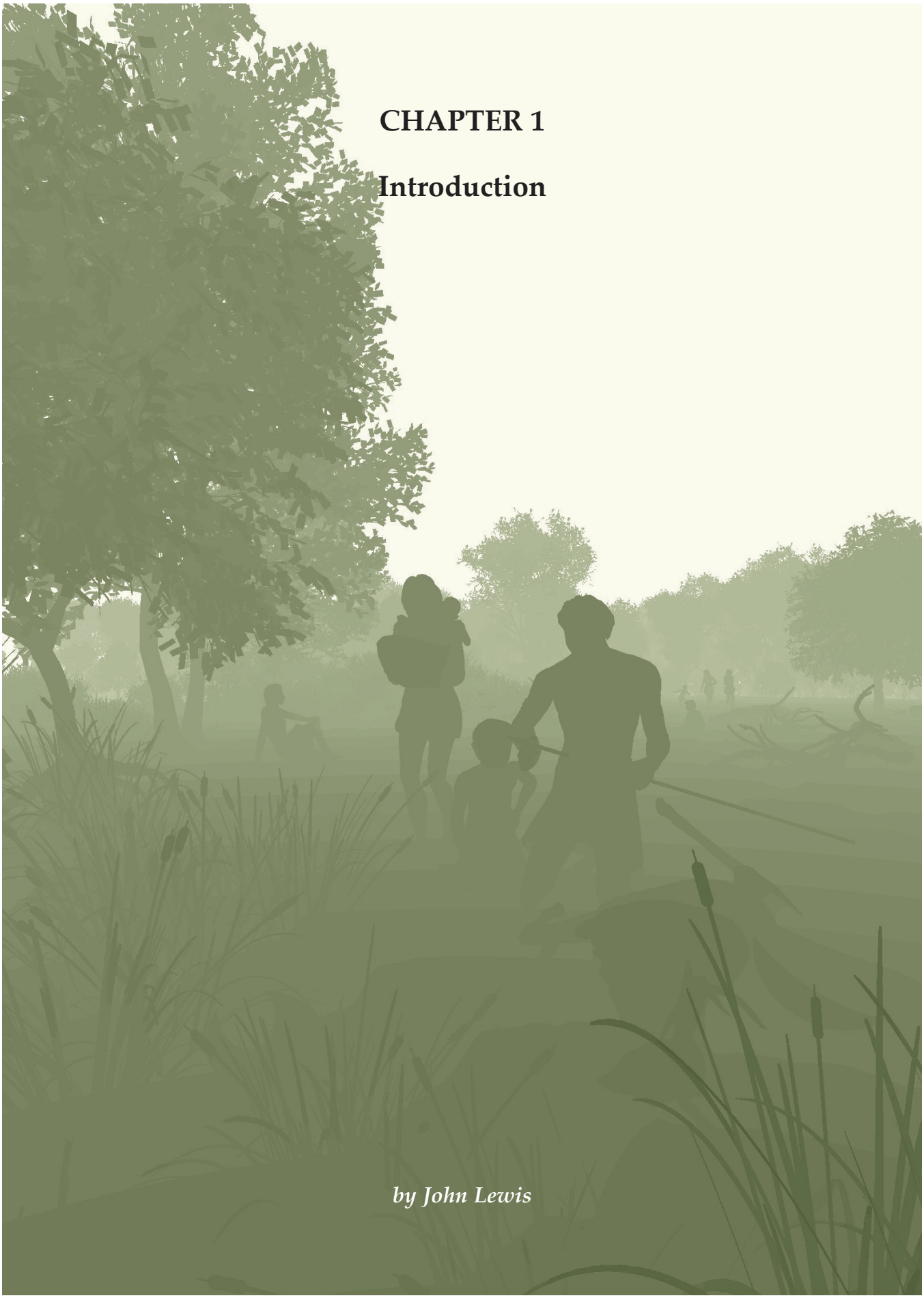

CHAPTER 1

Introduction

by John Lewis

Introduction

This volume presents the findings of excavations at Terminal 5 ('T5'), Heathrow Airport, London Borough of Hillingdon between 1996 and 2007. It includes and builds upon the earlier results of excavations at Perry Oaks sludge works, previously published as *Volume 1* (Framework Archaeology 2006). The area investigated totalled approximately 75 hectares.

The main excavations were carried out by Framework Archaeology, a joint venture agreement between Oxford Archaeology (OA) and Wessex Archaeology (WA), established to provide archaeological services to BAA. The results of archaeological investigations by other organisations on the site have also been incorporated where appropriate.

The results of the Terminal 5 excavations are presented in the form of a historical narrative, which is ordered chronologically but which seeks to explore a number of historical themes and processes. This introductory chapter seeks to guide the reader through the main body of the report.

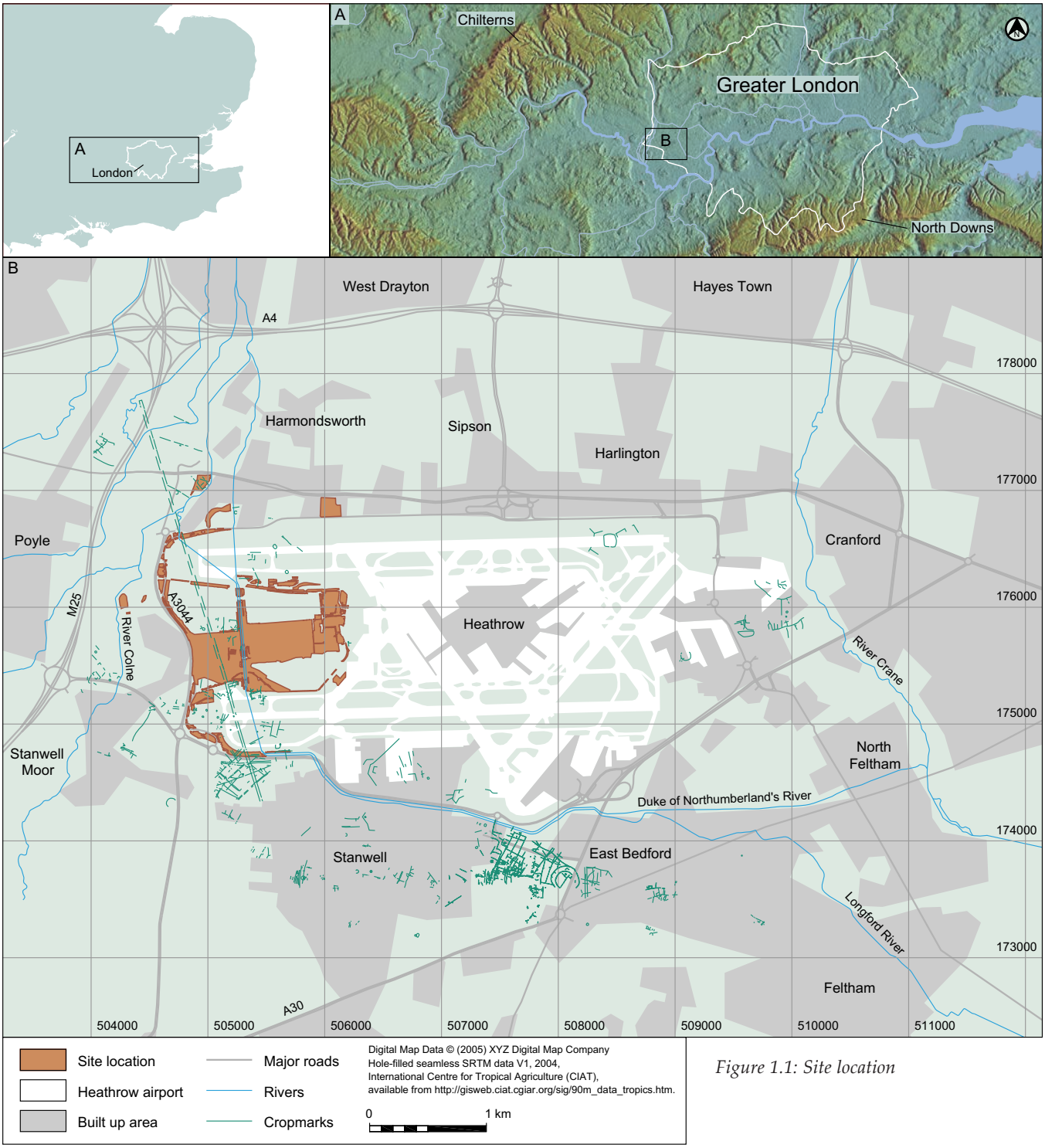

Figure 1.1: Site location

Plate 1.1: Heathrow Airport, aerial view of T5 construction site, May 2006 (© BAA Limited see www.baa.com/photolibrary)

Site location

Terminal 5 is situated in the Middle Thames Valley, approximately 4.5 km north-east of the River Thames, and on the eastern edge of the floodplain of the River Colne, itself a tributary of the Thames. The site (TQ 055 756) is bounded to the north, south and east by Heathrow Airport and to the west by the A3044 and the Western Perimeter Road.

The requirement for excavation

In 1993 BAA plc and Heathrow Airport Limited jointly submitted planning applications for outline planning permission to develop an additional passenger terminal complex ('Terminal 5'), together with the provision of aircraft aprons, taxiways and associated facilities, an air traffic control visual control room, realignment of rivers and landscaping. The planning application was subsequently the subject of a long running Public Inquiry.

The London Borough of Hillingdon and their archaeological advisors English Heritage agreed that the archaeology on the site of the Terminal 5 development could be dealt with effectively by the imposition of an appropriately worded archaeological mitigation condition which should refer to a Written Scheme of Investigation. During the Public Inquiry, agreement was reached between BAA (represented by Gill Andrews, the BAA Archaeological Liaison Officer) and London Borough of Hillingdon on the Written Scheme of Investigation (BAA/454).

As a result of the Public Inquiry, permission was granted for the construction of Terminal 5, and with regards archaeological remains, the Secretary of State imposed the following condition:

None of the development hearby permitted shall commence on any part or parts of the site until within that part or parts the applicant has secured the implementation of a programme of archaeological work in accordance with the document BAA/454 Final, 'Heathrow Terminal 5 Archaeology Strategy: Written Scheme of Investigation'.

The Written Scheme of Investigation adopted the academic and practical concepts developed and deployed during the excavations at Perry Oaks sludge works in 1999 (Framework archaeology 2006, 14–24), and the same approaches were adopted for the Terminal 5 excavations from 2002 to 2007.

Site Name	Site Code	Site sub-division	Excavated area (ha)	Fieldwork period
Perry Oaks Sludge Works	POK 96		3.83	Summer 1996
Perry Oaks Drying Beds	WPR 98	Bed A	6.18	Apr-Oct 1999
Perry Oaks Drying Beds	WPR 98	Bed B	4.39	Apr-Oct 1999
Perry Oaks Drying Beds	WPR 98	Bed C	8.04	Apr-Oct 1999
Perry Oaks Drying Beds	WPR 98	Bed D	1.39	Apr-Oct 1999
Northern Taxiway	GAI 99		1.01	Oct-Nov 1999
Grass Area 21	GAA 00		0.35	Apr-May 2000
Sub-total Perry Oaks (Volume 1)			***25.19***	
Perry Oaks Cottages	WPM 00		0.19	March 2000
Terminal 5	PSH 02	3	0.81	Apr 2002-Apr 2004
Terminal 5	PSH 02	12	2.52	Apr 2002-Apr 2004
Terminal 5	PSH 02	14	1.09	Apr 2002-Apr 2004
Terminal 5	PSH 02	15	0.69	Apr 2002-Apr 2004
Terminal 5	PSH 02	16	0.55	Apr 2002-Apr 2004
Terminal 5	PSH 02	17	0.20	Apr 2002-Apr 2004
Terminal 5	PSH 02	18	0.25	Apr 2002-Apr 2004
Terminal 5	PSH 02	19	0.83	Apr 2002-Apr 2004
Terminal 5	PSH 02	20	1.01	Apr 2002-Apr 2004
Terminal 5	PSH 02	21	0.20	Apr 2002-Apr 2004
Terminal 5	PSH 02	23	0.30	Apr 2002-Apr 2004
Terminal 5	PSH 02	24	2	Apr 2002-Apr 2004
Terminal 5	PSH 02	26	0.46	Apr 2002-Apr 2004
Terminal 5	PSH 02	27	0.86	Apr 2002-Apr 2004
Terminal 5	PSH 02	28	1.92	Apr 2002-Apr 2004
Terminal 5	PSH 02	30	0.09	Apr 2002-Apr 2004
Terminal 5	PSH 02	34	0.75	Apr 2002-Apr 2004
Terminal 5	PSH 02	35	0.37	Apr 2002-Apr 2004
Terminal 5	PSH 02	42a	0.49	Apr 2002-Apr 2004
Terminal 5	PSH 02	45	0.58	Apr 2002-Apr 2004
Terminal 5	PSH 02	47	0.76	Apr 2002-Apr 2004
Terminal 5	PSH 02	49	5.22	Apr 2002-Apr 2004
Terminal 5	PSH 02	51	1.30	Apr 2002-Apr 2004
Terminal 5	PSH 02	52	0.48	Apr 2002-Apr 2004
Terminal 5	PSH 02	54	0.24	Apr 2002-Apr 2004
Terminal 5	PSH 02	54a	0.19	Apr 2002-Apr 2004
Terminal 5	PSH 02	58 "Twin Rivers"	2.75	May-August 2004
Terminal 5	PSH 02	61 "Twin Rivers"	1.55	May-August 2004
Terminal 5	PSH 02	61i "Twin Rivers"	0.10	May-August 2004
Terminal 5	PSH 02	72	1.99	Apr 2002-Apr 2004
Terminal 5	PSH 02	73	1.38	Apr 2002-Apr 2004
Terminal 5	PSH 02	74a	0.84	Apr 2002-Apr 2004
Terminal 5	PSH 02	75	1.76	Apr 2002-Apr 2004
Terminal 5	PSH 02	77	1.59	Apr 2002-Apr 2004
Terminal 5	PSH 02	89b	0.99	Apr 2002-Apr 2004
Terminal 5	PSH 02	89c	0.01	Apr 2002-Apr 2004
Terminal 5	PSH 02	90a	0.06	Apr 2002-Apr 2004
Terminal 5	PSH 02	99	0.63	Apr 2002-Apr 2004
Terminal 5	PSH 02	100	1.23	Apr 2002-Apr 2004
	PSH 02 sub-total		***39.03***	
Terminal 5 Concourse C	TEC 05	P2A1	2.47	March-June 2005
Terminal 5 Concourse C	TEC 05	P2A3	0.21	March-June 2005
Terminal 5 Concourse C	TEC 05	P2A4	1.84	March-June 2005
Terminal 5 Concourse C	TEC 05	P2A5	2.18	March-June 2005
Terminal 5 Concourse C	TEC 05	91	2.92	Oct 2006-Aug 2007
Longford Flood Alleviation	LFA 05		1.34	March-Apr 2005
Total excavated area			**75.38**	

Extent of the archaeological excavations at Terminal 5

The excavations were undertaken as three main phases of work (Fig. 1.2; Tables 1.1–2):

- 1996: excavations by the Museum of London Archaeology Service of approximately 4 ha of sludge stockpile areas (site code POK96). The results of these excavations were presented in Volume 1 of the Terminal 5 publications (Framework Archaeology 2006).

