the River Cam was also an intensive area of pottery production for the Horningsea pottery industry. The location of the kiln(s) on the bank of the Car Dyke at its very junction with the river confirms the transport function of the monument. The presence of the Roman building (Trench IV) appears to link to the Car Dyke, acting as a warehouse/industrial area close to the canal. The activity present at the site appears to span the main period of Romanisation, from the mid 2nd century AD through to a height in the 3rd century, before tailing away at the beginning of the 4th century. The site appears to have been totally abandoned by the Later 4th century prior to the overall decline in Roman influence during this period. Perhaps the maintenance of engineering works of this type were the first to lost with the onset of the decline in Imperial authority..

6 PHASING DESCRIPTION

A general synopsis of the sites occupation divides into 4 basic phases, based on the pottery spot dating. The Car Dyke canal itself divides into 13 distinct phases from its Roman construction through to the Post-Medieval period, from purely stratigraphic description. Overall the pottery spot dating has not contradicted the stratigraphic sequences and has added a more concise date to the periods of occupation. Only pottery spot dating has been undertaken at this stage of the project. The pottery dating suggests a Hadrianic to later 3rd century range for the site and collection.

The sites topography and geology is an important factor in its development. Situated on the edge of the 1st terrace river gravel, the archaeology of the site is located on the terrace, overlooking the alluvial flood plain of the River Cam, although the Car Dyke canal connects with the natural watercourse.

Phase 1 (Hadrianic/Antonine mid-late 2nd century AD)
The first period of Roman occupation occurs in this period, with the construction of the Car Dyke canal. There does not appear to be other associated buildings during this period, although the warehouse was not investigated fully and its construction date is uncertain. During this period the canal is in use with evidence of re-cutting and cleaning.

Phase 2 (early-mid 3rd century AD)
Represents the main period of occupation on the site. The Car Dyke canal is re-cut and infilled in periods. At this time the Horningsea style pottery kiln is cut into the western bank of the canal, along with at least two more (not excavated). The warehouse in Trench IV is in use at this time, although only limited data is available. During this phase the canal is in its main period of use, with localised pottery production and transport (presumably both north and south) and a warehouse related to these function.

Phase 3 (late 3rd century AD)
Continued canal function, with no evidence of re-cutting, leading towards disuse. During this phase the kiln is abandoned, although the warehouse continues to be in use. It is possible that during this phase the artificial bank along the edge of the gravel terrace is constructed as a defence against rising water levels?.

Phase 4 (early 4th century AD)
The Car Dyke canal is abandoned, infilling to leave only a shallow drain. A small cremation is interred into the upper fill of the canal in this phase. The warehouse also appear to be abandoned at this time.

Later Phases (Post-Roman to Post-Medieval)
Later occupation on the site is most evident from the peat filled channels in Trench III. These are cut into the alluvial deposits of the medieval period and although the function is unknown, are probably for use in water meadows or such like. The later phases of the infilling of the Car Dyke indicate that alluvial/flood deposits choke the channel from the River Cam to the east. There is a small drainage ditch cut/running along the course of the Car Dyke in the Post-Medieval period, which contained running water.

7 MANAGEMENT RECOMMENDATIONS

The quality of archaeological remains is such that the site will be recommended for *Scheduling* under the Ancient Monuments & Archaeological Areas Act 1979, which will provide a measure of protection for the site in the future. Moreover is a recommended that the site should remain in pasture (permanently) and that this should be the condition of any

Land Sale, to be included as a *Covenant* to prevent any arable cultivation of the land. The possibility for the land to remain within Local Authority (County or District) control should not be discounted, potentially as part of a 'Pocket Park'. At present a covenant has now been placed on the land, although no sale has yet been finalised.

The quality and extent of the archaeology has implications for any future investigations. The presence of large numbers of Horningsea style pottery kilns is an important factor, the fuller understanding of which is crucial to both local and regional research into Roman Britain. The use of ground sensing survey techniques may be able to accurately determine the presence of a turning and docking area, where the Car Dyke runs into the River Cam, suggested during the 1997 excavation. Additionally the location and excavation of the lock system should be a key research aim for any future work on the Car Dyke.

8 ASSESSMENT OF ARCHAEOLOGICAL POTENTIAL

Key to abbreviations in Task Lists
Cons = Conservator, EC = External Consultant, ILL = Illustrator, PM = Project Manager, PO = Project Officer

8.1 STRATIGRAPHIC AND STRUCTURAL DATA by Stephen Macaulay

8.1.1 Quantity of materials and records

The number of records relating to the excavated features are as follows:
350 context records, of which 183 describe deposits, 110 describe cuts, 9 finds spots, 2 test pits, 4 small finds, 6 general cleaning and unstratified, and 9 for kiln pallisters.

A digital context record of the site;
26 hand drawn plans as scale 1:20;
A digital base plan of the site, hard copies of which may be reproduced at any required scale;
35 hand drawn sections at scale 1:10
3 hand drawn sections at 1:20
341 photographs
8 sample records
English Heritage Samples (4 x Pollen Monoliths, 2 x Plant Macrofossil Monoliths, 4 x Soil Micromorphology tins, 19 x Samples for Archaeomagnetic analysis)

Unexcavated features were recorded both on the digital base plans and the hand drawn base plans.

8.1.2 Provenance and dating

The majority of deposits excluding the topsoil and natural geology can be attributed to the Romano-British period, specifically from the Hadrianic-Antonine (2nd century AD) through to the beginning of the 4th century AD. These dates are based on pottery spot dating, stratigraphic and spatial associations. Within this date span a minimum of four distinct stratigraphic phases exist (see section 6 above). Other periods represented on the site is medieval/Post-Medieval in date, relating to post-alluvial phases and water meadow management.

8.1.3 Range and variety

Feature types are mostly cut features containing at least one deposit. Excavation on the site was; Trench I - machine excavated section through the Car Dyke canal; Trench II, III and IV - open areas, on the gravel terrace, to expose archaeological features. The nature of the excavation, as an assessment, resulted in only a partial excavation of features. In Trench IV the remains of a building were encountered, however only the upper levels and sampling was carried out. There is no evidence of upstanding building remaining. Site alluviation, degradation has resulted in some truncation of deposits, although the canal deposits were well preserved, including the bank materials.

Cut features included ditches, both larger V-shaped boundary/enclosure ditches and narrow slots, including many beam slot foundations. A large canal trench was excavated (the Car Dyke), including surviving banks. Banks also include flood defences along the gravel terrace, again of Roman date. Other Roman ditches include several cut to provide flood/drainage defences along the gravel terrace and flood plain of the River Cam. Later ditch/channel features in Trench III are interpreted as water management for Post-Medieval water meadow, although this interpretation is not definite. Some pitting was recorded, importantly including a Horningsea style pottery kiln on the western bank of the Car Dyke canal. Other pits include a hearth/rubbish pit within the Roman building in Trench IV. Structural remains include numerous postholes and beam slots from the Roman building foundation in Trench IV.

8.1.4 Condition

Many of the archaeological deposits were horizontally truncated across much of the site. Much truncation has been caused by alluviation caused by regular episodes of flooding both removed and added to the deposits. However most damaging has been the ploughing of archaeological features on the gravel terrace. The very thin depth of topsoil (as little as 0.15m) has resulted in much feature truncation and spreading as a result of plough erosion. Residual pottery and artefacts recovered from the topsoil horizon suggest that the area has not been plough recently.

The preservation of deposits within the Car Dyke canal is good and palaeoenvironmental records are good, with permanent waterlogging which has preserved organic material and artefacts such as leather and wood. Features on the gravel terrace other than the canal deposits are only seasonally wet and do not contain good preservation of organic material.

8.1.5 Primary sources/documentation

The records for the excavated deposits are complete and have been checked for internal consistency. All context records have been computerised to aid in cross-referencing and record consistency, using the 'Dataease' software package for PC's. Written records have been completed on archival quality paper using light fast waterproof ink and have been fully indexed. Drawn records in pencil have been checked, referenced and levels checked. All digital and computerised records have been archived and copies are held at separate locations in a fire proof safe. The site matrix has been produced and checked/cross-referenced during the assessment stage, including pottery spot dating information.

All primary records are retained the AFU offices, Fulbourn.

8.1.6 Means of collecting data (method of assessment)

The primary paper records have been checked in conjunction with the site matrices and the assessments of artefactual and ecofactual materials to generate the information for this

assessment. General finds information for individual contexts has been collated using the computerised records database. Some preliminary grouping of contexts, deposits and features have been undertaken, as well as a site phasing sequence developed.

8.1.7 Selection of data for further analysis

All records dating to the Roman remains will be subject to further analysis. A limited analysis will be carried out on the medieval and Post-Medieval features in Trench III.

8.1.8 Statement of potential

The contextual data is the main component of data and is sufficient to form the foundation of the site narrative. The sites major significance is based upon the recording of the stratified sequence of Roman occupation and in particular the understanding of the construction, use and disuse of the Car Dyke canal. In addition the Horningsea pottery kiln is of great significance it is the best preserved example of its kind yet excavated. Finally the remains of a Roman building represent the first warehouse/canal features directly related to the Car Dyke and its impact on the immediate environs.

Preliminary pottery dating has indicated that there does not exist a tight dating sequence from artefactual material alone. However the significant detail includes no mid-late 4th century material and a construction date for the Car Dyke canal of Hadrianic/Antonine date (mid-2nd century AD).

8.1.9 Analysis methods and quantity statement

The site data will subjected to rigorous analysis. All contexts dating to the Roman period will be grouped and phased based on information from pottery, feature types, spatial distribution and matrices. This information will be distributed to relevant specialists to allow accurate analysis of the material categories on the basis of the contextual data. The full site report will be based on a combination of the contextual data and the reports compiled by individual specialists, it is therefore envisaged that the final report will not be written until all specialist analysis is completed. Reference to, and comparison with other sites of similar period and type will be made wherever possible. The site will also be considered in on-going research studies by the AFU into the Roman occupation of the Cambridgeshire fen-edge. Useful comparisons can be made with the on-going Fenland Project, excavations around the Car Dyke canal and transportation into the fens north of Cambridge City. Importantly additional post-excavation projects (e.g. pottery assemblage) will be generated from the excavation.

8.1.10 Potential of methods to meet aims and objectives

By subjecting the contextual data to rigorous analysis and incorporating all the specialist data into the site record it should be possible to produce a database and report which can be used for useful comparison with other excavations of the Romano-British period and the fens in general.