- 1999–2000: Framework Archaeology excavated approximately 21 ha in the Perry Oaks sludge works (site code WPR98) and adjacent Airport sites, described in Volume 1 of this series (Framework Archaeology 2006). The excavations at Perry Oaks were undertaken to mitigate the deleterious effects of the sludge works operation on the surviving archaeological deposits. However, they were also carried out with the expectation that the construction of the proposed fifth passenger terminal ('T5') at Heathrow Airport would be approved. In the event approval for Terminal 5 was granted and the Perry Oaks sludge works were relocated.

- 2002–2007: excavations by Framework Archaeology as part of the construction of Terminal 5 (see Plate 1.1). The results of these excavations (site codes PSH02 and TEC05) have been integrated with those presented in Volume 1, and are the subject of this Volume.

In addition other areas (such as Bedfont Court and NPC06) were subject to trial trenching or watching briefs. Table 1.1 shows the areas in hectares of all the part of the Terminal 5 site that were archaeologically excavated. Table 1.2 lists the additional areas that were evaluated by trial trenching but where further work was confined to monitoring measures intended to preserve archaeological deposits *in situ*.

Table 1.1: Areas of excavation at Terminal 5

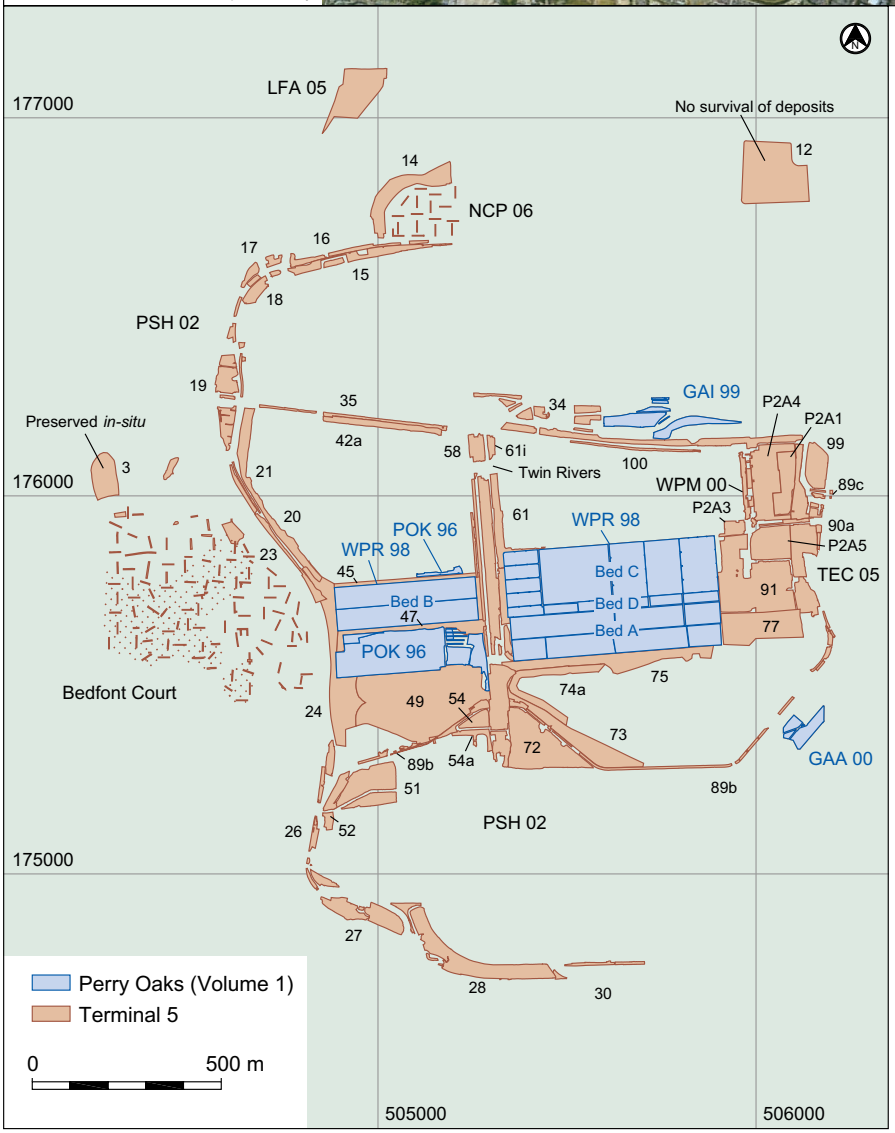

Figure 1.2: Archaeological investigations at Terminal 5

A feature of the Terminal 5 archaeological excavations was the extensive planning and programming that was undertaken before the work commenced. This involved the complete integration of the archaeological work with the construction programme, and resulted in a very productive working relationship between BAA, their consultants, Gill Andrews and John Barrett, Framework Archaeology and the civil engineering contractors, Laing O'Rourke. In consequence, all the archaeological areas were excavated on time and budget, with no delays to the construction programme.

Figure 1.2 shows the location of all the sites in Tables 1.1 and 1.2, together with the site sub divisions (referred to as 'areas' in this volume). The approximately 75 ha which were archaeologically excavated represent all the areas where potential archaeological deposits survived, and where the proposed development would have ensured their destruction. Thus Figure 1.2 shows that the excavated sites are spread over an area measuring approximately 2.1 km

Site Name	Site Code	Site area (ha)	Number of trenches and test pits	Excavated area (ha)	Fieldwork period
Bedfont Court	BU 02	23.7	70 trenches each nominally 2 x 30 m but some extended, 210 test pits each 1 sq m	0.76	Sept-Dec 2002
N3 Staff Car Park extension	NPC 06	2.6	17 trenches 2 x 30 m, followed by watching brief	0.10	March-July 2006

Table 1.2: Evaluations at Terminal 5

north to south, and 1.6 km west to east (excluding the Bedfont Court evaluations). The excavations therefore represent a sample of the Heathrow landscape covering approximately 3.36 sq km.

Geology and topography

The underlying geology consists of Taplow Gravel capped by the Langley Silt Complex ('brickearth') (Fig. 1.3). The Taplow Gravel forms one of the sequences of gravel terraces created during the Pleistocene by the movement of the River Thames.

Throughout this report the area of Hounslow Heath now occupied by Heathrow Airport is referred to as the 'Heathrow Terrace'. We have used this term to describe the block of landscape which is defined by the River Colne in the west and the River Crane in the east (Fig. 1.3). To the north, the Heathrow Terrace is defined by the junction of the Taplow and Lynch Hill Terraces, and to the south by the junction of the Taplow with the Kempton Park Terrace. These geological boundaries appear on the ground as breaks in slope, sometimes almost imperceptible, sometimes quite marked. However, in the past their topographic effect would have been much more noticeable than today.

Terminal 5 lies immediately to the east of the River Colne floodplain at an altitude rising from *c* 21 m OD in the west to *c* 23.5 m OD in the east (Fig. 1.4). It is thus a broadly flat landscape with a very gentle upward slope from west to east. However, the 23 m contour can be

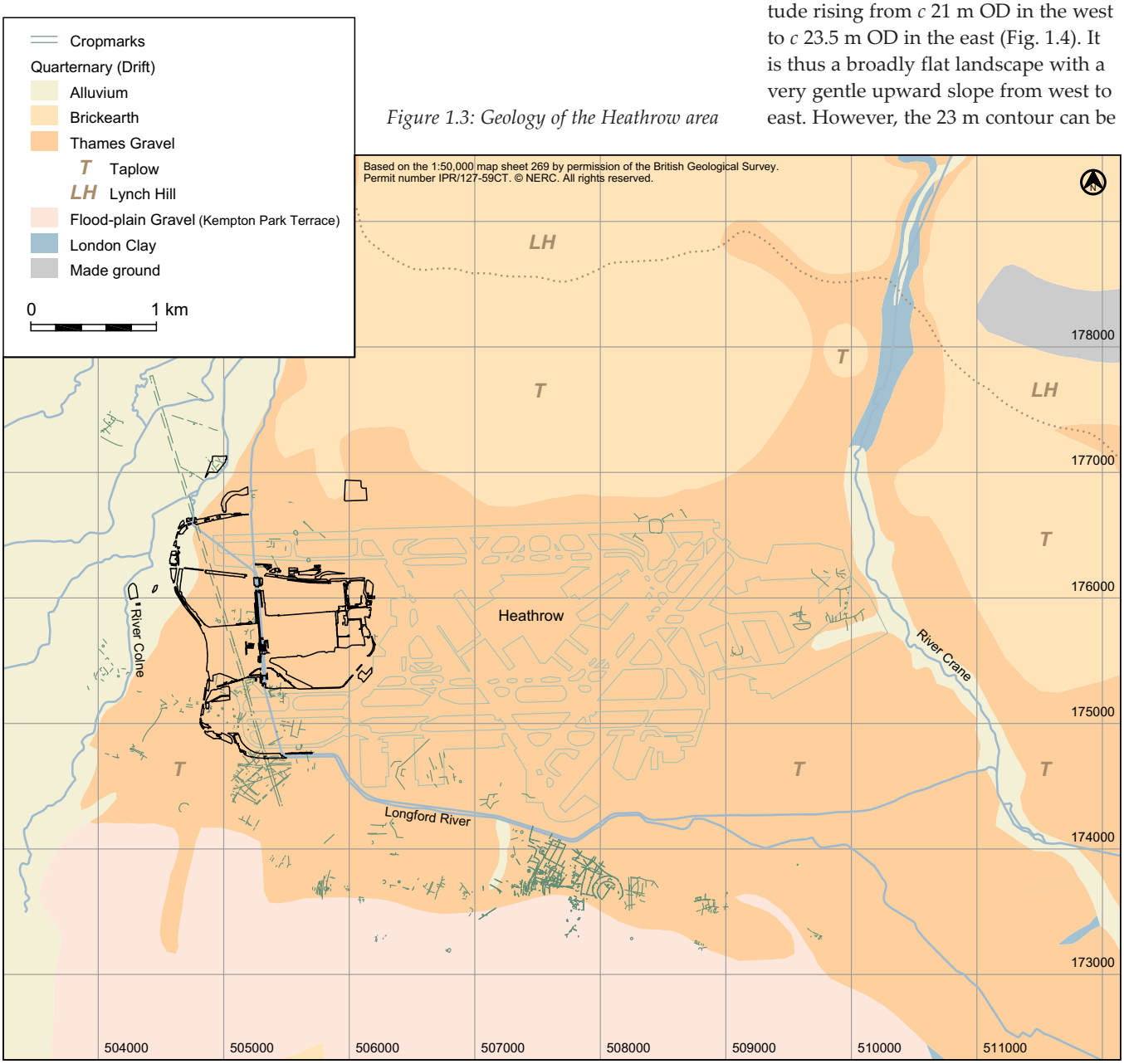

Figure 1.3: Geology of the Heathrow area

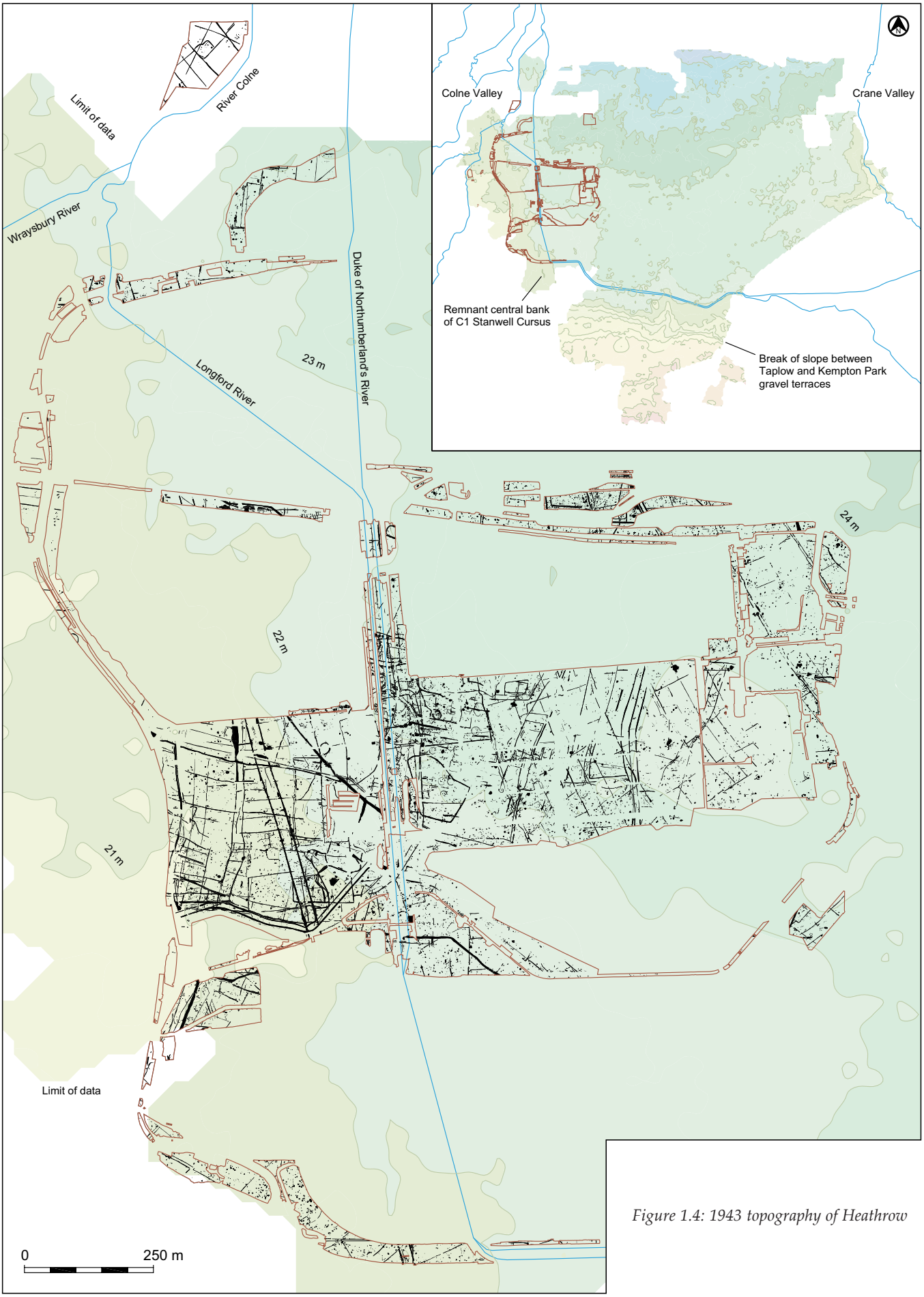

Figure 1.4: 1943 topography of Heathrow

seen to 'swing' away to the south-east. As we will show in Chapter 3 (on the 2nd millennium BC agricultural landscape), field ditches and hedgerows also followed this change in topography.