The chance to investigate a fully preserved sequence of deposits from the Car Dyke canal is unique for Cambridgeshire and will shed light on the construction, main periods of use and re-use and eventual abandonment of this important monument. The understanding of the engineering of the canal will also be possible with data relating to the water levels, implications for sluices and locks and the relationship of the canal and the River Cam. Finally, the data will shed light on the later deposits of the canal and the shifting course of

the River Cam. All these results will be incorporated into the future management recommendations for the monument.

Stratigraphic data relating to drainage and flood defences and the raised gravel bank along the gravel terrace will be instrumental in determining the nature of the Roman waterside occupation, and the first such research in the local.

The discovery of the remains of a Roman building, potentially a warehouse or such like, related to the Car Dyke canal is of great significance. It location close to the canal and located on the edge of the gravel terrace is of interest and the results from this feature will directly relate to the canal and the nearby Romano-British settlements. This includes a band of settlements, both domestic and industrial which stretches from this point south along the banks of the River Cam to Cambridge.

The discovery of the Horningsea style kiln, with others nearby is of very great importance. There are now more recorded examples of the Horningsea style kilns on the western bank of the River Cam on the Waterbeach/Milton side. The location of the kiln on the bank of the Car Dyke, within 15m of the connection with the River Cam is significant and confirms the function of the canal for transportation.

Other than the Roman archaeology recorded on the site, the intriguing channels and narrow ditches in Trench III are of importance. They represent the only significant post-Roman remains and are potentially water meadow features. However further analysis is required to accurately determine the function of these features.

8.1.11 Task List See

Compile groups and phasing for distribution to specialists	2 day (PO)
Liaise with specialists and incorporate specialist reports	2 days (PO)
Compile illustrations list and liaise illustrator	2 days (PO)
Write excavation report	15 days (PO)
Contribute to report in its regional context	2 days (PO)
Assemble report	2 days (PO)
Edit report	2 days (PM)
Incorporate edits	2 days (PO)
Proof reading	2 days (EC)
Draw and mount maps/plans/sections	10 days (ILL)

8.2 **POTTERY** (Spot dating) by Jeremy Evans & Margaret Ward

8.2.1 Provenance and quantity

The material from Car Dyke, Waterbeach consists of over 8,763 sherds weighing 155,383g. It derives from features of Romano-British date, excavated during the excavation.

8.2.2 Dating

The Car Dyke assemblage contains only sherds of Romano-British date, derived from both undisturbed features and residual material contained within the topsoil.

Some 55 sherds of Samian were recovered from the site from a maximum of 40 vessels. Despite the smallness of the sample the absence of any Samian from South Gaul is immediately obvious. Indeed, very little of the material could be dated as early as the Hadrianic period. Most (70%) was produced after c.AD 150 and 28% was produced after

c.AD 160. It was striking that up to 13% originated in East Gaul (probably in the late 2nd to 3rd century workshops at Rheinzabern and Trier). This fairly high proportion would suggest occupation of the site in the 3rd century.

The date range of the material spans from the Hadrianic-Antonine period (mid-2nd century) through to the later 3rd century AD. The mid-2nd century date for initial occupation, including the construction of the Car Dyke canal, is in line with the accepted date for the Romanisation of the fens. There is little, if any, clear evidence of 4th century occupation and certainly no evidence of later 4th century activity.

8.2.3 Fabrics and forms

The coarse pottery consists very largely of Horningsea material the dating of which is at a very early stage, and to which groups from this site may contribute, however, sufficient sherds of Nene Valley colour-coats assist matters as does the imitation in Horningsea fabrics of well-dated BB1 and BB2 types. Not a single sherd of 'Belgic' grog-tempered ware was recovered from the site, despite this being the predominant pottery tradition from the later Iron Age to the Flavian period, occupation here is this period can probably, therefore, be ruled out. A couple of reeded-rimmed bowls from the site would seem to have a Neronian-Trajanic date-range, but given the lack of other 1st century material they are unlikely to be earlier than Trajanic. Horningsea appears to have produced greyware Gallo-Belgic copy dishes (Millett 1980), probably in the 1st century (J Pullinger (pers comm) informs me Horningsea fabrics are present in early 1st century contexts in Cambridge), but these are absent from this site. In contrast 2nd century types are abundant, most being copies of BB2 bead rimmed bowls, with some others which appear to be inspired by the BB1 flange rimmed bowl. The BB2 copies predominate and would appear to be later 2nd or early 3rd century in date, which their consistent association with Nene Valley colour-coated ware sherds, many with barbotine decoration, confirms. Earlier 3rd century material would seem to be as common as Antonine. A number of contexts are clearly of a later date. Nene Valley colour-coated bead rimmed bowls and Dr 36 copies occur with some frequency, as do 3rd to 4th century Nene Valley parchment ware mortaria with iron slag trituration grits. Later 3rd century Nene Valley beaker types, however, are much outnumbered by their later 2nd to mid 3rd century predecessors. Similarly there are a few developed beaded and flanged bowls in Horningsea greyware of later 3rd to 4th century date, but there are similar numbers of incipient beaded and flanged bowls of early-mid 3rd century date, despite the likelihood that the former type was much commoner than the latter overall.

The form types of the material are of importance.

All material is Romano-British wheel made, with no evidence for local handmade material within the assemblage.

8.2.3 Primary sources and documentation

The primary comparative sources are very poor and work on the Roman pottery of the fens (Cambridgeshire in particular) is a national research priority. Little quantified information, except for Stonea (Potter 1997), exists and even less synthesis on trade patterns within the Fenland. Recently excavated material from Milton (Reynolds 1994) and Waterbeach (Guttmann & Robinson 1996, Macaulay & Reynolds 1993, Macaulay forthcoming) will provide comparative data for trade into the fens. Comparisons of this assemblage with that at Stonea may well help to define supply corridors within the Fenland.

8.2.4 Data collection

Each context has the Roman sherds analysed for spot dating with only a limited form/fabric type investigation.

8.2.5 Discussion and potential

The collection is of regional interest for a number of reasons. Quantified data from rural (or indeed urban) sites in the region are sadly lacking and this site will help address that. Further all the indications from the site suggest it was something more than a basic rural site. The sites location within an industrial/potteries area, part of the Horningsea Industry and the proximity of the Car Dyke canal indicate that the assemblage informs not only on local patterns but on exotic contacts and broader implications for the region as a whole.

Fabric supply to the site may well help to elucidate more about the marketing of Horningsea wares, about which there is currently little quantified information. Understanding the trade patterns of the Fenland will be enhanced, especially as the site will contribute to other studies around the Cambridge fen edge, including the Car Dyke Roman canal.

The size of the assemblage enhances the potential of further analysis, where a fully quantified and studied report would be the first significant (and quantified) Roman pottery assemblage for Cambridgeshire. At present the lack of recent quantified pottery from Cambridgeshire is the gapping omission in Roman studies in the region. The importance of the Car Dyke assemblage is further enhanced when one considers other local assemblages which need to be interpreted (Milton, Landbeach) and re-interpreted (Car Dyke at Cottenham ,ClarK 1947). As well as the understanding of the Horningsea pottery industry.

8.2.6 Recommendations

Although there is no doubt that it is recommended that the Roman assemblage should be fully analysed and reported on, to include full description of selected sherds and a comparison of material with other assemblages in the region. Within the scope of the investigation of the Cambridgeshire County Farms Evaluation project, of which the excavation at Car Dyke is one, there was not the resources to carry out a full analysis. The present level of report, including spot dating for site interpretation and sequencing, has been deem sufficient (English Heritage pers. comm.).

This post-excavation assessment does however recommend that from the Car Dyke assemblage a fuller, specific pottery research project will be initiated. The principal (and support) of this has been form English Heritage, where the Car Dyke assemblage will be fully studied and compared with other local assemblages from Milton, Landbeach as well as a re-assessment of Clark's excavation at Car Dyke at Cottenham (Clark 1947). Additionally, some fenland assemblages such as those from Stonea Grange (Potter 1996) and Littleport (Macaulay forthcoming) will be incorporated into this research. Ultimately this will provide the basis for the understanding of the Roman ceramic traditions of the southern Cambridgeshire fen edge.

In summary, the present level of investigation into the pottery from Car Dyke, Waterbeach which includes spot dating from all contexts and a full Samian catalogue will be sufficient for the site specific reporting. The incorporation with other larger assemblages will ultimately provide the basis for the Roman fen ceramic traditions.

8.2.7 Task list

Illustration of selected sherds	2 days (ILL)
MAP 2 Assessment Report	£1,800

Pottery Research Project to be submitted to English Heritage March 1999

8.3 THE FAUNAL REMAINS by Ian L. Baxter

8.3.1 Quantity

A total of 392 fragments of animal bone was recovered from hand excavated deposits. A small amount of bone was recovered from the heavy residues of sieved environmental bulk samples. Where diagnostic features are lacking long bone shaft fragments vertebra fragments and rib fragments are classified as Large Mammal or Medium Mammal. With such a small assemblage it is not possible to provide any detail regarding the age structure or kill-off patterns of the domestic animals.

The total weight of the assemblage is 6,644g, this figure DOES NOT include material recovered from samples. A total of 264 fragments or 67% of the total could be identified to some extent.

8.3.2 Provenance

All the faunal remains were selected for analysis, derived from a total of 58 contexts. They reflect the full range of feature types identified during the excavation, however the demographic/spatial distribution bias is particularly relevant. Faunal remains recovered from Trench IV dominate the collection (N=43) or 74% of the assemblage. Importantly this also represents the area of settlement and occupation. Full details of the faunal material recovered from each context, phase and feature type is given in the archive report.

8.3.3 Range and variety

Of the 392 fragments within the report, 264 fragments were recognisable or 67% of the total. The unidentified material mostly consists of undiagnostic small bone chips.

Cattle dominate the faunal assemblage, both in terms of weight and number of fragments, accounting for 48% of identified fragments or 52% if combined with Large Mammal (L.M.). Sheep/Goat form the next group with 33% or 40% when combined with Medium Mammal (M.M.). Other species together comprise the remaining 19% with pig accounting for just fewer than 5.5% and horse nearly 7%.

Notes on the species

Horse
A total of 6 horse fragments were recovered from the site, comprising nearly 7% of bone identified to species. A lower P4 from (466) came from an animal approximately 6 years old (based on Levine 1982). Other remains comprise a right innominate from [104] (107) dating from the late 3rd-4th century, a cervical vertebra with dog tooth punctures from [138] (109), a radial carpal from [446] (445), a phalanx I from [104] (119) and a proximal tibia from [506] (585).

Red Deer
A total of 15 vertebrae and 1 rib fragment attributable to red deer were found in ditch [474] (471). Further red deer fragments comprising a scapula fragment, proximal radius, and ulna fragment were unstratified, context (9999).

Cattle
The remains of cattle comprise nearly 48% of bone identified to species, 52% if combined with large mammal. Unstratified remains of probable Roman date from (1000) seem to comprise the partial skeleton of a beast approximately 105.0 cm high at the withers, based on the multiplication factors of Matolcsi (1970). A horn core fragment from [138] (109) came from an old adult short horn cow (based on Armitage and Clutton-Brock 1976, Armitage 1982). Mandibles from [138] (109) and (405) came from adult animals. A mandible fragment from (450) came from a calf. Butchery marks on cattle bones include an ulna fragment from [476] (473) with transverse cut and chop marks and a large mammal rib fragment from [446] (445) with a transverse chop mark. The left femur from (1000) has polishing (eburnation) on the inner aspect of the femur head in the region of the epiphyseal join. However, other criteria suggestive of osteoarthritis are not present (Baker and Brothwell 1980).

Pig
The remains of domestic pig account for 5½% of fragments identified to species. A proximal Mc.V fragment from (463) has transverse cut marks on the anterior surface below the articulation.

Sheep/Goat
No remains attributable to goat were found in the assemblage, which is therefore considered as sheep. Sheep comprise a third of identified fragments, 40% if combined with medium mammal. No bones are sufficiently complete to provide withers height estimations of the sheep. A mandible from [138] (109) came from an adult animal. Younger animals are represented in (109), (445), and (450). A distal femur from (147) has been chopped across the condyles and a lower M3 from (463) has been chopped through.

Dog
A right humerus from a small bow-legged dog was found in (466) dating from the 3rd-4th century. Dogs of a similar type have been found at other sites in Britain and in life probably resembled dachshunds (Baxter forthcoming). This specimen stood approximately 28 cm high at the shoulder (based on multiplication factors in Harcourt 1974). The right innominate of a somewhat larger dog was found in [138] (110) dating from the mid 2nd-early 3rd century.

Beaver
Fragments of the left ulna of a beaver were found in an unstratified context (4000) in Area IV.

Fowl
A carpometacarpus of domestic fowl was found in (450). A femur was also found in (9999).

8.3.4 Condition

The preservation of bone from the site was good. The majority of the bones had good clean surfaces. Although the waterlogged nature of the site degraded some of the surfaces of bones. Where surface modification (in the form of slight exfoliation and concretions) has been recorded it has not affected identification or effaced marks made by humans or animals. Chops, gnawing and butchery marks have been recorded.

8.3.5 Method of Assessment/Report

A full detailed report has been compiled on what is a small assemblage of faunal remains from Car dyke, Waterbeach. All recognisable fragments have been analysed recording species, skeletal elements, butchery, pathology and taphonom. Bone was identified by comparison with published descriptions (in particular Schmid 1972, Sisson and Grossman 1953, Cohen and Serjeantson 1986), and reference material in the author's collection and the collections of the Leicester City Museums. Animal bone measurements are based on Jones et al (no date), von den Driesch (1976), Eisenmann (1986) and Harcourt (1974).

8.3.6 Selection of data for further analysis

A full report has already been compiled and no further research will be undertaken.

8.3.7 Statement of potential

A full report was undertaken since conducting an assessment would not be worthwhile.

The quantification and analysis data of the domestic species will be considered when attempting to understand the sites economy in terms of animal husbandry and function in general. When considered together with the stratigraphic data it may be possible to distinguish the relative importance of different domesticates over time. Moreover the distribution of faunal remains is centred on the building remains and not within the deposits of the Car Dyke canal.

8.4 FIRED CLAY AND KILN FURNITURE

8.4.1 Quantity

The assemblage consists of 19.689g of kiln furniture and only 5g of Daub. The kiln furniture derives from a single Horningsea style pottery kiln, with the material divided into kiln roofing (8.704g) and kiln lining (10.985g). A total of 193 pieces was recovered.

8.4.2 Provenance

All kiln material derives from a single kiln, dating to the Roman period. The kiln is Horningsea style and dates to the early 3rd century AD. The kiln is cut into the western bank of the Car Dyke canal.

8.4.3 Condition

The overall condition of the daub fragments was good, with sizes ranging from large cohesive pieces to very small fragments. Most of the material was hard and compact allowing most impressions to be clear and measurements taken. The kiln lining was particularly hard and compact (see Archaeomagnetic report below)

8.4.4 Fabrics and forms

Within the contexts examined the fragments were divided into broadly two main fabric types with sub-variants resulting from uncontrolled firing.

Kiln roof
Hard light grey-brown colouration, exhibiting clear 'wattle' or straw etc. impressions. The fired clay are disk shaped (approx. 12cm diameter). It is likely that these were part of a turf roofing to seal the kiln.

Kiln lining
Hard smooth light yellow-grey colour, a thick lining over 3cm width.

8.4.5 Method of assessment/report

The fired clay or daub was analysed by dividing the material in fabrics based on visual analysis incorporating colour, consistency, inclusions and voids. Additionally, diagnostic features including wattle impressions, dimensions, and surface description were also recorded.

8.4.6 Discussion and potential

The full analysis and research into the kiln material and Horningsea kiln will be undertaken as part of the specific research into pottery (see 8.2.1 above).

8.5 TILE

Only 1,128g of tile was recovered from the site. The assemblage derives from only 5 contexts. 679g or 60% was collected from the metal, detector survey, while 419g or 37% derived from a single context of dumped material within the Horningsea pottery kiln. This is a very small assemblage considering the period and propensity for such material. Although the limited excavation may account for this. However, it is unlikely that the building in Trench IV had a tile roof due to the almost complete absence of tile from that area.

The usual fabric of hard well fired tiles is present, with a red or red-brown colour. Likely sources would be from sites in Norfolk. Fragments of a more local production have been encountered, a dark grey fabric, poorly fired with shell inclusions.

Tegulae (roof tile) and *Pedalias* (floor tile) were present within the small assemblage.

8.6 OTHER FINDS

A number of miscellaneous finds were recovered from the site, these are listed below.

Stone/Masonry	5,456g (*Does not include large ballast material*)
Wood	537g
Shell	368g
Glass	7g
Metallic	
- Fe	976g*
- Cu	101g*
- Pb/Ag	259g*
- Slag	4008g

**Does not include Post-Medieval or Modern material from Metal Detector Survey*

8.6.1 Stone/Masonry

Stone fragments, some large (not all weighed) were recovered from the site. A total of 5,456g was recovered from excavated contexts. All the stone was imported, since no local sources exist. The origins of the are unknown although quantities of Barnack stone (nr Peterborough) were identified amongst the large material. The material was recovered from the Car Dyke canal and the building in Area IV. All the masonry was fragments of rubble probably used for ballast in barges from excess building stone.

There is no requirement to study or analyse this material category further.

8.6.2 Wood

A total of 537g (Does not include harpoon) of wooden material was recovered from the site. Both charcoal and preserved wood were excavated. The preservation of wooden material within the lower water logged deposits of the Car Dyke canal was excellent.

Wooden artefacts recovered from Area I Car Dyke canal included preserved wooden stakes and a harpoon. These artefacts were retrieved from the lowest fills of the canal. They were not in-situ, although several stakes were found together and these were likely to have been form dock material. All the wooden artefacts are with the AML lab for freeze drying and conservation. It is recommended that they be identified for species and construction techniques.

The consequences of local dewatering on the preservation of organic material is discussed below and must be prevented if the excellent quality of wooden artefacts is to be preserved. It is worth noting that only two machine trenches were cut into the Car Dyke canal and the recovery of artefacts such as the harpoon suggest that there is a significant quantity of preserved organic material within the lower fills of the canal.

Other wooden material from the excavation was in Area IV with the building remains. This material was carbonised and associated with some hearth/oven features. Within the scope of the project no further work is suggested for this material.

8.6.3 Shell

Oyster and mussel shells were recovered from 14 contexts, totalling 368g. The material is associated with occupation phases. and deposits within the Car Dyke canal. The limited excavation in part explains the small size of the assemblage, although the lack of domestic occupation remains would also suggest that this material category might be small. Only species identification and provenance are required.

8.6.4 Glass

Only 7g of glass was recovered from the site, from two contexts. No further analysis is necessary.

8.6.5 **Metallic Finds** with contributions from Chris Montague.

Cu Alloy

A total of 101g of Cu Alloy material was recovered from the site, plus 90g Cu Alloy coins from Metal Detector Survey. The majority of this material was recovered from metal detecting the site after machine stripping, investigating spoil heaps and the systematic survey prior to excavation (c.f.). A number of artefacts were encountered; Roman coins (N=21,

Survey=6, Excavation =15) and a boss disk brooch with guilded black/blue glass (2nd-3rd century AD). The coins are of low value, mostly Dupondius, although a few Sestertius were recovered. The dating is consistent with the mid-2nd century date for the site's beginning. Coin dating ranges from Hadrian (119-138 AD) and Antoninus Pious (138-161 AD) to late 3rd century including Constantine. Only a full coin identification will be required for further analysis.

Fe

A total of 976g of Fe or Iron finds were recovered from the site, also a Roman hammer found from the metal detector survey (650g). This material derives from only 8 contexts. The assemblage consists entirely of iron square headed nails (plus hammer). The assemblage derived from features associated with the building foundations in Area IV (stakeholes, postholes, beam slots, layers and pits) and is directly associated with the occupation on the site. Further research is not recommended for the nails. The iron hammer however needs further investigation.

Pb

A total of 259g of lead (Pb) material was recovered. The assemblage is derived from only 3 excavated contexts as well as unstratified finds from Area IV. The artefacts are mostly weights, although a spindle whorl weight was present. No further research is recommended.

Slag

A total of 4,008g of smithing slag was recovered from the site. The material is derived from 15 contexts all from Area IV in and around the building foundations. 1,199g or 30% was retrieved from spoil tips and unstratified deposits. The potential of industrial functions of the building is suggested and iron smithing nearby is likely. The area is known for Romano-British industrial activity. No further analysis is recommended.