Throughout the remainder of this volume we will make repeated reference to the flatness of the landscape. This flatness has shaped the 20th-century history of the area; it was one of the reasons for siting the sludge works at Perry Oaks, and of course for the subsequent construction of Heathrow Airport. Prior to any modern changes, however, the topography of the landscape was more varied, with slight rises and lower lying areas (such as palaeochannels), which would undoubtedly have held significant topographical importance (see below). Human modification of the landscape from the 4th millennium BC has utilised these variations, usually to enhance them. Most importantly, almost any human endeavour that resulted in the raising of a mound, bank or other earthwork or timber structure would most likely have made a distinct impression on this landscape.

Topography prior to the construction of the sludge works in the 1930s and the airport in the 1940s

In 1943 the Air Ministry undertook a survey of the ground levels of the Heathrow area prior to the construction of the airport. The survey covered an area of 20 square kilometres of Hounslow Heath and theodolite survey readings were made every 20 feet producing a total of 23,763 points. Framework Archaeology digitised the original survey data and produced a computer-generated model, which also included survey data from the engineering drawings for the sludge works in the 1930s.

For the purposes of this report we have assumed that the 1943 ground surface would have equated with the prehistoric and Romano-British ground surface. Agriculture will, of course, have eroded some parts of the landscape, and colluviation and alluviation will have deposited material in others. Nonetheless, this model has provided the essential topographical framework within which we can consider the architectural modifications made by people since the 4th millennium BC. It also allowed the construction of the Truncation Model described below.

The Truncation Model

The Truncation Model (Fig. 1.5) consists of a contour and wire mesh drawing of the difference in heights between the pre-sludge works ground surface (derived from the 1943 Air Ministry Survey and the Perry Oaks sludge works engineering drawings described above) and the top of the gravel surface following archaeological stripping and survey. This was achieved by using the 'residuals' function in the Surfer computer program to subtract the OD heights in the 1933–43 survey from those of the modern day grid file to produce a third grid file which could be contoured. The degree of truncation was then checked against the surviving archaeological deposits in POK96. It was apparent during excavation, from archive aerial photographs and documentary research, that the eastern part of POK96 had undergone substantial terracing. The truncation model allowed the depth of disturbance to be quantified, and its effect on archaeological features to be assessed.

The truncation model proved to be a very valuable tool during excavation and post-excavation analysis since it could be used to assess the validity of artefact distributions, and to determine if the absence of features in a particular area could be attributed to the effects of the construction of the sludge works.

Modern land-use

The majority of the Terminal 5 site was occupied by the Perry Oaks sludge works. This was constructed as one element of the West Middlesex Main Drainage Scheme, conceived following the First World War at a time when West Middlesex was developing rapidly in both industry and population. The Scheme was devised in 1928 by John D Watson, past President of the Institution of Civil Engineers, in order to replace 27 sewerage works operated by 22 local authorities.

John D Watson reported fully on the construction of the Perry Oaks works in 1937, and this was followed by a further report on the first 10 years of operation by Townend (1947). These reports—and the Thames Water Utilities Ltd engineering drawings—proved invaluable in both recording the history of the development of the works and also in assessing their impact on the surviving archaeological deposits. This impact has been described more fully in Volume 1 (Framework Archaeology 2006, 10–11) and will not be repeated here, except to say that the construction of the drying beds led to variable degrees of truncation of the underlying archaeological deposits (Framework Archaeology 2006, 8; Fig. 1.5). In addition to drying beds, substantial areas of the Perry Oaks works comprised deep sludge lagoons. Some of these were constructed in the 1930s, but as late as 1980 some replaced areas originally set out as drying beds. The depth of these lagoons was sufficient to totally destroy any archaeological deposits. Their impact on the field system of the 2nd millennium BC is particularly striking. Elsewhere, archaeological survival was variable, with Area 49 (Burrows Hill Close) and the Longford Flood Alleviation site having the least disturbance, because they were situated outside the sludge works and airport boundary. Archaeological excavations within the existing airport boundary were rare, the principal sites being Northern Taxiway (GAI99) and Grass Area 21 (GAA00), both of which were described in Volume 1. Paradoxically, survival was very good on these sites, as they had lain relatively undisturbed beneath grass areas adjacent to runways and aprons. Sites along the western boundary of the development and associated with the diversion of the Western Perimeter Road had generally suffered a fairly large degree of disturbance and truncation from services and repeated road realignment.

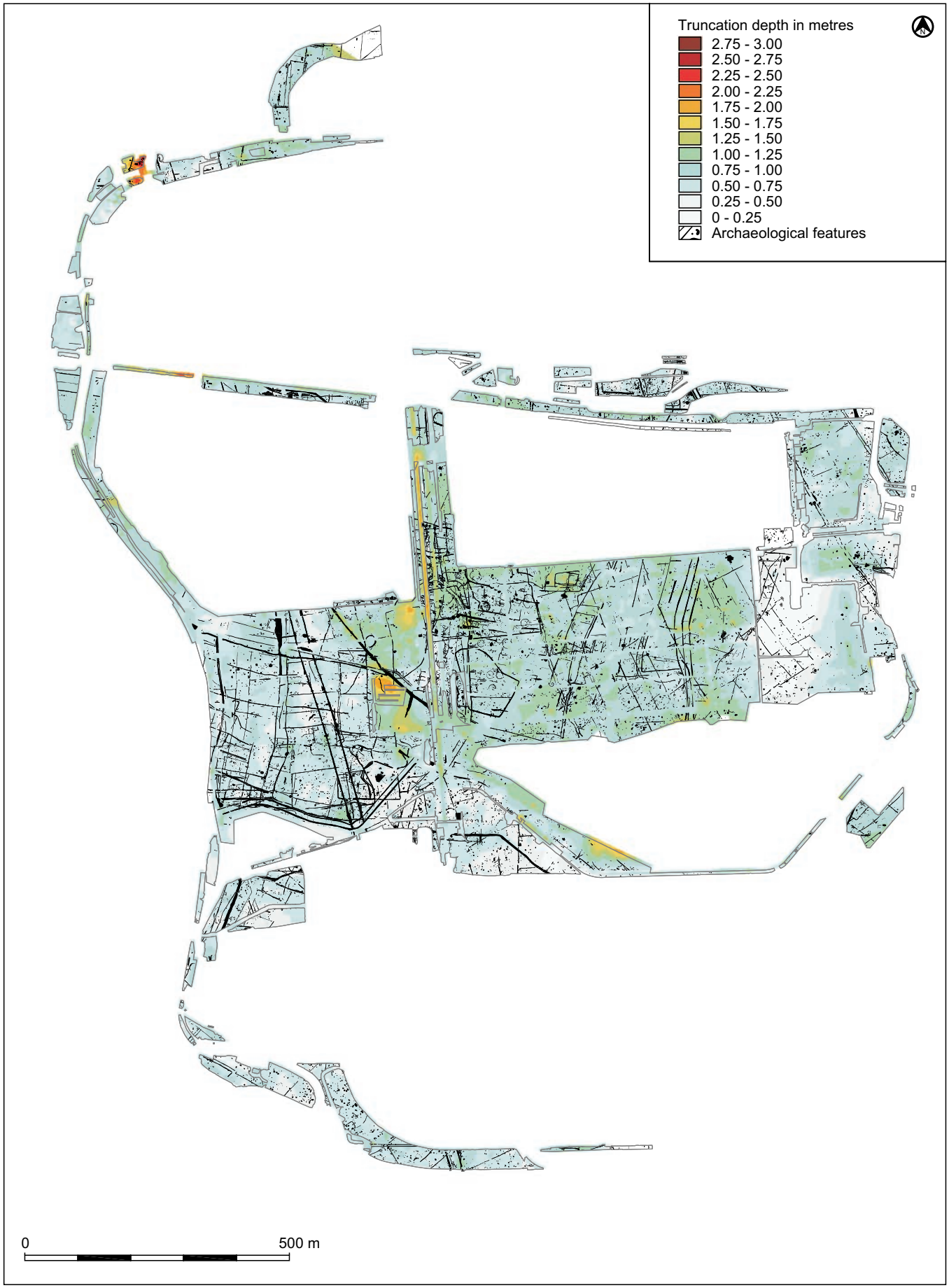

Figure 1.5: The truncation model

The archaeological background to the area

The Terminal 5 excavations were undertaken in a landscape that had been archaeologically investigated for over 50 years. Figure 1.6 shows the scale and extent of the investigations surrounding the site, along with the results of two separate surveys of aerial photographs which were commissioned by the Museum of London Archaeological Service of the Heathrow area (RCHME 1995 and 1997). Most excavations were undertaken by the Museum of London Archaeological Service (MoLAS) (or its predecessors) from the late 1970s onwards, ahead of gravel extraction and other commercial development (MoLAS forthcoming).

Located a few kilometres to the south-west of Terminal 5 (not shown on plan), the Staines (Yeoveney Lodge) Neolithic Causewayed enclosure was partially excavated prior to destruction through gravel extraction in the early 1960s (Robertson-Mackay 1987). In the early 1980s the Surrey Archaeological Unit excavated a length of the Stanwell cursus, the 2nd millennium BC field system and Saxon features to the south of Terminal 5 (O'Connell 1990). In the 1990s Wessex Archaeology excavated large multi-period sites to the north of Heathrow at Prospect Park (Andrews 1996; PPK) and Imperial College Sports Ground (Crockett 2002; A Powell, forthcoming; ICSG, IMC).

While the airport was being built in 1944, Professor Grimes excavated the famous Heathrow Romano-Celtic style 'temple' situated within an Iron Age enclosed settlement (Caesar's Camp) (Grimes and Close-Brooks 1993). The report on this excavation also provided information on the archaeological and historical background of the area, and demonstrated the rapid destructive effects of arable agriculture on standing earthworks (ibid., 306–307). In 1969 Roy Canham undertook limited excavations in advance of the western extension of the northern runway (Canham 1978; HEA69).

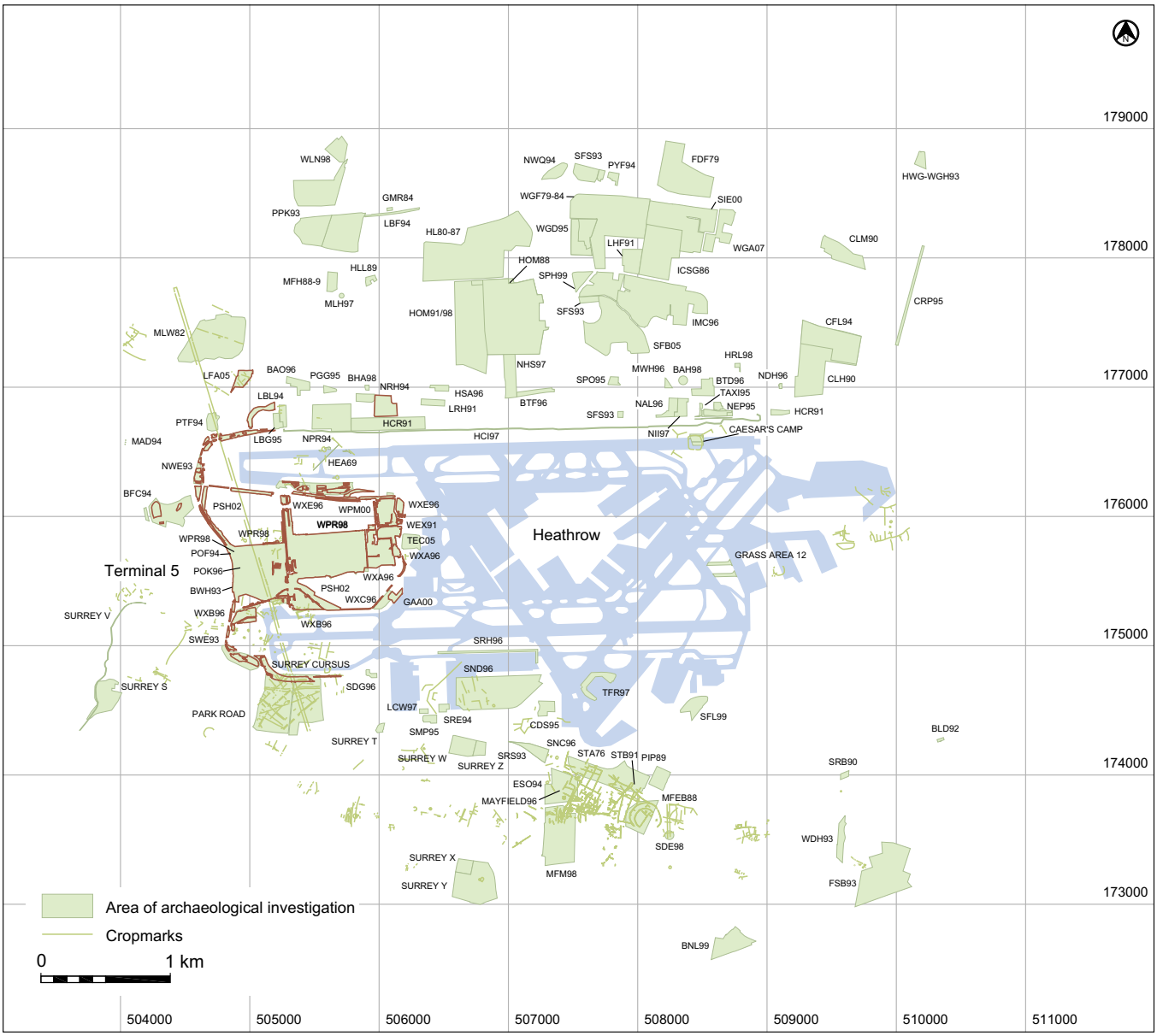

Figure 1.6: Extent of all known archaeological investigations at Heathrow

Slightly further afield, a multi period site at Ashford, Middlesex, has recently been published (Carew *et al.* 2006). It contained a Neolithic ring ditch, Bronze Age fields, Late Iron Age settlement, Romano-British ditches and a possible Saxon building. At Horton, on the Colne floodplain, another Neolithic ring ditch and later field systems have been published (Preston 2003), while further work here at Kingsmead Quarry has revealed extensive evidence for activity from the Late Upper Palaeolithic to medieval periods, including a rare Early Neolithic house (WA 2009).