8.7 ENVIRONMENTAL Assessment of macrofossils, with an Appendix on sediment water content and pH by Peter Murphy

8.7.1 Introduction

Excavations were undertaken at the Car Dyke Roman canal close to its confluence with the River Cam at Waterbeach (TL 496642) by the Cambridgeshire County Council Field Unit, under the direction of Stephen Macaulay in August and September 1997 (Macaulay 1997). The key purpose of the project was "to ensure future protection of the site by having a fuller understanding of the archaeological remains". Specific project aims pertinent to this report are to: "record archaeology associated with the Car Dyke and River Cam" and to "examine the present water levels and waterlogging of archaeological deposits, with particular reference to the impact of the proposed Rowing Lake from Milton to Waterbeach".

8.7.2 Factual data

Quantification of material

The following 10 x 10 x 50cm monolith samples were collected.

Monoliths 1 and 2

Through the bank of the canal and underlying 'buried soil', 'peat' and alluvium.

Monolith 1. Top at 2.77m OD = '0cm' in description below.

Monolith 2.	Overlap of 7cm with base of Monolith 1.
0-22cm	Greyish-brown very firm, slightly silty clay; prominent large reddish-brown mottles; charcoal flecks, shell fragments; merging boundary (bank upcast).
22-35cm	Light greyish-brown very firm, slightly silty clay; some off-white inclusions and small reddish-brown mottles; shell fragments; merging boundary (? buried soil).
35-49cm	Dark greyish-brown firm slightly silty clay; shell fragments; narrow boundary (?alluvium).
49-68cm	Very dark greyish-brown firm organic silty clay; degraded wood and charcoal fragments; merging boundary (described as "peat" by the excavators).
68-77cm	Greyish-brown firm slightly sandy clay; merging boundary ('alluvium').
77-93cm	Light greyish-brown firm sandy clay; reddish-brown mottles; flint pebbles near base.

Monoliths 3 and 4

Through the fills of the canal. Top of Monolith 3 at 1.78m OD. Monolith 4 overlaps Monolith 3 by 7cm *i.e.* top of Monolith 4 is at 43cm in Monolith 3.

0-15cm	Dark greyish-brown firm organic mud; reddish-brown mottles; charcoal flecks and shell fragments; merging boundary.
15-83cm	Dark greyish-brown slightly firm organic mud; charcoal flecks and shell fragments; merging irregular boundary.
83-93cm	Brown slightly firm slightly organic mud; very shelly towards base

Additional 'spot' samples were taken from some other contexts, not included in the monoliths.

136	Dark greyish-brown dry very firm silty clay; shell fragments; pottery. ('occupation deposit')
137	Very dark greyish-brown dry very firm silty clay loam; fibrous intrusive roots; degraded shell fragments ('peat')
152	Light greyish-brown moist firm silty clay; fibrous intrusive roots; shell fragments (upper canal fill)

Data collection and method statement

Sub-samples of 5 x 10 x10 cm were removed from the monoliths from the main sediment units for assessment. These varied in weight, depending on lithology, but were *c.* 0.7kg. 0.5kg sub-samples from 136, 137 and 152 were examined. The samples were disaggregated by prolonged soaking in hot water. Some resistant clayey aggregates were not fully broken down by this means, but adequate disaggregation was achieved for assessment. Organic fractions were separated by wash-over, using 0.25mm meshes, and the mineral residue was wet-sieved on a 0.5mm mesh. The organic fractions were kept wet, but the mineral material (including mollusc shells etc.) was air-dried. Two petri dishes of both fractions were scanned under a binocular microscope at low power, noting the presence of plant and animal macrofossils (and large microfossils), and recording any particularly abundant taxa. The focus of attention here was on plant macrofossils and molluscs, these being the most abundant and best-preserved macrofossils. Insect remains, cladocerans and mosses were noted, but they were sparse and very fragmentary, and were not thought to merit separate assessment. Ostracods were present in some samples. Results are presented in Tables 1 and 2.

Sub-samples were also removed for determination of pH and % water content of sediments. pH estimations were made on homogenised sediment from the 'spot' samples and the canal fills in Monolith 3. For each determination, a 0.5ml spoon spatula-full was suspended in 10ml of de-ionised water, and pH was measured using an Eijelkamp electronic meter. % water content was determined by drying samples at 100°C for 24 hours, preceded and followed by weighing.

pH and % water content

Results are presented in Tables 3 and 4 and Figure 1(Appendix 1), where their significance for management purposes is considered.

8.7.3 Statement of potential

The project may be considered to have three components: palaeoecological reconstruction, the recording of the state of preservation of biological remains as they exist at present as a 'benchmark' relevant to future monitoring of the site and evaluation of the potential of animal microfossils (particularly ostracods) to yield pertinent palaeoecological data.

The canal fill samples assessed from Monoliths 3 and 4 indicate consistently freshwater conditions, with no clear evidence from either molluscs or plant macrofossils for discontinuities of deposition or phases of desiccation (Table 1). There is, however, some evidence for changes in water quality: *Ranunculus sceleratus*, (commonly an indicator of eutrophication) and Charophyta, (an indicator of water free from organic pollution) show variations in abundance, which require further investigation. Such variations probably relate to the intensity of human activity in the vicinity.

In Monoliths 1 and 2, plant macrofossils were very poorly preserved, but the molluscs, (dominated by 'freshwater slum' taxa) will provide data on changing conditions on the canal banks. For the same reason, further work is required on the molluscs from three 'spot' samples (Table 2). In 136, the relatively well-preserved uncharred plant macrofossils and charred material (hinting at cereal processing in the vicinity also need further work).

From a management viewpoint the macrofossils most sensitive to future changes in hydrology are the plant remains. Their current state of preservation needs record, following an objective scheme so that any effects of de-watering related to the Rowing Lake construction can be monitored during future excavations and appropriate mitigation adopted.

8.7.4 Appendix 1: sediment water content and pH

Resources were not available during this evaluation excavation for thorough study of the physical and chemical characteristics of the deposits. Long-term monitoring of the site would be required for a real understanding of its hydrology and any threat from de-watering. However, two variables were readily measurable (water content and pH of samples). These provide some preliminary indication of the current nature of the sediments, and suggest lines for further investigation.

The percentage water content and percentage dry weight of samples from Monoliths 1 - 4 and the 'spot' samples are shown in Table 3 and Figure 1. The canal fills below 1.78m OD in Monoliths 3 and 4 were fully waterlogged when sampled, with water contents of about 50%. The rather lower water content of the basal sample (Monolith 4, 88-93cm) is misleading for this is a shelly lag deposit, coarser-textured with more inclusions than the overlying organic mud fills of the canal. Sediments at higher elevations (Monoliths 1 and 2) show evidence of de-watering, with water content generally decreasing upwards.

8.8.5 Laboratory work

Pollen samples were processed using the standard method; about 1 cm^3 subsamples were dispersed in dilute NaOH and filtered through a 70µm mesh to remove coarser material. The organic part of the sample was concentrated by swirl separating on a shallow dish. Fine material was removed by filtration on a 10µm mesh. The material was acetolysed to remove cellulose, stained with safranin and mounted on microscope slides in glycerol jelly. Counting was done with a Leitz Dialux microscope. Identification was using the writer's pollen reference collection, seen with a Leitz Lablux microscope. Standard reference works were used, notably Fægri and Iversen (1989) and Andrew (1984). For the purposes of the assessment fairly small pollen counts were done to provide pollen sums, used in calculating percentages, of 120-200 grains. The pollen results are presented in pollen diagrams which have been drawn using the TILIA software programme. The nomenclature and order of the taxa partly follows Bennett (1994) and Kent (1992) respectively.

8.8.6 Results

These are shown in outline pollen diagrams for Car Dyke A (Fig 3) and Car Dyke B (Fig 4). The diagrams are arranged in approximate ecological groups as far as they can be told from the pollen records.

Trees and woodland
The selection of trees and shrubs, with *Quercus* (oak), *Alnus* (alder), *Corylus* (hazel) and *Pinus* (pine), together with a range of other trees and shrubs. The amounts suggest a mainly open, occupied, landscape with a little remaining woodland. On the basis of the rather coarse resolution so far obtained, no evidence can be seen of much change in the balance of woodland and other vegetation during the period represented by the diagrams, which approximates to the Roman period from the 2nd to the 3rd and 4th centuries (Macaulay 1997).

Crops and weeds
These are represented by a small but fairly consistent record of Cerealia type pollen throughout Car Dyke B, and in the upper part of Car Dyke A. There were possible records of *Vicia faba* (bean) and *Pisum* (pea) at the bottom of Car Dyke B, things which are not often found. A number of pollen records of weeds, such as Chenopodiaceae (goosefoot), *Artemisia* (mugwort) and *Anthemis* type (mayweeds) and possibly *Rumex* (docks and sorrels) could represent weeds of cultivated ground, such as *Rumex acetosella* found among the macrofossils (Murphy 1998). There is no significant change through time seen in these records. Further work would probably provide more detail on these important aspects of the Roman landscape.

Grassland herbs
Although Poaceae (grasses) feature here, in fact grasses can be found in almost every habitat. Similarly, Lactucae, which includes many yellow-flowered composites such as dandelions, hawkbits and similar, and *Ranunculus* type, which includes buttercups, could indicate various habitats. Better evidence of grassland comes from a number of pollen records that represent mainly grassland plants, such as *Centaurea nigra* (knapweed), *Trifolium* species (clovers), *Plantago lanceolata* (ribwort plantain). Two records, *Centaurea scabiosa* (greater knapweed) and *Sanguisorba minor* (salad burnet) are especially characteristic of calcicole habitats, such as limestone grassland.

Other herbs
A number of other pollen records which are rather unspecific may give more information when compared with macrofossil identifications to species, such as Brassicaceae, comparing with *Brassica* sp. (black mustard, etc.).

Wetland herbs
As usual with waterlain deposits, wetland and aquatic herbs pollen is plentiful. These records correspond closely with the macrofossil records, thus Apiaceae (*Oenanthe* sp., water dropwort), *Alisma* type (Alismataceae, water plantain), *Ranunculus Batrachium* type, (water crowfoot), *Nuphar* (*Nuphar lutea*, yellow water-lily), *Nymphaea* (*Nymphaea alba*, white water-lily, *Nymphoides* (*Nymphoides peltata*, fringed water lily), *Potamogeton* (pondweeds), Cyperaceae (*Cladium mariscus*, *Carex* species, sedges) (Murphy 1993, 1998).

There were a few records of spores of *Polypodium* polypody and from *Pteridium* (bracken.). In Car Dyke B there was a record of *Trichuris* (whipworm) parasite ova at 10 cm, which suggests a level of sewage contamination in the canal.

8.8.6 Correlation with other sites

The outline pollen diagrams Carr Dyke 7 and Carr Dyke 8 (Boreham, undated), show a similar pattern of trees, crops, herbs and aquatics to that outlined above.

The macrofossil results (Murphy 1998) are partially comparable with the pollen results, as mentioned above. Trees are usually better recorded from pollen, and what the macrofossils add to the picture so far obtained is that *Alnus* (alder) and *Salix* (willow) were locally present (as might be expected), and that *Salix* is rather under-represented in the pollen results. Crops were not represented in the canal fill, but some charred cereal remains appeared from other samples such as occupation deposit 136, further evidence of arable farming there. Little sign of grassland was found among the macrofossils.

8.8.7 Research design (see below)

Aims and objectives
1. To provide detailed and dated information on the local environment during the Roman period, and land use and the crops grown, integrated from the evidence of the various lines of biological, sedimentological and archaeological evidence.
2. To detect and any changes with time to the landscape, for example connected with the abandonment of the canal.
3. To establish the state of preservation of pollen now, as a guide to management policy in the future.

8.8.8 Methods statement

It would be worth increasing the sums of 250 grains per sample. It would also be worth counting 13 intermediate samples to bring resolution of the results in Bar Dyke B by counting more pollen bring the counts up to pollen the resolution up to 5 cm interval between samples.

8.8.9 Tasks and timing

1.	Technician, preparation of 13 pollen samples		1 day (£70)
2.	J. Greig.	Further pollen counts to 13 samples already prepared and counted	6 days
	J. Greig.	counts of 250 grains pollen sum on 13 additional samples	12 days
	J. Greig.	Writing report for publication	3 days
	total days		**21 days**

Acknowledgements
The support of English Heritage for doing this work is gratefully acknowledged. My thanks to Stephen Macaulay and Peter Murphy for providing unpublished information for quotation here.

8.9 CAR DYKE MICROMORPHOLOGICAL ASSESSMENT
by M. G. Canti

8.9.1 Introduction

The stratigraphy at the SW end of trench 1 consisted of gravels from the western bank of the canal, thrown up onto the pre-existing layers (see Figure 1). At the base was a peat (114) on clayey alluvium, with a paler alluvium over it (113) and bank materials (132 and 111) over that. The aim of this work was to determine whether there were any remains of buried soils or other land surfaces between the peat and pale alluvium layers (114-113) or between the alluvium and bank layers (113-132/111), and to report on any analytical potential that such layers would offer.

Four sample tins were taken from a column encompassing the target boundaries (Figure 1). All four were impregnated to stabilise them, but only two (nos. 2 and 3) were selected to produce thin sections for this assessment - these two enclosed most of the actual boundary layers.

8.9.1 Slides

The two slides are highly similar. They consist mostly of fine silt-sized (2-15 μm) calcium carbonate along with shell fragments and a small scattering of sand-sized quartz or calcium carbonate grains. flint and earthworm granules. Iron staining and organic remains are found in places, but there are no consistent changes either in the expected positions (top of 2 and bottom of 3) or elsewhere which would suggest remains of buried topsoil material.

8.9.2 Conclusions

There are no grounds for thinking that the buried land surface is preserved in this part of the stratigraphy. Most probably, alluviation occurred at a steady pace for most of the pre-Roman Holocene, with only a single pause now represented by the peaty layer (114). No further analytical work is recommended.

8.10 ARCHAEOMAGNETIC ANALYSIS OF SAMPLES FROM A ROMAN KILN AT CAR DYKE, CAMBRIDGESHIRE By GeoQuest Associates (edited version for assessment by Stephen Macaulay)

8.10.1 Introduction

This report describes the result of an archaeomagnetic study of samples obtained from a Roman kiln excavated in the bank of the Car Dyke canal near Cambridge.(TL 496 641). Archaeomagnetic sampling of the feature was carried out on 2nd September 1997 by Paul Linford of the Ancient Monuments Laboratory, English Heritage. Oriented specimens were removed from the following contexts:

Context 120: Kiln floor of yellow, plastic fired clay with ash (samples CD1 - CD12).
Context 143: Wall of kiln of hard fired clay or concrete (samples CD13 - CD19).

The samples were despatched to GeoQuest Associates on 17th September 1997. All specimens arrived in good condition.

8.10.2 Sample Preparation and Measurement

Archaeomagnetic sampling of the kiln floor and wall utilised the button method described in Appendix A in full report.

Each specimen was first consolidated by impregnation with a diluted solution of PVA in acetone. The samples were then cut with a water cooled diamond saw until the button retained a volume which fitted the standard 25x25mm specimen holder inside the GeoQuest archaeomagnetic magnetometer. After drying at room temperature, a further protective coating of PVA was applied to each sample.

The natural remnant magnetisation (NRM) of all samples was measured in a Molspin fluxgate spinner magnetometer with a minimum sensitivity of around $5x10\text{-}^{9}Am^{2}$.

From a study of the demagnetisation test data, an alternating field of 5mT was chosen which would provide for the optimum removal of secondary components of magnetisation in the remaining samples from Context 143 (kiln wall). It was not feasible to carry out demagnetisation tests on any specimen from Context 120 since the archaeomagnetic NRM was too weak and close to the noise level of the fluxgate magnetometer.

8.10.3 Results and Discussion

General

The kiln floor contained weak NRM, barely detectable above noise level of the magnetometer. This suggests either that the material contains only a small fraction of ferrimagnetic minerals or that the floor deposit has been insufficiently heated in the ancient geomagnetic field.

In contrast, samples recovered from the fired clay or concrete kiln wall were found to contain strong to intense NRM, indicating that the fabric contains a significant fraction of remanence-carrying ferrimagnetic mineral.

Context 120: Kiln Floor

NRM vectors in this context were found to be highly scattered. This factor, coupled with a low intensity of the magnetisation, has unfortunately made it impossible to derive an archaeomagnetic date for the firing of the kiln floor. On the basis of the archaeomagnetic evidence it seems likely that Context 120 represents a deposit of ashy or otherwise unfired material that was deposited onto the floor of the kiln at a temperature below 580°C.

Context 143: Kiln Wall

Although the set of vectors is poorly grouped, each sample clearly contains an archaeomagnetic remanence which has been geomagnetically controlled.

Absolute Dating

The set of six archaeomagnetic vectors in Context 143 are too dispersed to compute a mean direction from which an archaeomagnetic date can be derived. In order to test whether individual samples from the kilnwall might provide some indication of firing date it was decided to compare each vector to the British Master Curve. Neither vector could be correlated with the curve and that the dispersion of the group exceeds the amplitide of geomagnetic secular variation during the Roman period. Hence it has not been possible to draw any conclusions regarding the last firing date of the kiln wall.

8.10.4 Conclusions

The results of this research can be summarised as follows:

1 An archaeomagnetic study has been carried out of two contexts in a Roman kiln recently excavated at Car Dyke in Cambridgeshire, with the aim of determining the last date of firing.

2 An almost random distribution of archaeomagnetic vectors was found in samples obtained from the kiln floor. This suggests that the material has either not been fired to a sufficiently high temperature or that it contains a very low concentration of magnetic iron oxides.

3 An intense archaeomagnetic, evidently controlled by the Earth's magnetic field was measured in samples from the kiln wall. However, the vectors were too scattered to obtain a date through comparisons with the British national curve. This dispersion may reflect differential movement in the kiln wall during burial.

9 UPDATED PROJECT DESIGN

9.1 SITE CONTEXT AND SIGNIFICANCE

English Heritage's updated survey of archaeological endeavour and agenda for future work (English Heritage 1997) draws attention to the importance of archaeological remains dating both to the Late Iron Age and Romano-British periods (300 BC-AD 200) and the nature of the change in the late Romano-British society (200-700 AD) in the 3rd and 4th centuries (English Heritage 1997, 44). Of particular significance is the impact of the Roman colonisation of the fens (regional variation) and the on-going research into the complexity of the transition. The excavation of the Car Dyke canal at Waterbeach, which begins in the Hadrianic/Antonine (early-mid 2nd century AD), relates to the first significant Roman impact in the Cambridgeshire fens, and will contribute to such issues, as well as enhancing the English Heritage funded Fenland Research Project.

The site does not persist into the later 4th century, rather ending by the late 3rd/early 4th century, a fact which has important implications, not least of which is the deterioration of the environmental conditions. English Heritage research priorities (English Heritage 1997) state importance of understanding sites, with reference to the environmentally driven reasons for continuity and change. Cambridgeshire's local priorities for Roman pottery directly feed into the national agenda's for assemblages derived from well understood and stratified sites. At present no quantified pottery assemblages exist for Roman Cambridgeshire, outside of Peterborough and Godmanchester.

Car Dyke, Waterbeach will add to the on-going Regional/Local research on the Roman period. Research and Archaeology: A Framework for the Eastern Counties - 1. Resource Assessment (Going in Glazebrook 1997) for the Roman period notes the lack of knowledge of rural settlements in the region (Going in Galzebrook 1997, 38). Indeed there is a need to define the settlements kinds, which do not fit the traditional terminology (e.g. Villa). The excavations at Waterbeach are in an area of proto-industrial activity areas north of Roman Cambridge on the southern fen edge. It is an area of both continuity and change from the Iron Age and early Roman periods. The Cam valley reveals both a continuation of Late Iron Age (1st century BC/AD) settlement which persists after the Roman conquest, but begins to show significant changes towards the end of the 2nd century AD, at a time when the Romanization of the country was reaching its zenith. To the north of Cambridge, along the River Cam, Romano-British settlement in the 2nd century shows areas of industrial activity, pottery industries and riverside settlement. The Roman Road and canal networks begins to become established and the exploitation of the fenland enters a new stage. For the Roman fens, Potter in Fenland Research (No:7 1992), does state that the hypotheses for the area, are largely based on few facts. The Roman 'small' town or administrative centre at Stonea Grange, Wimblington has been interpreted as the Imperial centre for the fens and as such replacing/discounting the need for private Villa estates within the fens. Car Dyke, Waterbeach will provide more data on the role of trade, contact and the economic developments of the area. The excavation, although limited, provides large, quantified site and artefact assemblages, which not only inform about Waterbeach, but provide important implication for the fens in general, and contact with the rest of the country, as well as continental Europe.