More general synthesis and discussion has also been published (eg Cotton, Mills and Clegg 1986), along with a recent assessment of the archaeology of Greater London (MoLAS 2000).

Summary of the Heathrow archaeological landscape prior to the Terminal 5 excavations

At the outset of the project, a succession of past landscapes was identified (based on Andrews and Barrett 1998). However, the review of existing evidence highlighted significant shortcomings. These comprised the following:

- *Hunter-gatherer communities and early agricultural practices (300,000–4000 BC)*

Hand axes and other lithic tools of Lower Palaeolithic date were deposited amongst the Thames terrace gravels, but those located within the Taplow terrace, upon which Terminal 5 is located, have been acknowledged as being rolled and reworked from the higher Lynch Hill terrace (Gibbard 1985). The same has been suggested for artefacts within the Colney Street gravels of the River Colne (ibid., 131). Since this material is derived and redeposited, it did not feature as a research priority.

The surface of the Taplow gravels was occupied from the Late Lower Palaeolithic (300,000 BC) onwards. Antiquarian observation and fieldwork over the last 100 years suggest that much of the evidence for occupation during this period lies buried beneath the Langley Silt (Brickearth) deposit capping the gravels. At Terminal 5, the Perry Oaks sludge works had severely truncated this thin capping, and thus this early period did not feature as a research priority.

Evidence for Late Glacial and Mesolithic occupation (from 9000–4000 BC) across the terrace would have taken the form of lithic and bone scatters, deposited on the contemporary land surface. Again, the severe truncation at Terminal 5 would have removed most *in situ* traces of these remains. There was no opportunity for studying occupation of the landscape to the same level of detail as that of the Colne floodplain (Lacaille 1963). However, diagnostic lithics of this period did survive in tree-throws and several contemporary pits, as well as residing in later features.

- *Early agricultural and ritual practices (4000–2000 BC)*

The construction of the first monuments in the Heathrow and West London landscape can be dated to the Neolithic period. These consist of linear cursus monuments (such as the Stanwell example described in this volume) as well as smaller circular or sub-circular enclosures. Notably absent are earthen long-barrows of the early 4th millennium BC. Along the Thames to the west of Heathrow lay a series of larger causewayed enclosures (eg at Yeoveney Lodge Staines and Dorney) of the 4th millennium BC, while the large double-ditched enclosure at Mayfield Farm to the south-east of Terminal 5 may also date to this period.

The construction of small circular enclosures may have continued in the 3rd millennium BC, although the characteristic features of this period (Middle and Late Neolithic) in the area are pits containing either Peterborough Ware or Grooved Ware pottery. Overall, the emergence and chronological development of the monumental landscape was far from clear.

- *Agricultural transformation and the rituals of social reproduction (2000–100 BC)*

During the 2nd millennium BC the monumental landscape of the preceding millennia was transformed into one of fields, settlements and trackways. Exactly when in the 2nd millennium, why and how this took place were uncertain, as were the extent and intensity of the agricultural landscape. Conspicuously absent from West London were many aspects of the Late Neolithic / Early Bronze Age material and monumental 'package': round barrows, burials and Beaker pottery. From *c* 1500 BC onwards, cemeteries with Middle Bronze Age Deverel-Rimbury pottery had been recorded (Barrett 1973), and together with the succeeding post-Deverel-Rimbury pottery of the Late Bronze Age, were clearly associated with field and settlement systems. Relatively little was known about the Early Iron Age in the region, although by the middle of the 1st millennium BC, Middle Iron Age settlements comprising roundhouses, pits and four-post structures, were spread across the landscape. The Heathrow 'temple' (Grimes and Close-Brooks 1993) was tentatively dated to the Middle or Late Iron Age, although the function of this structure remains far from certain (Black 1986, 203; Smith 2001, 64).

- *Rural landscapes and urban hinterlands (100 BC–AD 1700)*

The transition from Late Iron Age tribal society to post–conquest Roman province was poorly understood in this region. The Romano-British landscape was characterised by small farmsteads consisting of enclosures, field boundaries and (probably) earth and timber buildings, which served the markets of roadside towns such as at Staines and possibly Brentford, and of course the capital, *Londinium*. A growing number of such Roman rural farmsteads have been excavated along the Thames gravel terraces in recent years, and yet there is a notable lack of villas or other high status sites. There are indications of a decline in some settlements during the 2nd and early 3rd centuries AD,

though it appears that that the landscape of the later 3rd and 4th centuries underwent some form of reorganisation, seemingly reflecting changes observed within the urban centres at Staines and London.

The archaeological evidence for the early and middle Saxon periods consisted of isolated or small concentrations of sunken-featured buildings. Sometimes these were located away from medieval and present-day villages and in other cases they were found close to villages such as Harmondsworth. Local medieval villages presumably developed from their Saxon predecessors. By the post-medieval period, a number of hamlets and villages were dotted across Hounslow Heath, which began to be enclosed in the 18th century. Finally, some of these settlements, including Heathrow itself, were destroyed by the construction of the airport in 1944.

This briefly sketches the state of knowledge of the West London landscape in general—and Heathrow in particular—prior to the Terminal 5 excavations. The Terminal 5 project thus had the potential to make a significant contribution to our knowledge of the history of human occupation within the Heathrow landscape, and of the Middle Thames region in general. However, the scale of the project presented a number of challenges, both intellectual and practical, that had to be addressed before undertaking any excavation, and these will be discussed in the following section.

The nature of the challenge and the solution

The excavations at Terminal 5 provided a number of important challenges, not least because it became necessary to design an approach to the recording and interpretation of the archaeological data that would enable a sound academic philosophy to be produced. Evaluations undertaken by MoLAS on behalf of BAA during the early 1990s demonstrated that elements of the Heathrow ancient landscapes described above survived to varying degrees within the confines of the Perry Oaks sludge works (BAA Series reports). Subsequent excavations by MoLAS (Site Code POK96; see Fig. 1.2) confirmed these results and served to refine the research philosophy and approach. It was clear from the POK96 excavations that archaeological deposits, though truncated, probably remained beneath the active sludge works and were thus threatened by the daily workings of the drying beds.

Framework Archaeology was appointed by BAA in 1998 to undertake all archaeological mitigation for the Terminal 5 project. One of the first tasks was to record the archaeological remains that were being destroyed by the daily workings of the sludge works. This would entail stripping a very large open area within an operating sludge works, which itself posed problems with regard to working practice and Health and Safety. However, were the proposal to build Terminal 5 to be approved, the archive record of the Perry Oaks excavations (and those undertaken by MoLAS) would have to fit seamlessly into those resulting from investigation of subsequent excavations. The huge extent of the area that might ultimately be exposed demanded a digital recording system. Large quantities of written and graphical records, as well as artefactual and environmental material, were likely to be produced. The only practical way to manage these data was to adopt a database system, linked to digital plans via a Geographical Information System (GIS). Importantly, by adopting a GIS approach, and by processing and assessing as much of the finds and environmental data as possible on site, the data could be used to inform the excavation strategy.

The adoption of digital survey techniques, along with a standard recording system and database, through the entire life of the Terminal 5 project was essential in allowing the standardised capture and analysis of data. Table 1.1 shows that most of the PSH02 and TEC05 excavations were relatively small sites. Many of these were spatially close together, but several years may have separated their excavation. The GIS allowed the data from all these excavations to be assembled into one unified plan.

The process of historical inquiry that was demanded by the academic philosophy at the heart of the project (see below) could now be pursued through an iterative excavation and interpretative process. At the same time, the opportunity was taken to design a recording system based on those of the parent companies, but which focussed on those processes of excavation and interpretation. The GIS and database were then designed around the recording system.

Academic aim and approach

Various 'research designs' have been prepared with the aim of providing guidance for British archaeological work. The most recent examples have operated within period-specific remits at either a regional or a national level and have tended to specify research issues in terms of particular categories of material, or with reference to particular period-specific research questions.

By contrast the Terminal 5 Research Design prepared by BAA's archaeological consultant, Gill Andrews, and academic advisor, John Barrett (Andrews and Barrett 1998), was developed at a more 'generic' level of analysis. It established an approach towards the archaeology of all periods that was intended to be applied with reference to the resource model for the Terminal 5 development area and with reference to our current understanding of the archaeology of the Middle Thames Valley.

Principles

The aim of the Terminal 5 archaeological programme was to move beyond the recovery and description of archaeological remains as they are distributed across the landscape and to arrive at an understanding of the history of human inhabitation. The archaeology of inhabitation demands more than the recording of the traces of human activity and the history of inhabitation involves more than tracing the changing organisation of activities in a landscape.

Inhabitation concerns the practical ways in which people established their presence in the material, social and political conditions of their day. To establish a presence involves having the power, common to all human agency, to move and act in the world according to available opportunities and constraints, where such actions express knowledge of various levels of technical proficiency, social adequacy and moral authority. The archaeology of inhabitation is therefore an investigation of the various ways the human presence was established in and contributed towards maintaining or transforming the material and social conditions of history. It is an investigation of the material, moral and political contexts of human diversity.

This understanding of history is therefore not a matter of simply tracing changes in material forms (be they cultural or 'environmental') as expressed by phased sequences of material, nor is it a matter of noting that people in the past 'did things differently'. Rather, it concerns the ways lives were shaped in terms of social and political realities. These realities created different identities by virtue of varying access to resources and to modes of authority. Historical change arose as these differences were negotiated or were otherwise transformed by human practices, and by virtue of the cumulative changes in material conditions.

Human practice necessarily occupies areas of time and space. Spaces are 'opened up' by the activities that people carry out within them, and attempts can be made to define them in material terms by such things as enclosures, pathways and focal markers. Spaces and times may be appropriated and allocated to people and resources.

Application

Current excavation procedures normally treat the recovered material as data that represent historical processes. This means that field technicians record evidence that is destined for future interpretation. Our approach treats the materials excavated as components of the material conditions of history. It therefore treats excavation as primarily the investigation of history, rather than a preliminary stage in facilitating future interpretation. This places a clear interpretative responsibility with the excavators, and it ensures that the production of a coherent and empirically validated site narrative remains the fundamental objective of the excavation programme.

Plate 1.2: Excavations at Terminal 5 in all conditions

As we have seen, inhabitation may be regarded as the creation of human realities with reference to certain material conditions. Consequently the interpretative emphasis must be placed upon the ways people brought social conditions into existence through their performance of different practices.

Two concepts frame our inquiry. These are defined as *structural conditions,* which concern the ways in which the existing material conditions operated upon the lives of the landscape's inhabitants in any one period, and *structuring principles,* which describe the organisation and interrelationship of the practical performances by which the various schemes of political and cultural order were reproduced.

Structural Conditions

Structural Conditions identify the ways in which the occupation of time and space was partly circumscribed and partly guided by existing material conditions, including the various

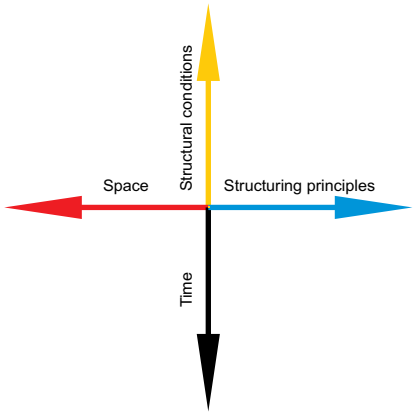

Figure 1.7: Diagram showing relationship between Structural Conditions and Structuring Principles

structures in their different stages of decay that had been built into the landscape by previous generations. It is possible to identify these major structural components at various levels of generality or detail as excavation and interpretation progresses. These components will be labelled as *entities*.

The definition of *entities* enables the isolation of major architectural components through and around which lives were performed, and significant deposits and residues associated with these activities accumulated. Talking about *entities* enables us to trace the ways the physical conditions of the world were modified. *Entities* will map out, for example, the ways in which different places were linked and thus different movements may have been choreographed, the way activities may be framed by various forms of architecture, and the dominant points of reference, both monumental and topographic, that were negotiated in the occupation of the landscape.