Roman settlement in the Waterbeach area is linked to similar settlement along the southern Cambridgeshire fend edge e.g. Milton, Cottenham, Landbeach and Horningsea. The pottery industry at Horningsea is of particular importance. recent excavations have revealed a great number of pottery kilns on the western banks of the River Cam, indicating that the potteries were not simply local to Horningsea itself. Importantly the understanding of the ceramic material for trade and transportation, relationships to the Roman Roads (e.g. Akeman Street) and the waterways (e.g. possible docks at Stuntney and the Car Dyke Canal to the north), within the fens will add to the on-going research on the Cambridgeshire potteries, particularly the industries at Horningsea and for settlement along the southern fen edge (e.g. Milton, Landbeach, Waterbeach, Denny End, Cottenham etc.) and Cambridge City.

The general picture of the Roman fen and fen edge settlement develops from an intensively developed southern and western perimeter towards the 'inhospitable' fens, developing along the arteries of roads and waterways. Settlement clusters and site types have been defined in the Fenland Project, in the main from fieldwalking, with some limited excavated material to support (Hall 1996). It has been suggested that these sites were geared towards cattle and selected industrial functions. Agricultural siltland settlements were mainly concerned with animal husbandry (Coles & Hall 1998). The most remarkable (Coles & Hall 1998) Roman discovery in the fens, remains the Roman building at Stonea Grange, first identified in 1979 and excavated during the early 1980's by the British Museum (Potter 1996). The massive building has formed the basis for a theory of an Imperial Fen Estate and administrative centre. This, although many Roman villas are located around the fen-edge are thought to have controlled large territories. It may be that the on-going work on the Cambridgeshire Car Dyke will shed yet more light on the systematic exploitation of the fens, as well as the nature of the contact and trade along the eastern seaboard , as well as further west.

9.2 STATEMENT OF POTENTIAL

The Assessment Report identifies the **Stratigraphic (8.1)** and **Ceramic (8.2)** assemblages as the critical data for the understanding of the site and information key for meeting the project's Aims and Objectives (see 9.3 and 9.4 below). The contributions of the palaeoenvironmental assessments also need highlighting at this stage.

9.2.1 Material Categories

Stratigraphic Data
The primary purpose of the project was to determine the nature, condition and survival of the Car Dyke canal and the related archaeology to accurately make recommendations for the future management of the site. In addition the understanding of the stratigraphic/phasing development of the Car Dyke Canal, its construction, use and dis-use, was a primary concern. As was the investigation of the engineering of the monument, determining its relationship with the River Cam and by implication its construction. The data now exists to accurately understand the canal for the first time and accurately date and sequence the monument.

Palaeoenvironmental
The investigation into the survival of buried deposits (both artefactual and ecofactual) from the Car Dyke , has been critical in determining not only the archaeology of the site, but to make important recommendations and proposals for the future management of the site. This ability to accurately advise on the state of buried (and waterlogged) materials will be fundamental in protecting the site, in an area of extensive development and fluctuating water levels. The potential identification of a *perched* watertable is of crucial importance in making recommendations on the impact of proposed nearby developments.

Ceramic
The recovery from the Car Dyke, Waterbeach excavations of a very large pottery assemblage, has been further enhanced by the discovery of a Horningsea style pottery kiln on the bank of the Car Dyke canal, within metre's of the connection with the River Cam. Apart from the obvious significance of such a find on a site, the present lack of understanding of the Cambridgeshire Horningsea pottery industry, coupled with the dearth of useful, large, quantified pottery assemblages for Cambridgeshire as a whole. Mean that the ceramic assemblage from Car Dyke, Waterbeach takes on a significance beyond that of the project itself.

9.2.2 Publication beyond the Project

As stated within the Post-Excavation Assessment and above, the **Ceramic Assemblage** will be considered for publication beyond the scope of the site report. The site report will contain a brief assessment and spot dating on the assemblage. A Full Report, which will include other important local assemblages (e.g. Cottenham and Horningsea) and pertain to the wider local and region will have a Research design submitted in 1999.

9.3 AIMS AND OBJECTIVES

The updated aims and post-excavation objectives for analysis can be defined as:

(1) Refine dates and sites sequence of the Roman settlement development, in particular the date(s) for the construction, use, re-use and dis-use of the Car Dyke canal.
(2) Understand the relationship (engineering) between the Car Dyke canal and the River Cam.
(3) Determine the extent of plough damage and the extent of preservation.
(4) Record all the archaeology associated with the Car Dyke and the River Cam.
(5) Understand the modern water levels and the impact of modern land management for the future preservation of the buried deposits at the site.
(6) Contribute towards an understanding of the distribution and development of the pottery of the Romano-British period in the region and in the Cambridgeshire fens in particular. The pottery will be included in a forthcoming English Heritage for Cambridge fen edge pottery.
(7) Contribute to the Fenland Research Project and the interpretation of the Roman fen edge.
(8) Add to the on-going debate concerning the role of the Car Dyke canal, its function(s) and relationships to sections in Lincoln and Cambridgeshire.
(9) Understand the process of *intra* site development and changing economic and occupation function of the site and the implications for the development of the wider area. Interpret these changes through the environmental changes and impact of the wider fens during the Roman period. This will contribute to the knowledge of the character and management of the fens during the period and suggest models for the fluctuating sea levels and exploitation of resources.
(10) Contribute to the investigations of Roman coastal agricultural regimes (Going in Glazebrook 1997) and the character, change and development of Romano-British rural life. The understanding of the full sequence of site occupation will provide excellent data for an area possessing few such stratified sites.

9.3.1 Specialist Reports

Following consultation with the English Heritage Inspector, within the scope of the project little further analysis will be carried out on the material categories recovered during the excavation. The incorporation of existing specialist reports and assessments will be sufficient to meet the aims of the project. As stated above the pottery is worthy of further analysis, however this will be completed through a separate project. The only further analysis, other than the compilation of the full report from the stratigraphical and structural data, is detailed below and concerns the work on Plant Macrofossils and Pollen for Palaeoenvironmental reconstruction.

9.3.2 ENVIRONMENTAL Assessment of macrofossils, with an Appendix on sediment water content and pH by Peter Murphy

Aims and Objectives

These are threefold:

(1) To provide information from plant and animal macrofossils on local environmental conditions, flow and sedimentation within the canal, thereby indicating changes in its utility as a routeway. Additionally palaeoecological data from canal-side deposits will give an indication of the ways in which the adjacent land may have been used.

(2) To give an objective measure of the state of preservation of biological remains at the site *now*, so as to provide a 'benchmark' for future monitoring and management.

(3) To evaluate the potential of ostracods for yielding data on water flow and quality in the canal fill samples (Monoliths 3 and 4).

Methods Statement

It is considered that the sub-samples already assessed will yield sufficient data to meet objectives (1) and (2), once analysed. They are partly processed already, as described above (*Data collection and method statement*), and now only require complete disaggregation of resistant soil aggregates, followed by sorting by a technician, using a binocular microscope at low power. The sorted molluscs and plant macrofossils will be identified by comparison with modern reference material. Objective evaluation of the state of plant macrofossil preservation will be recorded (Murphy and Wiltshire 1994) for graphical comparison with % water content. Insects are rare and generally poorly preserved in these deposits, but any material present will be extracted and submitted to an appropriate specialist: Mark Robinson (Oxford). Ostracods were noted in some samples from Monoliths 3 and 4, and it is proposed that further sub-samples should be submitted to James Wells (A.M. Lab, London) for evaluation and subsequent analysis if they are considered informative and appropriate.

9.3.3 ASSESSMENT OF POLLEN AND PLANT MACROFOSSILS FROM CAR DYKE, WATERBEACH CAMBRIDGESHIRE (WATCD 97) by James Greig

Research design

Aims and objectives

(1) To provide detailed and dated information on the local environment during the Roman period, and land use and the crops grown, integrated from the evidence of the various lines of biological, sedimentological and archaeological evidence.

(2) To detect and any changes with time to the landscape, for example connected with the abandonment of the canal.

(3) To establish the state of preservation of pollen now, as a guide to management policy in the future.

Methods statement

It would be worth increasing the sums of 250 grains per sample. It would also be worth counting 13 intermediate samples to bring resolution of the results in Bar Dyke B by

counting more pollen bring the counts up to pollen the resolution up to 5 cm interval between samples.

Tasks and timing

1.	Technician.	preparation of 13 pollen samples	1 day (£70)
2.	J. Greig.	Further pollen counts to 13 samples already prepared and counted	6 days
	J. Greig.	counts of 250 grains pollen sum on 13 additional samples	12 days
	J. Greig.	Writing report for publication	3 days
	total days		**21 days**

9.4 METHOD STATEMENT

The table below summarises the potential of each of the suggested analysis areas to meet the research aims and objectives.

Research Aims:	1	2	3	4	5	6	7	8	9	10
Main Analysis Area										
Stratigraphic	X	X	X	X	X	X	X	X	X	X
Pottery	X		X	X		X	X	X	X	X
Faunal remains				X					X	
Fired Clay/Kiln		X		X		X	X	X	X	X
Tile				X		X			X	
Other Finds	X	X	X	X			X	X	X	X
Plant Macrofossils	X	X		X	X		X	X	X	
Pollen		X		X	X		X	X	X	
Soil Micromorph										
Arch Mg Dating										

It is important to note that each of the areas of analysis will be of little value if studied without regard to its context both at site, local and regional level. Assessment has indicated that there may be potential for looking at the spatial/stratigraphical distribution of a number of data types. The function and activity zones on the site change both through time and with regard to spatial positioning. Certain periods are richer in faunal remains and the industrial activity shifts through the site. Further analysis will show the full development of the site and the implications for the sites economic and functional development, potentially demonstrating both zonal and temporal activities.

10 PUBLICATION SYNOPSIS

In addition to the archive report, it is intended to publish the report in the County Council County Farms Evaluation Report Series. Summaries will be submitted to Britannia (Notes). As stated above the pottery will be included in a forthcoming English Heritage project for the Roman Cambridgeshire Fenland and Southern Fen-edge.

It is suggested that the final report will follow an established pattern, as follow;

Background to excavation, archaeological and historical context
The site summary - phases of activity
The pottery and ceramic material
The environmental remains
The faunal remains
The other finds
Discussion and Conclusions (including regional and local settlement contexts)

11 RESOURCES AND PROGRAMMING

Task List

Compile groups and phasing for distribution to specialists	2 day (PO)
Liaise with specialists and incorporate specialist reports	2 days (PO)
Compile illustrations list and liaise illustrator	2 days (PO)
Write excavation report	15 days (PO)
Contribute to report in its regional context	2 days (PO)
Assemble report	2 days (PO)
Edit report	2 days (PM)
Incorporate edits	2 days (PO)
Proof reading	2 days (EC)
Draw and mount maps/plans/sections	10 days (ILL)

Environmental Analysis (Tasks and timing)

1. Technician. Disaggregating, sieving and sorting 12 samples and sub-samples. Submitting material to insect specialist. Removing additional samples from Monoliths 3 and 4 for submission to ostracod specialist.

10 days at £60 = £600

2. P. Murphy.

Identification of molluscs and plant macrofossils from 12 samples.	15 days
Recording plant macrofossil preservation.	2 days
Liaison with other specialists, supervision, co-ordination.	1 day
Report for publication.	3 days
Total input	**21 days**

REFERENCES

Amorosi, T (1989). **A Postcranial Guide to Domestic Neo-Natal and Juvenile Mammals**. BAR Int Ser. 533. Oxford.

Andrew, R. (1984). **A practical pollen guide to the British flora.** Quaternary Research Association, Technical Guide 1, Cambridge

Armitage, P.L (1982). "A system for ageing and sexing the Horn Cores of Cattle from British post-medieval sites (17th to early 18th century) with special reference to unimproved British Longhorn Cattle. In: Wilson, B, Grigson, C and Payne, S (eds.). **Ageing and Sexing Animal Bones from Archaeological Sites**. BAR Brit. Ser. 109. Oxford: 37-54.

Armitage, P.L and Clutton-Brock, J. (1976). A System for Classification and Description of the Horn cores of Cattle from Archaeological sites. **J.A.S. 3**:329-348.

Astbury, A.K. 1958. **The Black Fens**. The Golden Head Press Ltd. Cambridge.

Babington, C.C. 1883. 'Ancient Cambridgeshirei. Octavo Series Proc. **Cambridge Antiq. Soc** XXIX 1851-1897.

Bennett, K.D. (1994). **Annotated catalogue of pollen and pteridophyte spore types of the British Isles**. unpublished report.

Boreham, S. (1994) **Carr Dyke pollen analysis**. Unpublished report

Boreham, S. (undated) **Carr Dyke: Second report on the preparation and assessment of pollen samples**. Unpublished report

Cambridgeshire Sites and Monuments Record (SMR).

Clark, A.J., Tarling, D.H. & Noel, M. (1988). 'Developments in archaeomagnetic dating in Britain' in **Archaeometry, 15**, 645-667.

Clark, J.G.D et al (1935). 'Report on Recent Excavations at Peacock's Farm, Shippea Hill, Cambridgeshire'. **Antiq. J. 15**:248-3.

Clark, J.G.D. 1949. 'Report on Excavations of the Cambridgeshire Car Dyke 1947'. **Antiquaries Journal 29**: 145-163.

Coles, J and Hall, D. (1994). **Fenland Survey: an Essay in Landscape and Persistence**. English Heritage, Arch Rep 1, Billington Press.

Coles, J and Hall, D. (1998). **Changing Landscapes: The Ancient Fenland.** Cambridgeshire County Council.

Darby, H.C. 1983. **The Changing Fenland**. University Press Cambridge.

Dewhurst, P.C. 1964. 'Wool Street, Cambridgeshire'. **Proc. Cambridge Antiq. Soc LVI & LVII**; 42-60

Driesch, A. von den (1976). **A Guide to the Measurement of Animal Bones from Archaeological Sites.** Peabody Mus. Bull. 1. Harvard.

Driesch, A. von den and Brossneck, J. (1974). Kritische Ammerkung zur Widerrithohenberechnung aus Langenmassen vor- und Fruhgesschichlicher Tieknochen. **Saugetierkundliche Mitteilungen 22**:325-348.

English Heritage (1991). **Management of Archaeological Projects.**

English Heritage (1997). **English Heritage Archaeology Division Research Agenda.** Draft.

Fægri, K. and J. Iversen (1989). **Textbook of pollen analysis** (4th edn.), in K. Fægri, P.E. Kaland and K. Krzywinski, Wiley, Chichester.

Fock, J. (1966). Metrische Untersuchungen an Metapodien einiger europaischer Rinderrassen. Dis. Munich.

Fowler, G. 1932. 'Fenland Waterways, Past and Present. South Level District.' **Proc. Cambridge Antiq. Soc XXXIII**: 108-128 (Part I) & XXXIV: 17-33 (Part II).

Fox, C. 1923. **The Archaeology of the Cambridgeshire Region.** University Press Cambridge.

Glazebrook, J. ed (1997). **Research and Archaeology: a Framework for the Eastern Counties, 1. Resourse assessement.** EAA Occ. Paper No. 3.

Grant, A. (1982). The Use of Tooth Wear as a Guide to the Age of Domestic Ungulates. In: Wilson, B, Grigson, C and Payne, S (eds.). **Ageing and Sexing Animal Bones from Archaeological Sites.** BAR Brit. Ser. 109. Oxford: 91-108.

Gurney, D. (1986). **Settlement, Religion and Industry on the Fen Edge: Three Romano-British Sites in Norfolk.** EAA No. 31.

Guttmann, E. and Robinson, B. (1996). **'An Archaeological Evaluation of the proposed site of the Cambridge Rowing Trust Rowing Lake at Milton and Waterbeach, Cambridgehsire.** Cambs CC Arch. Field Unit Report No. 120.

Hall, D. 1985a. 'Cambridgeshire' In R.J. Silvester (ed) **Fenland Research Vol 2**: 46-49.

Hall, D. 1985b. **The Fenland Project, No.2 Fenland Landscapes and Settlement between Peterborough and March.** East Anglian Archaeology Report No.35, 1987.

Hall, D. & Coles, J. 1994. **Fenland Survey.** English Heritage, Billington Press Ltd.

Hall, D. (1996). **The Fenland Project 10: Cambridgeshire Survey, the Isle of Ely and Wisbech.** EAA No. 79.

Harcourt, R.A. (1974). The Dog in Prehistoric and Early Historic Britain. **J.A.S. 1**:151-175.

Hartley, B.R. 1970. 'The Dating of the Cambridgeshire Car Dyke'. in Phillips (ed). **The Fenland in Roman Times.** R.G.S Research Series No.5, 126.

Kent, D.H. (1992). **List of vascular plants of the British Isles.** Botanical Society of the British Isles, London.

Lethbridge, T.C. 1933 'Huts of the Anglo-Saxon period' **Proc. Cambridge Antiq. Soc XXXIII**: 133-151

Lethbridge, T.C. *1935* 'The Car Dyke, the Cambridgeshire Ditches and the Anglo-Saxons' **Proc. Cambridge Antiq. Soc XXXV**: 90-96

Lethbridge, T.C. 1957. 'The Riddle of the Dykes' **PCAS LI**: 1-7

Macaulay, S.P. (forthcoming). **The Car Dyke canal and Roman Warehouse Clayhithe, Waterbeach** Cambs CC Arch. Field Unit Report No.

Macaulay, S.P. and Reynolds, T. (1994). **Car Dyke: a Roman Canal at Waterbeach**. Cambs CC Arch. Field Unit Report No. 98.

Macaulay, S.P (1997). **Car Dyke Roman Canal, Waterbeach 1997.** ***Summary report.*** Cambridgeshire County Council Arch Field Unit Internal/SMR Report.

Malim, T. 1990. **Archaeology on the Cambridgeshire County Farms Estate**. Cambridgeshire County Council.

Mansfield, R. 1965. **The Roman City of London**, G Benn Ltd, Cambridge.

Milne, G. 1985. **The Roman Port of London**. Batsford London.

Molyneux, L. (1971). 'A complete result magnetometer for measuring the remanent magnetisation of rocks' **Geophys. J. R. astr. Soc. 24**, 429-433.

Murphy, P (1993). **The Car Dyke, Waterbeach, Cambridgeshire (WATCD92). Assessment of soils, sediments and macrofossils**. Unpublished assessment report.

Murphy, P. and Wiltshire, P.E.J. (1994). 'A proposed scheme for evaluating plant macrofossil preservation in some archaeological deposits'. **Circaea 11**(1), 1-6.

Murphy, P (1998). **Car Dyke, Waterbeach, Cambridgeshire (WATCD97). Assessment of macrofossils with an appendix on sediment water content and pH**. Unpublished assessment report.

Noel, M & Batt, C.M. (1990). 'A method for correcting geographically separated remanence directions for the purpose of archaeaeomagnetic dating', **Geophys. J. R. astr. Soc., 102**, 753-756.

Phillips, C.W.(ed) 1970. **The Fenland in Roman Times**. RGS Research Series No.5: 126

Potter, T. 1966. 'The Roman Pottery from Coldham Camp and its Affinities' **Proc. Cambridge Antiq. Soc LVIII**: 12-37

Potter, T.W. (1992). 'Fenland Research Priorities: Roman' in **Fenland Research No. 7**. CAU.

Potter, T.W. and Jackson, R.P.J. (1996). **Exacavations at Stonea, Cambridgeshire 1980-85**. British Museum.

Pryor, A. 1978. **The Car Dyke Durobrivae: A Review of Nene Valley Arch. No.6**: 24, 25.

Ravensdale, J.R. 1974. **Liable to Flood.** University Press Cambridge.

Reaney, P.H. 1943. **'The Place-names of Cambridgeshire and the Isle of Ely'**. Cambridge University Press.

Reynolds, T (1994). **Iron Age/Romano-British Settlement at Milton Rescue Project 1994.** Cambs CC Arch. Field Unit Report No. 104.

Seale, R.S. 1975. **Soils of the Ely District**. Harpendon.

Silver, I.A. (1969). The Ageing of Domestic Animals. In Brothwell, D and Higgs, E (eds.). **Science in Archaeology**. Thames and Hudson, London.

Simmons, B.B. 1975. **The Lincolnshire Car Dyke**. The Car Dyke Research Group Publication No.1

Simmons, B.B. 1979. 'The Lincolnshire Car Dyke: Navigation of Drainage?'. **Britannia Vol.10**: 183-196.

Sisson, S and Grossman, J.D. (1953). **The Anatomy of the Domestic Animals.** W.B. Saunders, Philadelphia and London.

Swan, V.G. 1984. **The Pottery Kilns of Roman Britain**, RCHM, HM Stationery Office, London.