Each generation lives within its own archaeology of standing buildings, of ruins, and of a managed landscape of high antiquity. Understanding something of the structural modifications undertaken in any period should inform an understanding of the ways by which this archaeology of the past was accommodated in the contemporary landscape and thus the ways in which that archaeology was utilised, remembered or eradicated.

Structuring Principles

By emphasising the active ways in which social life is created we can identify four broad *spaces* which facilitated that activity. These spaces were inhabited with reference to those material conditions that are represented by the excavated evidence (the structural conditions). Analysis is directed at the ways these spaces were designed and the ways in which they interrelated. The four spaces are:

Routine. These were the spaces of every day activities. They were built by acting out commonly held, if conflicting, values for often mundane and routine purposes. These activities expressed the realities of life that were taken for granted.

Explicit order. These spaces brought into being explicit statements and claims to authority, political power and the demonstration of various kinds of supernatural, or indeed natural, orders that were presumed to govern the wider order of the world. Where routine knowledge is likely to have been taken for granted, these spaces evoked a more explicit form of knowledge.

Inscription and control. These were the spaces by which resources (material resources, forms of knowledge and people) were defined by others and could be acted upon. These spaces were made in the operation of power over the lives and material conditions of others.

Exclusion, marginality and resistance. These are the spaces that may have lain beyond dominant political authority. They may have been the routines that rarely expressed their own identities, or the spaces in which arose attempts to challenge or avoid the normality of routines and the control of dominant authority.

Each of the different kinds of space outlined above are always related through performance.

- Routine practices must involve action on and control of resources, operate against the background of explicit forms of political and religious order, and contain alternatives within them.

- Explicit order always makes sense by reference to routine experience, supports power wielded over some portion of the world, and may ignore, seek to silence or capture those actions that question its validity.

- The inscription and control of resources is achieved by an effective authority, imposes itself upon the routines of life, and its boundaries partly define the spaces of alternatives and resistance.

The hidden and marginal spaces of the world contain their own routines, may express alternative views of order and seek to avoid forms of dominant control. In other words none of the performances defined here occupied spaces that did not require mediation, negotiation or confrontation with other regions of social performance. The material entities that are identified in fieldwork formed part of the technology by which these social dramas operated, and history is driven by such processes.

The different ways in which these practices brought these spaces together is what defines the character of different historical periods, and can be summarised in Figure 1.7.

Application: the recording system and data presentation

The Framework Archaeology recording system and fieldwork methodology were developed to apply the academic approach outlined above. The field procedures and database structure have been described previously (Framework Archaeology 1999a; 2002) and are documented in the *Framework Archaeology Field Manual*. This section will summarise the definitions of the key concepts employed in excavation and post-excavation analysis, demonstrate how those concepts are used in the analytical process, and briefly describe the final product in terms of published output.

Definitions

The following section defines the key concepts of *context, intervention, stratigraphic group, feature, entity* and *interpretative group* as used in the Framework Archaeology Database (Fig. 1.8).

Context

The uniquely-numbered *context* is traditionally the primary conceptual unit of recording in British archaeology and the usual means by which artefacts and ecofacts are located to their site of recovery. Contexts are primarily sub-divided into cuts (stratigraphic events) and deposits (stratigraphic units—fills or layers that might contain finds or samples). A context can be a stratigraphic unit or stratigraphic event, but the practice of excavation means that a context may represent a sub-division of a single stratigraphic unit or event. For example, two excavators might excavate the same deposit in two different locations, assigning different context numbers to the deposit. This produces the need for the *stratigraphic group* (see below).

Intervention

An *intervention* binds groups of contexts together in an area of archaeological investigation. It is usually a stratigraphic event (cut) and at least one stratigraphic unit (deposit—taken here to include masonry and structural timbers). The intervention must exist on the digital site plan and must represent an area of archaeological investigation. The latter is usually excavation but may on occasion be the result of a non-invasive recording method. The intervention is used for producing artefact distribution plots within the Geographical Information System (GIS) and is also used in displaying archaeological deposits three-dimensionally.

Stratigraphic group

The *stratigraphic group* is used to link equivalent contexts exposed in separate interventions within the same feature. For example, a stratigraphic group would be used to link together the separate context numbers given to the cut of a ditch in each of the interventions excavated, provided that it can be demonstrated to a reasonable level of confidence that they are equivalent. The same process would be applied to all deposits within the ditch.

Feature

A *feature* is defined as one or more interventions that represent the remains of a past activity. It represents something that existed in the past, such as a ditch or a pit, which has been rediscovered through the process of archaeological investigation.

Entity

The *entity* is the basic tool of structural synthesis, a means of linking a group of related features together. For example, a number of postholes might have formed a structure or a number of ditches an enclosure. This can be employed at an extremely detailed or a very broad level (eg an entity linking all the features making up a Bronze Age field system might contain hundreds of ditches). By definition, the entity includes all deposits within the assigned features. Not all features need belong to an entity, whereas some features may be assigned to more than one entity, depending on the analytical perspective.

Interpretative group

Interpretative groups can be used in one of two ways:

- To sub-divide entities into phases of time, which are defined as representing the construction of the entity, the use or disuse of the entity or the demolition of the entity. The distinction between disuse and demolition of the entity is defined by the visibility of the entity in the landscape. Disuse indicates that the entity was no longer used but still visible. Demolition indicates that the entity was no longer used and no longer visible in the landscape.

- To provide a method of linking deposits by a means unrelated to entities. An example would be the analysis of a landscape which no longer exists as features, such as a Neolithic landscape where all features have been removed by later activity. Only Neolithic finds re-deposited within later features would indicate the existence of such a landscape.

The decision to define interpretative groups within an entity depends on the perceived degree of analysis required. Not all entities will be sub-divided into interpretative group periods. The diagram in Figure 1.8 shows how the Stanwell Cursus would be represented by *contexts, stratigraphic groups* and *interpretative groups* and as

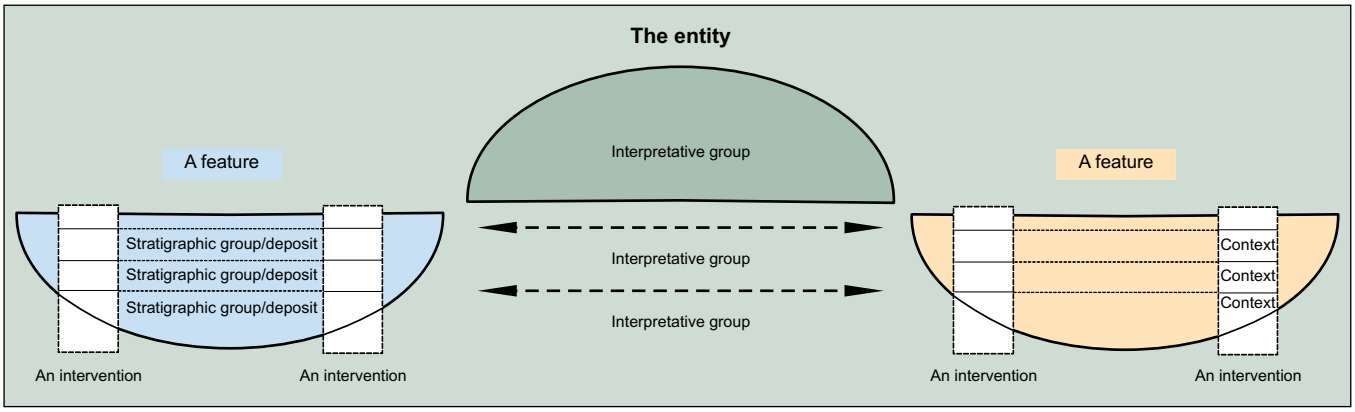

Figure 1.8: Modelling archaeological deposits

an *entity*. These elements can be used to model change through time and space, as demonstrated by the diagram (Fig. 1.7) showing *structuring principles* and *structural conditions*.

Information technology implementation

A computer system was installed on-site consisting of databases for matching up the excavation records, initial object identifications and the environmental samples with the plans of excavated and unexcavated archaeological features.

The purpose of the system was to allow cross-referencing of the recovered records and materials to produce initial phase plans and distribution plots of artefacts and samples which could be used to inform the excavation process.

Fieldwork procedures

The aim of the fieldwork programme was the creation of narratives of inhabitation, and those narratives were then further refined by off-site analysis. Interpretation at this level was the responsibility of the excavating team, rather than it being deferred to a post-excavation stage of analysis. Entities, soils, organic and inorganic residues were therefore examined in the field in order to establish the changing form of the landscape, the processes operating across that landscape and the history of the landscape inhabitation. The development of *landscape generic* to *landscape specific* sampling, and the analytical shift between *structural conditions* and *structuring principles* were designed to facilitate the development of this line of analysis.

The issues raised as structuring principles are not derived from the material itself but from an inquiry into the way human life was ordered by occupying that material. For example, the inhabitants of an Iron Age settlement established and extended that settlement within the remnants of an ancient landscape; some worked the land, food was prepared, material needs were satisfied unequally, rubbish was deposited, the dead were given funerals, gods and spirits were acknowledged. Generally expressed they may be, but these issues impinge directly upon our understanding of the archaeological resource.

The above analytical sequence is one of increasing generalisation through which it will be possible to relate the archaeology of specific practices to more general historical themes and thus to a wider level of regional analysis for both the Middle Thames Valley and for southern Britain. In contrast, the excavation programme will, of necessity, have to move from the general to the particular, by initially assigning deposits to the chronological model proposed in the Research Design before interrogating those deposits to understand the operation of the structural principles through which the landscape was occupied.

Practical application

The excavation consisted of removing any overburden by 360 degree tracked excavators under archaeological supervision. The archaeological features which were soon exposed were then digitally surveyed using electronic distance measurers (EDMs) and (from 2002 onwards) portable GPS survey devices to produce a digital map of the archaeological deposits.

To achieve the levels of analytical resolution demanded during the excavation, two main stages of investigation were identified, *Landscape Generic* and *Landscape Specific*. The main elements of these two stages were as follows:

Landscape Generic

- To characterise the overall nature of the archaeological resource and to understand the processes of its formation;

- To define in plan all archaeological features;

- To establish the character of those features in terms of cuts, deposits and interfaces;

- To recover across the site a sample of organic and inorganic material residues in order to understand site formation processes;

- To establish in outline a dated sequence of structures and thus to define changes in landscape organisation over time;

- To establish, within that dated sequence, the priorities for the investigation of a landscape specific archaeology of inhabitation.

The digital survey following the removal of overburden partially met some of the above aims. Confidence in the interpretation of some entities prior to excavation (eg the cursus monument) was more developed than for example, interpretation of linear ditches as field systems or enclosures. Our knowledge of these entities was in turn more advanced than features such as pits and isolated postholes, about which little was known. The purpose of the Landscape Generic phase was both to build on our present interpretation and add to our knowledge of other landscape elements, and it thus addresses the need to understand the *Structural Conditions*.

In order to manage the excavation programme the Landscape Generic investigations were sub-divided into two stages: LG1 and LG2. The information recovered at each stage was used to inform subsequent interpretations and guided decisions on future excavation strategy. This staged approach facilitated a fluid and dynamic approach towards the management of the excavation and ensured that critical feedback and the construction of a narrative of human inhabitation was achieved within the constraints of the programme. Within these two stages therefore, excavation, analysis and interpretation was an on-going process in which objectives and the means of achieving them were the subject of constant critical review. This iterative approach also had the advantage of allowing appropriate account to be taken of the varying levels of confidence in interpretation with which we started (see above).

Plate 1.3: Working shot of excavations at Terminal 5

LG1 was principally concerned with the following:

- characterising a sample of the main types of features (eg linears, circular structures etc.);

- establishing a basic chronology and relative stratigraphy of the above features;

- assessing the quantities and analytical value of the artefactual and environmental material from these features.

The information gathered from LG1 sampling was analysed during excavation and the results determined the approach to the next stage (LG2).

LG2 was principally concerned with:

- determining the stratigraphic relationships between the excavated features to refine the chronological development of the landscape;

- increasing the sample size of excavated features in response to trends in spatial patterning of finds, environmental evidence and trends in constructional technique of linears etc.

In practice, LG1 interventions were located away from the junction of two features so that relatively uncontaminated finds and environmental samples could be obtained. LG2 interventions were located at the intersection of features to determine stratigraphic relationships. In addition, some LG2 interventions were located to clarify questions raised by LG1 interventions or to obtain more meaningful finds assemblages.

Constant re-assessment of data retrieved during LG1 and 2 allowed the appropriate sample size for investigation of unexcavated elements of LG1 to be determined. For instance, if LG1 determined that a meaningful sample excavation size for roundhouses was 50%, then the remaining unexcavated samples would be excavated to this proportion.

Following LG1 and LG2 the main entities and elements of the stratigraphic groups were built (see Recording System above). Completion of the Landscape Generic phase provided the following:

- an understanding of the formation processes which led to the archaeological features and deposits which exist;

- a broad understanding of the structural conditions existing in successive landscapes;

- a baseline for future comparisons between human occupation of the different landscapes.

Landscape Specific

A series of period divisions in the history of landscape inhabitation was already defined in terms of the dominant traditions by which those landscapes were inhabited (see previous work above). On-site analysis interrogated this model of chronological development, moving between the details of human inhabitation at a site-specific level of analysis and at the more general regional level.

In practice, the results of the Landscape Generic phase of work produced a number of research-focussed tasks which were communicated in a Project Design Update Note in September 1999 (Framework Archaeology 1999b) whilst excavation was continuing.

It is important to note that none of the individual elements described below, or the processes that were used, are in themselves new. The basic level of recording remained the context, and these were grouped to form features, which in turn formed entities. Finds and environmental processing and assessment and analysis were undertaken in standard ways. The difference lay in where these tasks were positioned within the excavation and analytical sequence. For instance, Stratigraphic Groups (SGs) were produced at the end of the Landscape Generic (LG) phase of excavation: indeed, the construction of satisfactory SGs was a major test of whether enough data had been gathered during LG excavations. The creation of SGs allowed the excavators to interpret the construction, use and decay of features and deposits rather than disconnected contexts, and to consider how these operated in relation to contemporary and ancient landscapes. This was the beginning of the process that addressed the analysis of structural conditions and structuring principles (see above).