Tebbutt, C.F. 1957. 'A Belgic and Roman Farm at Wyboston, Bedfordshire' **Proc. Cambridge Antiq. Soc L:** 75-84

Thorpe, R. & Zeffertt, T. 1989. **Excavation of the Lincolnshire Car Dyke, Baston.** Fenland Research No.6.

Walker, F.G. 1912. 'Roman Pottery Kilns at Horningsea'. **Proc. Cambridge Antiq. Soc XX**: 14-69

Worssam, B.C. 1969. **Geology of the County around Cambridge**. HMSO, London.

Wheeler, R.E.M. 1950. **London in Roman Times**. London Museum Catalogues No.3

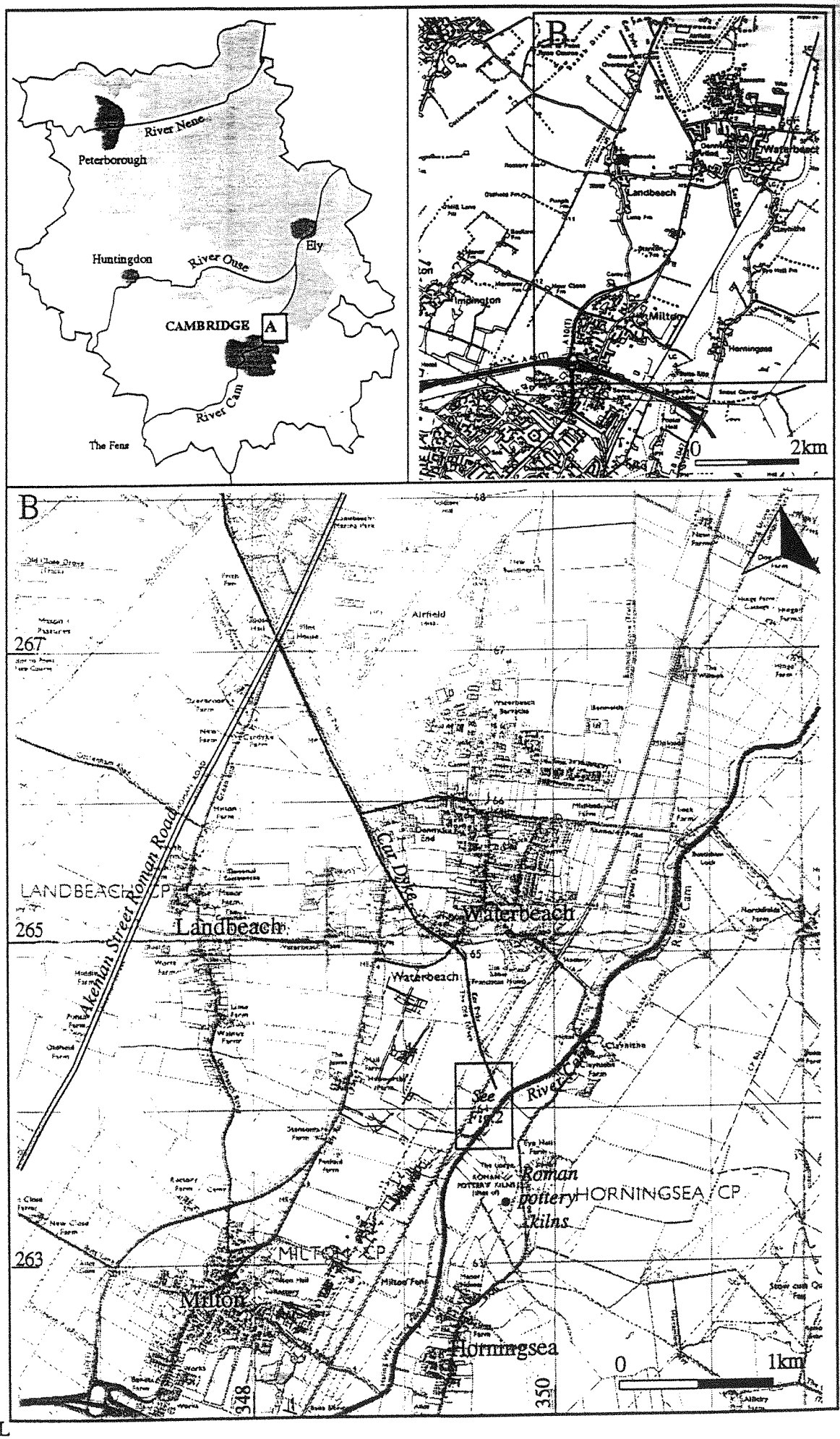
White, D.A. 1967. 'Excavations on a Romano-British Settlement on the Fenland Edge at Earith, Hunts' **Proc. Cambridge Antiq. Soc LX**: 7-17.

Wilkes, J.J. & Elrington, C.L 1978 **'Roman Cambridgeshire' A History of the County of Cambridgeshire and the Isle of Ely Vol VII**, University Press Oxford.

Estimated costs of Analysis and Publication of Car Dyke, Waterbeach Excavation Results

Stratigraphic and Documentary Report	
Compile groups and phasing for distribution to specialists	£282.58
Liaise with specialists and incorporate specialist reports	£282.58
Compile illustrations list and liaise illustrator	
£282.58	
Write excavation report	£2119.32
Contribute to report in its regional context	£282.58
Assemble report	£282.58
Edit report	£344.64
Incorporate edits	£282.58
Proof reading	£344.64
Draw and mount maps/plans/sections	£1412.88
TOTAL	**£5916.94**
Specialist Analysis and Reports	
Pottery Report	0*
Faunal Remains	n/a
Fired Clay and Kiln Furniture	0*
Tile	0*
Stone/Masonry	n/a
Wood	n/a
Shell	£100
Glass	n/a
Iron/Fe Material	£200
Bronze/Cu Alloy	£100
Lead/Pb	n/a
Slag/Fe	n/a
Plant Macrofossils (Technician)	£600
Plant Macrofossils (EH Specialist - Peter Murphy)	21 days
Pollen (Technician)	£70
Pollen (EH Specialist - James Grieg)	21 days
Soil Micromprphology	n/a
TOTAL	**£6986.94**
Less external contributions	£1750.30
TOTAL REQUESTED FROM ENGLISH HERITAGE	**£5236.64**

(This figure does **not** include EH Specialist time for Pollen and Plant Macrofossils)



Based upon Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationary Office Crown Copyright.
Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. (Cambridgeshire County Council licence No. LA 07649X 1997)

Figure 1 Location plan

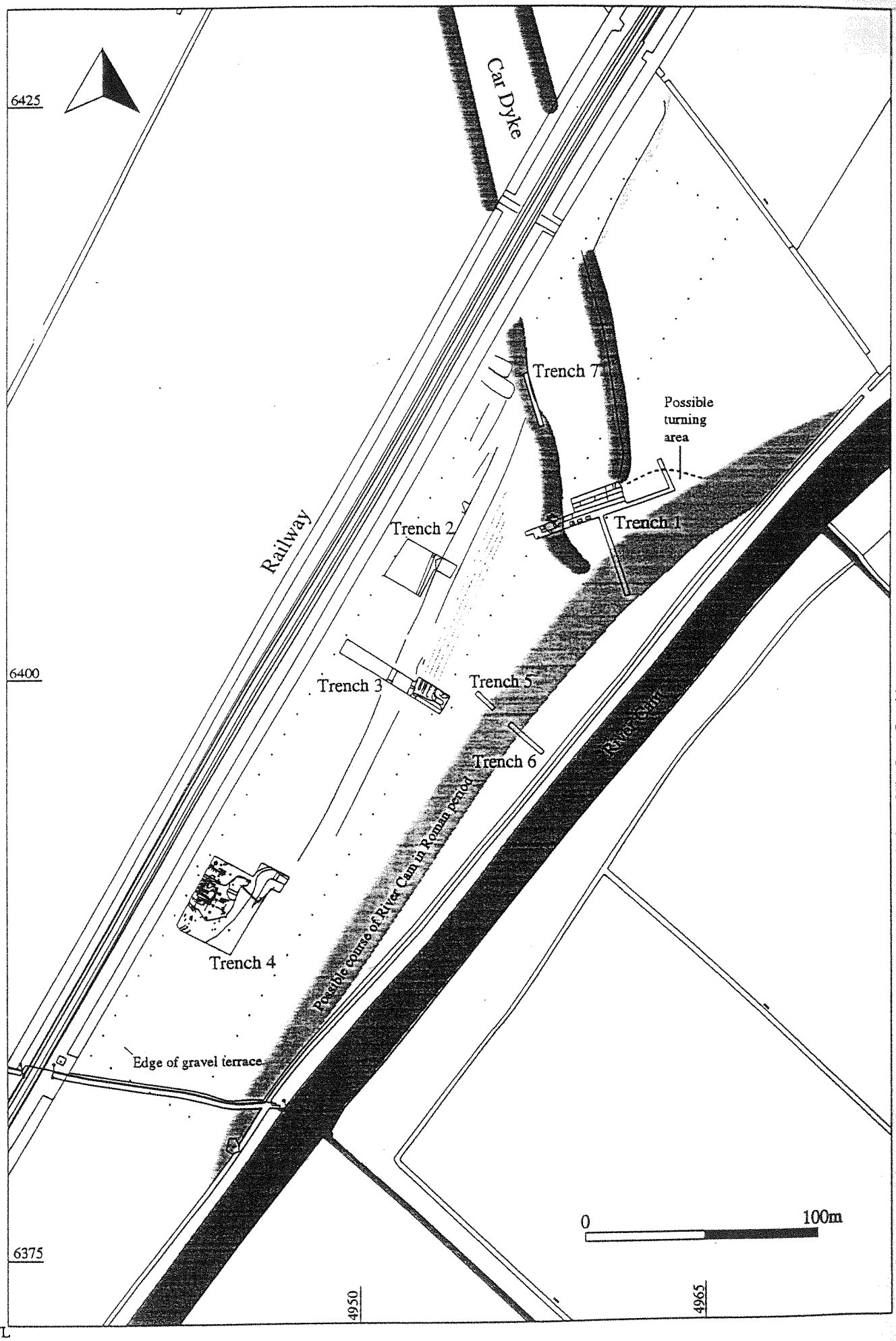


Figure 2 Trench plan

REGISTERED • ORGANISATION • IFA

Cambridgeshire County Council

Archaeology

The Archaeological Field Unit
Fulbourn Community Centre
Haggis gap
Fulbourn
Cambridge CB1 5HD
Tel (01223) 881614
Fax (01223) 880946