The requirement to address this level of interpretation during excavation, using finds and environmental data processed on site, facilitated the construction of the historical narrative in the field. The emerging narrative then acted as a source of inquiry for the Landscape Specific (LS) investigations, which may or may not have modified the initial interpretations. Excavation thus returned to the process that almost all archaeologists would agree it should be: a process of investigation of the past driven by questions and inquiry which demand observation, thought and interpretation, rather than attempting to achieve an arbitrary percentage sample across different features and deposits.

This system required site excavators and supervisors to engage with many elements such as grouping contexts and assessing dating evidence that has over the past 20 years tended to be deferred to the post-excavation phase of a project. It is our experience that one of the results of this deferral has been to segregate the skills base in British field archaeology, since field excavators usually have limited finds expertise and little experience of post-excavation analysis. This project provided extensive training in an attempt to raise the quality of excavators' interpretations from the context and intervention level to the feature, entity and landscape level. The results are contained in the interpretative text for the features and deposits, and can be viewed through the Freeviewer software first distributed with Volume 1, and which also accompanies this volume (see below). The content is variable, but provides a much richer record than some archives: we feel it is useful for the excavator to tell us his/her interpretation of what a feature actually *is*, rather than trying to work this out from the convoluted 'context speak' we often encounter.

As the Terminal 5 excavations progressed, the digital archive consisting of contexts grouped into features and deposits continued to grow, and was available for use by the excavation team. The artefactual assemblages were quantified and dated (where possible) and the environmental samples had mostly been processed and assessed for potential. In most respects the dataset was at a stage which most projects achieve after the post-excavation assessment phase, as defined by the Management of Archaeological Projects (English Heritage 1991). Nonetheless, a period following the excavation was required to enter a backlog of records into the database and to check through the digital archive for digitising, stratigraphic and dating errors. The archive was then used to refine the narrative and proposals for analysis and publication were presented in the Project Design Update Note 2 (Framework Archaeology 2005). This document was produced prior to the final phase of excavations at Terminal 5 at the far eastern limits of the site (TEC 05; Fig. 1.2). Data from this area was integrated within the archive in the normal way, and did not greatly affect the publication proposals.

Post-excavation analytical procedures

The analytical phase of the project comprised specialist analysis of the artefactual assemblages and environmental samples, in conjunction with the stratigraphic evidence through the medium of the GIS, a process that took several years. Could this process be shortened? Is it possible to come off site with all this detailed analysis complete? In theory yes; however a number of practical factors prevent this.

Firstly, some forms of detailed analysis such as palynology simply take a long time, especially with a large project and numerous samples. Pottery fabric and form analysis is best undertaken once the whole excavated assemblage is available, not whilst more material is being recovered. Samples for radiocarbon determinations (as with samples for environmental disciplines) need to be carefully selected and prioritised in the light of the full data set for reasons of cost-effectiveness.

Secondly, the structure of British archaeology is such that suitably qualified and experienced finds and environmental specialists are simply not able to move and work on a single site for months or years at a time. They are based in offices or laboratories with extensive existing commitments. However, the publication of the narrative in these volumes is dependant on this work, and until

those skills can somehow be returned to the field then a lengthy post-excavation programme will remain. Nonetheless, Volume 1 in this series was published in 2006, five and a half years after the completion of fieldwork. This volume is published in 2010, just under three years after completion of fieldwork at Terminal 5. Given the scale of the excavations, we feel this is comparatively speedy. At Stansted Airport, major excavations (covering 33 ha) undertaken on behalf of BAA by Framework Archaeology between 1999 and 2004 were published as a monograph (Framework Archaeology 2008) in February 2008. The recording, data processing and interpretative systems developed by Framework Archaeology have thus contributed greatly to the efficiency of publication for both Heathrow and Stansted.

Publication: scope, concept, presentation and archive

Scope of Volumes 1 and 2

Volume 1 (Framework Archaeology 2006) reported on the MoLAS POK96 excavations, plus the WPR98, GAI99 and GAA00 excavations undertaken by Framework Archaeology from 1999 to 2000 (Fig. 1.2; Table 1.1). These excavations occupied the central area of what would become the Terminal 5 development.

The subsequent excavations undertaken as part of the Terminal 5 construction programme (PSH02, TEC05 and LFA05) greatly extended the spatial coverage of the investigations, and in the case of Areas 58 and 61 (the Twin Rivers), proved valuable in linking together drying beds B, C and A excavated in 1999. Therefore, the only realistic strategy was for Volume 2 to report on the entire landscape, including reassessment of the areas already described in Volume 1. However, wherever appropriate, the features described in detail in Volume 1 would receive less attention in Volume 2.

All the periods of human inhabitation considered in Volume 1 have benefited from reconsideration in the light of the Terminal 5 data.

- The Neolithic monumental complex of the late 4th millennium BC is now seen to have been much more extensive, and the evidence for activity in the 3rd millennium BC is more abundant.

- The development of the 2nd millennium BC field system has been re-interpreted, and has benefited from modelling of a much greater number of radiocarbon determinations.

- The evolution of the settlement of the later 1st millennium BC and the Romano-British period have also been reconsidered in the light of the evidence from Areas 58 and 61 of PSH02.

- The Saxon and medieval periods were not discussed in Volume 1, and these have been reported in Volume 2.

In many ways, Volume 1 served as an interim publication, and due to the close interrelationship between that volume and this, a PDF version of the first volume is included on the *CD-Rom* accompanying this publication.

Publication concept, presentation and archive

Volume 1 developed the historical narrative and explored the major themes of landscape inhabitation, while at the same time presenting the archaeological data. This was always a challenging process, with a tension between satisfying two main readerships. Firstly, those who wish to read about the history of human inhabitation of the landscape and are content with a historical narrative supported by detailed example. Secondly, there are those who want to 'know what pottery they found there' (Mercer 2002, 363); that is, archaeologists who wish to use the data in their own research, or are simply content with descriptions of how many monuments and trackways were excavated, their dating and finds assemblages. Our ideal, of course, would be to produce a publication that would satisfy both these groups and allow people to move from narrative to data and back again with ease.

Volume 1 was experimental in other ways, not least of which was the development of a process of analysis using digital data, and then disseminating the data. The lessons learned from Volume 1 (and the Stansted project) were used by Niall Donald to comprehensively redesign the database and GIS structures to enable data to be accessed and analysed in a far more intuitive way, as well as to facilitate the transfer of data from the Framework database into the Freeviewer software.

The Freeviewer software was developed to solve the problem of dissemination of digital data. This is a GIS viewer, which allows the reader to view and interrogate a much larger dataset than would be possible with a normal publication. A CD-Rom containing data and software was distributed with every copy of Volume 1, and this has been repeated with this volume. The Freeviewer software has been developed to include more features, and of course the datasets are considerably larger. Recognising that the Freeviewer software will eventually become obsolete as computer operating systems progress, Archaeology Data Service (ADS) have been commissioned to develop a web-based alternative which will be maintained in the future. This can be found at **http://ads.ahds.ac.uk/**

Should a reader want more detail than the Freeviewer can provide, then the full digital archive will be deposited with the ADS, and the physical archive with the Museum of London.

This approach seeks to provide a historical narrative backed by key analysis and data, but also provides a structured path into increasingly more complex data via the Freeviewer and the full digital archive.

Summary of the historical narrative

This section summarises how the results of the pursuit of the academic philosophy in the field has been presented in this volume, providing a summary account of the history of human habitation at Terminal 5.

Hunter-gatherers and first farmers, 500,000 to 1700 BC

Chapter 2 outlines the chronological evidence before considering some of the historical processes through time. We will consider the significance of pits excavated by hunter-gatherers in the 7th or 6th millennia BC at a location on the edge of the Colne floodplain, as well as a complex of stakeholes of similar date on the floodplain itself.

There is evidence of activity in the 4th millennium BC, prior to construction of the major monumental complex. This consisted of numerous tree-throws, a posthole complex and a possible settlement consisting of pits, postholes and gullies. These were located along the alignment of the great C1 Stanwell Cursus, which we believe to have been constructed in the latter half of the 4th millennium BC. Remnants of at least three other cursus monuments were also excavated, that together with a possible fifth example (detected as a cropmark outside the area of excavation), clearly demonstrates the transformation of this particular location into a major ceremonial centre. In addition, a small circular enclosure was built. We will explore the social context for the construction of these monuments and the consequences for the community that built them. In the space of a few centuries, people had transformed the landscape from one defined by memories of ancient locations to one defined by the architecture of earthen banks and ditches. We will go on to suggest how people lived within this new world during the early part of the 3rd millennium BC. We will examine the processes that linked deposition of Peterborough Ware pottery in the cursus monuments with the deposition of this pottery in pits scattered across the landscape. This theme is continued through the 3rd millennium BC with the use of Grooved Ware pottery, and the possibility is considered that new, small circular monuments were linked with this material. However, by the latter half of the millennium, new monuments and practices of artefact deposition signal a change in the way people inhabited the landscape. By 1700 BC this change was to lead to the replacement of a system that apportioned land and resources through ceremony to one of physical demarcation: the first land tenure and field divisions.

The emergence of the agricultural landscape and its development in the 2nd and 1st millennia BC (c 1700 BC– 400 BC)

In Chapter 3 we will suggest a time and origin for the first land tenure boundaries that divided the Heathrow landscape in the first half of the 2nd millennium BC. We will show how settlements became archaeologically visible and developed within a landscape of small and large fields forming identifiable 'farmsteads', which were traversed by double-ditched trackways. The development from a single extensive farmstead to a multitude of differing farming units within two distinct landscapes is explored, along with evidence for a mixed arable / pastoral agricultural economy, supplemented by resources from the innumerable hedgerows which divided the fields. We will explore how the creation of these field systems and settlements need not imply any disjunctive or revolutionary change, but instead may indicate the continuation of successful social practices. What is beyond doubt, however, is that the ways in which people chose to physically construct their environments altered dramatically. Why those choices were made and what the results of those choices might have been are the basic questions this chapter attempts to address.

We will also show that during the middle of the 2nd millennium BC, people maintained links with the past and the overtly ceremonial world of monuments of the 3rd millennium BC through ceremonies resulting in particular artefacts being deposited in the base of waterholes. The repeated deposition of objects such as ard spikes, whole or broken pots, valuable metal objects, wooden bowls etc in waterholes points to the continued importance of these locations in the creation and maintenance of the Bronze Age world at Heathrow.

We will see how from the late 2nd millennium the settlement pattern changed, with a return to a single large focus of settlement in one landscape and the continuation of the pattern of smaller dispersed settlements in another. We can also see this change reflected in different patterns of artefact deposition at the base of waterholes.

Identifying the abandonment of the Bronze Age agricultural system is very difficult, though there is little specific evidence for any Early Iron Age activity at Terminal 5, beyond a small number of isolated features. However, we shall see how major elements of the Bronze Age agricultural landscape appear to have persisted in some form well into this period and beyond.

Development of the agricultural landscape from the Middle Iron Age to the end of the Roman period (c 400 BC–4th century AD)

Chapter 4 deals with the later Iron Age, after the abandonment of the small, dispersed settlements occupied by the Bronze Age inhabitants. We shall suggest that the Terminal 5 landscape came under the control of new cultural and economic influences and designs, culminating in a gradual transformation which saw the emergence in the Middle Iron Age of a nucleated settlement of roundhouses, four-post structures and livestock enclosures. The daily and seasonal routines of the Middle Iron Age inhabitants continued to be dictated by the requirements of a localised, probably entirely subsistence-based agricultural regime that was apparently biased towards a pastoral economy.

We will examine how this settlement in turn became a focal point for continuing occupation through into the later Iron Age and early Roman period. However, we will demonstrate that parts of the Terminal 5 landscape were radically altered at this time, with new alignments of field systems largely overwriting the previous land divisions. While pastoralism remained a fundamental part of the agricultural economy, the evidence suggests an

Plate 1.4: Mesolithic landscape

increasing emphasis on cereal crops from the Late Iron Age onwards.

We will demonstrate how the settlement complex appears to have been continually modified on a somewhat *ad hoc* basis into the later Roman period. At this point radically new styles of structure and wholesale changes to the eastern field systems were introduced, resulting in a substantial 'ladder' enclosure system, surrounding a major central droveway. This was part of the wider social, political and economic changes of the later Roman Empire. It cannot be proved that occupation continued at Terminal 5 beyond the end of the 4th century AD, although elements of the field and enclosure systems may well have persisted for some time.

The post-Roman landscape (5th/6th century–20th century)

In Chapter 5 we examine the history of occupation at Heathrow from the Saxon period to near the present day. We investigate the remains of an early Saxon settlement and any potential overlap between this and the late Roman settlement and enclosure system. The organisation and historical context of the early Saxon landscape is explored, providing a picture of a drifting settlement within a sparsely occupied land with limited evidence for arable cultivation.

An apparent desertion of the landscape is noted during the mid Saxon period, with no further definitive evidence for activity until the 11th or 12th century. New field systems were established across much of the landscape at this period, and a complex of enclosures and post-built structures, possibly related to stock management, was constructed at Burrow Hill within Stanwell parish. The origins and development of the medieval landscape of Heathrow are explored, along with evidence for pastoralism, arable cultivation and hay making.

The post-medieval landscape is seen to include some elements already in place by the middle Saxon period, while from the 15th century, further developments of the medieval field system largely took the form of enclosure of the common fields. We show how the character of the Heathrow area remained predominantly rural well into the 20th century, until the Perry Oaks sludge works were constructed in 1934 and the first phase of Heathrow airport was built between 1944 and 1946.

Running through all four chapters are two main historical themes:

- The strategies used to decide access to land and resources and how these changed through time;

- How these strategies were intertwined with the tensions between individuals, families and communities, and how these dynamics changed through time.

The description of the archaeological remains will be considered in terms of these historical themes and used as examples of change or continuity in these processes.

An environmental overview of the Heathrow landscape
by Wendy Carruthers

Chapters 2 to 5 of this volume draw on reports by environmental specialists where they are relevant to the features, farmsteads and settlements under discussion. Here, an attempt is made to integrate information from the different environmental disciplines (eg pollen, insects and waterlogged plant remains) in order to reconstruct the Heathrow landscape, bearing in mind that the vast majority of evidence was recovered from Middle Bronze Age deposits. A much fuller overview, together with the individual specialist reports, can be found on the *CD-Rom.*

The pre-monument landscape

It is unfortunate that little environmental evidence was recovered from the early prehistoric period and no buried soils survived to provide baseline information about the ancient forests that became established following the last Ice Age in the Heathrow region. Environmental evidence from excavations along the Middle and Lower Thames Valley suggests that, as warming of the climate moved towards the 'climatic optimum', succession in the Heathrow area followed the classic Holocene pattern described by Godwin (1975), ie birch followed by pine, with hazel and other deciduous trees such as oak, elm and lime, becoming established as the climate warmed. Alder moved in to wetter soils at

around 8000 BP. Alder carr became a dominant vegetation type along the floodplains of river valleys in southern England, from the Mesolithic through to the Bronze Age.

The scant evidence from Late Mesolithic features at T5 suggests low levels of human activity within a mixed pine and oak woodland, with hazel and hawthorn as part of the understorey (Plate 1.4). Pollen sequences through palaeochannel sediments considered to be Mesolithic to Neolithic in date were dominated at their bases by tree pollen of primarily oak and hazel, with some pine, elm and willow, with occasional grains of alder. It is clear that these samples pre-dated the spread of alder onto damp soils of the British Isles, an event dated to *c* 8000 BP by Birks (1989) and 8000–7500 BP at Runnymede (Scaife 2000, 181). Grasses and sedges growing in open, marshy areas amounted to 20% of the total land pollen. Microscopic charcoal levels were high, perhaps due to burning activities taking place in the forest. This was followed by a sudden fall in tree pollen, accompanied by a rise in fern spores. At this time marsh or fen appears to have been developing in cleared areas around the channel. Pollen from dry land trees was much reduced after this point and there was an abrupt rise in alder pollen, indicating that alder carr replaced willow on wet soils along the channel.

Neolithic monument building

According to the ceramic dating evidence the two parallel ditches and central bank of the C1 Stanwell Cursus were constructed in the mid to late 4th millennium BC. Pollen evidence from deposits pre-dating the monument's construction indicates that the western half of the excavated area was primarily open, although some oak/hazel/lime woodland existed on drier ground, with the low count for elm confirming the post-elm decline date. The relatively high occurrence of lime suggests that clearance associated with the *Tilia* decline, which occurred at around 3000–3700 years BP in other sites in the area such as West Heath

Plate 1.5: Early-middle Neolithic landscape

Spa, Hampstead Heath (Greig 1991) and Tilbury (Devoy 1979), had not yet taken place. The herbaceous pollen was dominated by grasses and taxa associated with cultivated land and pastures, while cereal pollen was quite high suggesting that arable cultivation was occurring locally. A burnt humic topsoil suggests that grazing land may have been managed by fire at this time; large scale woodland clearance by burning evidently occurred in the area some time before the construction of the cursus. Relict organic matter, possibly from dung, was observed in soil thin sections from the western cursus ditch.

Towards the eastern edge of the excavated area, a primarily 'open landscape' during the early-middle Neolithic is indicated by the pollen evidence; clearance was more extensive than just a corridor along the cursus (Plate 1.5). By the Late Neolithic, substantial woodland regeneration seems to have taken place, with up to 80% total land pollen and spores consisting of arboreal pollen.

Unfortunately, Neolithic features produced very few, poorly preserved charred plant remains and in some cases radiocarbon dating revealed that upper fills had become contaminated. Small numbers of charred emmer/spelt wheat grains and hazelnut shell fragments considered to be *in situ* demonstrated that both wild and cultivated foods were being consumed in the Early Neolithic period.

The Late Neolithic to Early Bronze Age

Relatively little information exists for this period from either Heathrow or Runnymede, or from the Middle and Lower Thames Valley as a whole on the floodplain. Molluscs from tufaceous silts thought to date to the Late Neolithic/Early Bronze Age suggest flowing water with marsh and some dry open country close by.

Scaife (2000) notes that in many cases early woodland clearances were only partial and short lived, with regeneration occurring, indicated by the influx of taxa such as ash, holly and secondary elm (eg Gatcombe Withy Bed, Isle of Wight; Scaife 1980; 1987). He suggests that in the Later Neolithic the economy of many sites moved towards woodland pastoralism and this is certainly a model that fits in with the scant evidence from Heathrow. Samples from Late Neolithic and/or Early Bronze Age pits produced no cereal remains but strong evidence of thorny scrub, including sloe, purging buckthorn and hawthorn-type in the charcoal assemblage; these thorny taxa are at an advantage when woodland is grazed by large mammals. Tree-throw holes dotted across the excavated area provided further evidence of clearance, although these mostly date to the period before and during the construction of the cursus complex, and no obvious pattern of felling was observed to confirm that humans were definitely involved.

Although scarce, the Neolithic to Early Bronze Age animal remains suggest that pastoral farming was taking place in the area, or at least that animals were being brought to the site, possibly for ritual purposes. Gathered foods, including hazelnuts and sloe, were clearly still important at this time.

By the Early to Middle Bronze Age, pollen evidence suggests that the area near the cursus was again 'open landscape', perhaps with some hedgerows or scrub. Livestock were grazing areas of grassland (indicated by pollen species characteristic of nutrient-enriched soils) and cereals and flax were being grown. Perhaps this cultivation represents small-scale, early stages of development of the Middle Bronze Age settlements, since cereals and flax were also the main crops grown at the later date.

The restricted distribution of waterlogged alder seeds and 'cones' in Bronze Age features along only the western side of the excavated area suggest that alder carr grew close by, and that periodic flooding washed these very buoyant remains into the waterholes and ditches closest to the floodplain.

The Middle Bronze Age agricultural landscape

Major reorganisation of the land occurred during the 2nd millennium BC, while preservation of waterlogged plant and insect remains in all types of features across the excavated area indicated that water levels were relatively high at this time. Even allowing for truncation of the deposits by the construction of the sewage works, soils must have been damp, with seasonal waterlogging being a regular occurrence for many of the settlements. There is also some evidence that such flooding may have become excessive towards the end of the period of occupation. The numerous field boundary and trackway ditches were therefore probably just as important for drainage as for marking boundaries and controlling livestock (Plate 1.6). The scarcity of obligate aquatics in the ditch samples shows that they functioned well, since

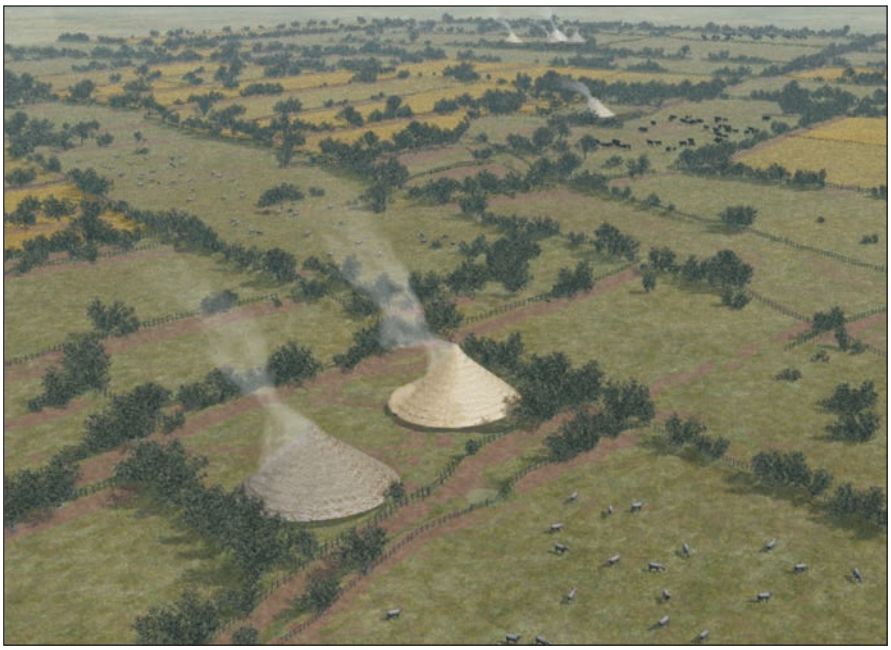

Plate 1.6: Mid-late Bronze Age landscape

standing water cannot have been present for much of the year. In contrast, more than half of the Mid to Late Bronze Age waterholes and waterlogged pits contained the remains of some obligate aquatic plants, such as water-starwort and water-plantain.

Whilst the evidence is inconclusive, it is possible that occupation was seasonal during this period, as suggested for the Middle Iron Age site at Farmoor, located in the Upper Thames Valley on the floodplain and first gravel terrace (Robinson 1979). Alternatively, and perhaps more likely, water levels may have risen during the period of occupation and may have been a contributory factor in the temporary decline in activity at around 1200 cal BC (see Chapter 3), particularly if crops and livestock were affected. The damp soils, at least in the lower lying western part of the Heathrow landscape, would, nevertheless, have provided lush pastures, particularly if seasonal flooding replenished the soil with nutrients. Cattle require a large amount of drinking water and are well suited to grazing damp pastures. Their predominance along the Thames Valley floodplain is typical during the Bronze Age and Iron Age.

Fruits and seeds from plants that grow on wet-ground occurred most frequently in samples containing charred flax seeds and capsule fragments rather than those containing cereal waste. This suggests that flax was being grown on the damper soils along the floodplain of the River Colne to the west, and that either the cereals were grown on higher ground to the east, or that the water table was much lower on the gravel terrace during the main period of occupation.

All of the environmental evidence indicates that the landscape was predominantly open in character, with grassland (probably both pastures and meadows) being the main vegetation type (Plate 1.6). The insect fauna was dominated by terrestrial species characteristic of well-drained, warm, open habitats, with frequent evidence for grazing animals in the form of dung beetles, some of which are typically now found further south in Europe.

Wood and tree dependent insects made up a small percentage of the records, and tree pollen from the lowest levels of most of the Middle Bronze Age features amounted to only 5 to 25% of total land pollen, although this rose to 60% at the east of the site, with oak pollen particularly frequent. This suggests that areas of heavier soils to the north may have remained wooded, perhaps consisting of fairly open oak / hazel wood pasture that could have been used for grazing as well as a

source of fuel wood. An increase in tree pollen in the Middle to Late Bronze Age may indicate some reduction in agricultural activity followed by some limited woodland regeneration (eg small copses). By the Middle Iron Age, however, very little woodland remained in the Heathrow area.

Waterlogged remains from wet ground taxa (alder and willow) were confined to features on the western side of the excavated area, closest to the River Colne.

As discussed further in Chapter 3, and *CD Section 14*, evidence for hedgerows was equivocal from the pollen evidence alone; a number of waterholes contained frequent woodland/scrub/hedgerow plant macrofossils, but palynological evidence was difficult to interpret, since most of the features produced fairly low tree pollen counts. To maintain a hedgerow that is dense enough to control livestock requires regular cutting, but severe cutting reduces flowering and the production of pollen. Nevertheless, the fact that the macrofossil evidence for thorny shrubs was consistently abundant in most of the Bronze Age features does suggest that hedgerows or scrub existed close by, and on balance the existence of hedgerows to control livestock and mark boundaries seems likely. An additional possibility is that areas of woodland pasture may have existed in some areas, with livestock reducing pollination to some extent by browsing. This would not explain the presence of woodland herb macrofossils, but could apply to some areas of the site. Soil analysis suggested that the ever-present evidence of trampling, enhanced phosphate and dung residues along the ditches, may have been due to livestock being able to roam between areas for most of the time, rather than being confined within enclosures for long periods. If soils were fairly damp, confining livestock in a small area for a long period would cause severe poaching of the soil and soon destroy pasture.

Hazel was probably growing on higher ground to the east where the soils were drier. The fact that hazel was not being used for construction, craft and only rarely for fuel, even though it is well suited to all of these purposes, suggests that the supply was limited in the Middle Bronze Age. This suggests that the soils were damp in the western half of the Heathrow landscape during the life of the settlements, rather than just around the time of abandonment.

Economy

Arable agriculture was clearly a major component of the Middle Bronze Age economy at Heathrow, as indicated by the large quantities of charred cereal remains (Plate 1.7). The principal crops grown were emmer (*Triticum dicoccum*) and spelt (*T. spelta*) wheat, hulled barley (most likely 6-row hulled barley; *Hordeum vulgare*) and flax (*Linum usitatissimum*). Spelt wheat was a newly introduced crop at this time and emmer was much more frequent. This is likely to be due to limited availability of seed corn, since over time, and prior to the widespread cultivation of free-threshing bread-type wheats in post-Roman Britain, spelt became the dominant cereal crop grown in southern England. Although spelt is a more robust and higher yielding crop than emmer, it is more demanding of nutrients. Increased cultivation of this crop at the expense of emmer during the Middle Bronze Age may have contributed towards soil impoverishment and acidification that appears to have been taking place on the river terrace gravels.

Unfortunately, the animal bone assemblage is too small to elucidate the pastoral economy or husbandry methods. Both mature and immature cattle and sheep were represented, suggesting both were reared locally. Cattle are better suited to damp pasture, while sheep probably grazed the higher and more marginal ground. Pig and red deer were also present, although the latter was represented only by antler fragments and a split skull with attached antler. Honey may have been utilised in the Mid-Late Bronze Age; fragments of honey bee (*Apis mellifera*) were recovered from Perry Oaks.

Plate 1.7: Bronze Age arable agriculture

Soil acidification

The removal of woodland, cultivation of the soil and grazing over many centuries would have caused the gradual loss of calcium from the terrace gravels and alluvial soils. Two shrubs of base-rich soils, purging buckthorn (*Rhamnus catharticus*) and dogwood (*Cornus sanguinea*), were represented at low levels by plant macrofossils, charcoal and pollen in Neolithic to Late Bronze Age features but not thereafter, suggesting acidification, which was confirmed by the appearance of remains from heathland vegetation in the Iron Age samples.

Plate 1.8: Middle Iron Age landscape

Changes during the Late Bronze Age

Continued use of some of the Farmsteads into the Late Bronze Age, including the large D-shaped enclosure (Farmstead 3), meant that changes in the environment from the Middle Bronze Age to Late Bronze Age period were not easy to identify. The waterholes continued to contain frequent woodland /hedgerow plant macrofossils and alder carr continued to occupy the area towards the Colne floodplain. The most obvious change was the reduction in the numbers of archaeologically detectable features. With smaller numbers of samples being available for study it was difficult to characterise this period of change, but pollen indicated that limited open woodland continued to occupy some areas of the site, and that grazed pastures still dominated the landscape as a whole. Cereal cultivation was still taking place in the area but this was undoubtedly on a much smaller scale than before, suggesting that by this time the lansdcape was largely pastoral. The Late Bronze Age features produced very little bone; one deposit may represent ceremonial activity or feasting.

The Middle Iron Age

By the time the Middle Iron Age nucleated settlement was established the landscape was extremely open with very few trees and shrubs, and there was no obvious pollen or plant macrofossil evidence of hedgerows (Plate 1.8). However, woodland fuel resources were available in the area, albeit perhaps in short supply, since species such as alder and sloe were recorded amongst the charcoal assemblage, as well as oak and elm. Although oak and elm burn well, alder burns poorly unless well seasoned or made into charcoal. Close cropping of hedgerows, and regular pollarding and coppicing of the limited woodland resources may have reduced pollen and seed production to a minimum.

Some arable cultivation and animal husbandry was clearly occurring locally, but pollen evidence suggests that grazing pressure, although initially high, may have fallen later, although the large increase in grass pollen could be explained by cultivation of hay. The latter explanation seems likely in view of the substantial evidence for rebuilding stock enclosures throughout the period, and the reduced reliance on grain and cereal processing waste for winter fodder. Charred cereal remains were very scarce and were poorly preserved, such that the only cereals identified were emmer/spelt and barley. The small charred weed assemblages indicated that damp, acidic and clay soils were being cultivated, and that soil impoverishment may have been a problem. The cultivation of heavier soils, probably to the north, suggests that soils on the gravel terrace may have become too acidic, impoverished and perhaps damp to produce good yields, and this may have been one factor leading the change to a pastoral-based economy.

The Late Iron Age/ early Roman period

The Late Iron Age to early Roman period saw the start of a return to arable cultivation on a similar level to the Middle Bronze Age. This intensification continued into the middle to late Roman period, perhaps in response to the emergence of the new towns at Staines and London nearby (see Chapter 4). Changes in the balance between arable and pastoral farming must have involved reorganisation of field systems and the ploughing up of some pastures or new areas of land. Some gradual, piecemeal changes to the eastern and southern fields are described in Chapter 4, although the main focus of settlement remained in the central area of the site. The Bronze Age field system on the floodplain in the west remained largely unchanged, and it is likely that summer grazing and hay-making continued in this area into the late Roman period. New areas of arable cultivation are likely to have been located on higher ground on the gravel terrace in the eastern half of the site, and probably also beyond the excavated area. As before, the presence of charred and uncharred stinking

chamomile seeds in some of the assemblages indicated that some cultivation may have taken place on the heavier brickearth soils immediately to the north, or on the London Clay, 6-7 km to the north-east or south-west. Crops may also have been imported from further afield.

Spelt wheat had become the dominant cereal grown for human consumption, although emmer was still an important crop. Oats and hulled barley were probably primarily grown for fodder. The introduction of cultivated oats to the Heathrow area must have been a significant advance, since oats are well suited to poor acidic, damp soils. At Heathrow oats appear to have replaced barley as a fodder crop to some extent, particularly in this period.

A large number of cotton thistle seeds (*Onopordum acanthium*) were recovered. Cotton thistle has great economic value since different parts of the plant can be used in a variety of ways; the stems can be boiled, peeled and eaten, the large seeds provide oil that can be used for cooking and lighting; downy fibres from the plant have been used to stuff pillows and mattresses in the past.

Charred seeds from wet-ground taxa such as spike-rush, sedge and buttercup provided evidence for the deposition of burnt waste from marsh or damp meadow hay from wetter soils on the floodplain. Either there were hay meadows in the vicinity and/or unburnt hay had been deposited as waste but had rotted away.

The presence of relatively mature woodland, or hedgerows managed for fuel by regular pollarding or coppicing, is suggested from the charcoal evidence, and this could explain the very small woodland signal in the pollen record. Pollen evidence continued to indicate a very open landscape with meadows and grassland, cereal cultivation and areas of waste ground. Traces of heather (*Calluna*) pollen were present in most of the samples, but the absence of insect species that feed on heathland vegetation suggested that this habitat was located some distance away.

Plate 1.9: Late Roman landscape with 'ladder' enclosure

The early/mid Roman and mid/late Roman periods

As discussed in Chapter 4, some degree of intensification seems to have taken place in the Roman period. The most obvious change was alteration to field boundaries in the eastern area during the 3rd century AD, creating a 'ladder enclosure' complex system with a central wide droveway, possibly in response to increased demand for meat products in the developing market towns (Plate 1.9). Unfortunately poor preservation of the bone meant that it was difficult to detect any changes affecting livestock as a result of intensification or 'Romanisation'. As with previous periods, cattle continued to be the most abundant species with some horse, sheep, sheep/goat and pig. Traces of red deer and roe deer were also found.

Plant macrofossil evidence suggests that water levels may have risen at the start of the Roman period, probably causing increased seasonal flooding and waterlogging in some areas of the site. Although standing water was not present on a permanent basis (since obligate aquatic plants were not represented), organic material was well preserved, particularly in the early/mid Roman pits. It is possible that by the mid- late Roman period more effective drainage systems (or reduced water levels) had improved the soils to some extent, since ditches from this period onwards did not contain organic material preserved by waterlogging. The absence of anaerobically preserved organic deposits could also be explained by greater levels of maintenance, with ditches being cleaned out on a regular basis.

As in the Iron Age, the landscape appears to have been extremely open during the Roman period, with very little woodland apart from perhaps a few scattered trees and possibly old, gappy, impoverished hedgerows. The pollen evidence suggests that grassland and meadows would have dominated the landscape, although evidence for cereal cultivation was more prominent than in earlier periods. A single grain of hemp/hops hints at other possible horticultural crops being grown for fibres, flavouring/preservative or medicinal use.

The scarcity of pollen from woodland taxa was again not borne out by the charcoal evidence, possibly because either a rigorous management regime was in operation, reducing tree/shrub flowering to a minimum, or that wood was brought in from some distance, perhaps being traded for agricultural produce. There was no evidence for the exploitation of heathland for fuel, despite traces of shoots and leaves being found amongst the charred and waterlogged plant macrofossils.

Arable cultivation appears to have increased gradually from the Late Iron Age period through to at least the mid Roman period. This may have been achieved by improvements in crop husbandry practices and improvements to the land, such as increased drainage and manuring. Nitrophilous plants such as henbane, black nightshade, hemlock and nettles were common, again suggesting middening. Other improvements in comparison with the Middle Bronze Age include changes in harvesting methods, from uprooting in the Middle Bronze Age to cutting below the ear in later periods.

Uprooting was demonstrated by the presence of cereal straw nodes and stem bases in Middle Bronze Age samples, together with the presence of low growing, twining and scrambling weeds. These were largely absent in samples of later date. Heavier soils were clearly cultivated in the Roman period. It is likely that clay soils would have primarily been used for growing spelt wheat, although a little more evidence for the cultivation of bread wheat was recovered from the mid/ late Roman samples. The gradual transition from cultivating primarily emmer to primarily spelt in was almost complete by this time. Rye (*Secale cereale*) may also may have been introduced to cope with poor, acidic but well-drained soils in the area.

A single grape pip demonstrates that luxury foods were being eaten, and probably represents imported dried grapes or raisins being purchased from a town nearby. Crops grown on the heavier soils may also have been imported. The high concentration of honey bee remains from Perry Oaks suggests that the Roman settlement was involved with beekeeping.

The early /middle Saxon period

Samples with potential for paleoenvironmental reconstruction were very limited. Charcoal included oak (perhaps reflecting structural timbers but also possibly deriving from post-abandonment dumping of domestic waste) as well as maple, ash, hazel, sloe and hawthorn-group. Clearly, oak was still readily available, although scrub or hedgerow species were also being used, perhaps from hedge-cutting or scrub clearance. It is interesting to note that heathland was still not being used as a fuel source, even though there was evidence for this at the nearby Saxon sites at Hounslow and Kingston upon Thames (Smith 2002, 33). Hawthorn, hazel and blackberry macrofossils suggest soils in the western area of the site might have become drier during this period and indeed features in Area 14 were not waterlogged. Elsewhere, there was some, albeit very limited, evidence for the presence of nutrient-enriched soils, with waterholes used by livestock fairly intensively over a long period.

The evidence for exploitation of wild animals was again very limited, as is typical for the period. While the sample size is small, sheep were probably the most frequent species (though making up a smaller proportion of the bones than on other Saxon sites), but pig and horse were common and cattle comprised a lower proportion of the bone assemblage than before. The relative frequency of pigs when compared with the general trend of decline in pig numbers in the Saxon period (King 1991) could indicate that areas of scrub and woodland were readily available as wood pasture.

Alongside the evidence for a reasonably diverse pastoral aspect to the economy, the evidence for arable cultivation was fairly minimal. Although it is uncertain whether the few cereal remains in these samples were representative of the settlement as a whole, the change to the production of more fodder crops than grain for human consumption could mirror changes seen in the Late Bronze Age to Middle Iron Age, reflecting a change in the arable / pastoral balance towards pastoralism. The small amount of evidence from the arable weed ecology indicated that clay soils were being cultivated, perhaps with some damp areas and manuring was probably taking place. Cereals being used on the site during this period included bread-type wheat, barley and probably oats.

Three different species of plant used to produce fibres were present in one waterhole, perhaps indicating small-scale craft activities taking place. As before, cotton thistle seeds were present, and there were a few fragments of possible hemp (cf. *Cannabis* sp.) seed and fragments of cultivated flax capsule, suggesting that the waterhole may have been used for retting. Since retting would cause pollution and eutrophication of standing water, the remains must represent a secondary use of the feature, having been abandoned as a waterhole.

The medieval period

Although the landscape was still predominantly open, woodland taxa were much more in evidence than at any time since the Bronze Age. Tree pollen in the area had increased to relatively high levels, particularly oak and ash, though also including holly, rose, elder and honeysuckle. The high oak values may indicate areas of wood pasture, consisting of large standard oak and ash trees surrounded by grazed grassland (Plate 1.10). Insects also provided evidence for woodland, with tree-dependant species including beetles found on ash (scolytid beetles *Hylesinus oleiperda* and *Leperisinus varius*), and willow/poplar (curculionid beetle *Dorytomous* spp.). The presence of pig and deer in the bone assemblage also suggests nearby woodland.

Heathland was exploited and probably existed close by, as confirmed by pollen and insect evidence as well as the recovery of frequent charred heather capsules and gorse/broom charcoal. As with the woodland taxa, heathland vegetation could have been brought onto the site for use as fuel, bedding, fodder and thatch. However, evidence for use of this valuable resource was very limited from earlier periods, despite pollen and some macrofossil evidence for heathland development in the area from at least the Iron Age. Therefore, either heathland was established in the area by the medieval period, or rapid-burning gorse/broom and heather was being brought onto the site as fuel for a particular purpose. It would appear that good fuel wood such as oak was not in short supply, as the charcoal was predominantly oak, although beech was used in reasonable quantities for the first time.

The fact that oak may have been growing so near to the western side of the excavated area and beech was more readily available suggests that water levels may have fallen by this period, a theory supported to some extent by the scarcity of waterlogged plant remains in features from all areas of the site.

Further specialisation in animal husbandry could be seen, with pigs

Plate 1.10: Medieval landscape

being killed relatively young for meat and cattle kept to maturity to provide secondary products such as milk, manure and traction. The main species of livestock represented were horses and cattle, with smaller numbers of sheep/goat and pig. The small proportion of sheep in what might be assumed to have been a wool-based economy was notable. However, preservation was, again, often poor and the origin of the remains unclear. Plant macrofossil and insect species represented in a rare waterlogged waterhole were typical of open grassland and disturbed habitats, including some plants of grazed meadows (eg thistles) and some of drier hay meadows (eg fairy flax). These may have originated from hay brought in for winter fodder. The damp alluvial soils of the floodplain would have been used for hay meadows and summer grazing, as in the centuries before.

High levels of weed infestation in an assemblage of charred cereal remains recovered from the remains of a burnt down barn imply the cultivation of impoverished, heavy clay soil. The stored crops included bread-type wheat, hulled six-row barley, oats and rye. Additional crops grown during this period may indicate crop rotation was taking place in order to help restore soil fertility. Cultivated vetch (*Vicia sativa* ssp. *sativa*), Celtic beans (*Vicia faba* var. *minor*) and possibly peas (cf. *Pisum sativum*) are leguminous plants that were commonly grown during the Saxon and Medieval periods for fodder, and sometimes for human consumption. Peas and beans may have been grown as garden plants, or on a larger scale in rotation with cereals. It appears that at this site they were probably being grown as field crops since they were found amongst charred cereals in all four samples.

The presence of several charred hazelnut shell fragments and a sloe/cherry/plum (*Prunus* sp.) stone fragment in the pits hints at other wild and possibly garden fruits and nuts that were being consumed. Flax cultivation seems to have continued. More or less the same range of crops was being grown in the later medieval period (13th-14th centuries).

The post-medieval period

There is little environmental evidence from this period, including some limited pollen evidence to suggest that woodland gradually increased, with ash and oak showing notable rises in frequency. This may suggest some reduction in farming intensity, enabling ash and then oak to become established in drier areas that were no longer farmed. Aquatic and marsh plants (including duckweed, water crowfoot and flote-grass) grew in damp areas around the former palaeochannel; flooding episodes were evident. Plant macrofossils from meadow plants such as meadowsweet and buttercups represent floodplain meadows growing along the Colne valley.