Northamptonshire National Mapping Programme Project

Management Report

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Northamptonshire County Council

ENGLISH HERITAGE

NORTHAMPTONSHIRE NMP PROJECT

MANAGEMENT REPORT

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SUMMARY

The Northamptonshire National Mapping Programme Project is operated and supported by Northamptonshire County Council (NCC) and funded through English Heritage's Archaeology Commissions Programme (and previously the Royal Commission on the Historic Monuments of England).

The project started in 1994 on the well-established foundations of skills and data developed by NCC since the mid-1970s. The Northamptonshire Project was the first NMP project to be implemented in a entirely digital environment and is the first to be completed with full GIS functionality. It is part of the continuing development of a broader historic digital data set for the county which includes Historic Landscape Characterisation and the Rockingham Forest Project.

This Management Report charts the progress, development and methodology of the project's mapping and interpretation stage, which ended in August 2001. It is also a springboard for the discussion of the future management and processing of air photograph data.

The project of 130 quarter sheets mapped and recorded over 14, 000 archaeological sites of which 15% were new to the SMR and more than 57% were new to the NMR. This data and the results of research and analysis will be disseminated through both formal and internet publication, the latter via the Archaeology Data Service. The data will also be available through the channels of the NCC and National Monuments Record Centre.

English Heritage: HOB UID Collection No. 1059503 Event No. 1225207

Northamptonshire County Council Sites and Monuments Record: Event No. NN101891

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1 INTRODUCTION

1.1 Background to the project

1.1.1 The National Mapping Programme

The aim of the National Mapping Programme (NMP) is "to enhance our understanding about past human settlement, by providing primary information and syntheses for all archaeological sites and landscapes (visible on aerial photographs) from the Neolithic period to the twentieth century." (Bewley, 2001:78).

The creation of the NMP, in 1992, was an ambitious venture developing on previous selective (geographically and thematically) approaches to mapping from air photographs (e.g. Johnson & Rose 1994, Leech 1977, Benson & Miles 1974, Palmer 1984). Following four pilot studies to assess methodology and resource requirements, the NMP promised an inclusive and standardised approach to mapping archaeological landscapes of all periods over extensive survey areas.

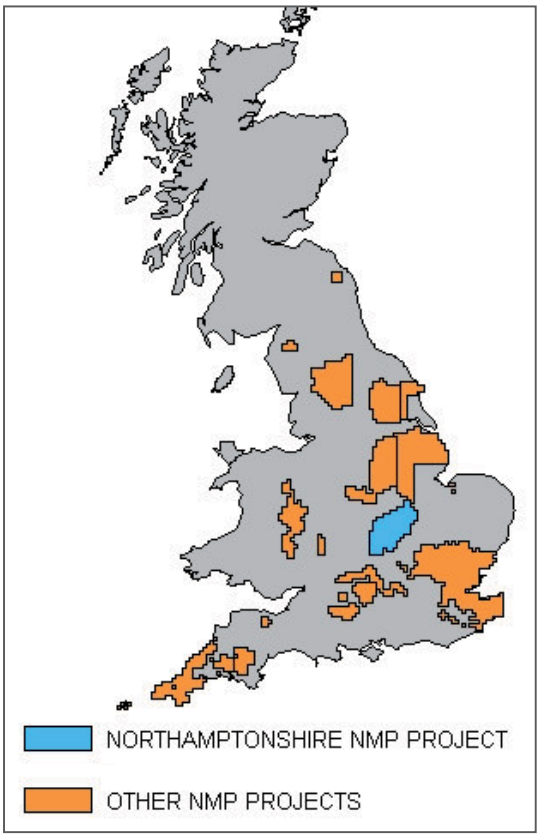


Figure 1. The National Mapping Programme in 2002.

The first NMP projects were the Lincolnshire project conducted by the Air Photo Unit (APU), Royal Commission on the Historic Monuments of England (RCHME), and the Essex (1993), Nottinghamshire (1993) Cornwall (1994) and Northamptonshire (1994) projects undertaken by Essex County Council, Air Photo Services, Cornwall County Council and Northamptonshire County Council respectively. The external projects were initially funded by English Heritage (EH) grant-aid through RCHME, then directly by RCHME. Since 1999, after the merger of EH and RCHME, the Northamptonshire project has been funded through EH's Archaeology Commissions Programme as part of the NMP Acceleration Programme.

At the time of writing 22 NMP projects have been completed and 7 are in progress, and nearly 30% of England has been mapped for the programme.

1.1.2 The context of the Northamptonshire project in the NMP

Northamptonshire County Council (NCC) had been conducting an annual aerial survey for archaeological sites since 1974, with funding from English Heritage and RCHME. This work included the integration of the survey results into the Sites and Monuments Record (SMR) and, until 1977, manual plotting of new sites at 1:2500 scale using the mobius network technique.

Computer-aided techniques of transcription were adopted in the early 1980s, following a

critical assessment of the manual and sketch plotting techniques hitherto employed in the county and elsewhere (Foard 1980). New sites identified during continued reconnaissance were plotted using AERIAL software and, crucially, the resultant files were archived.

With this history of reconnaissance and mapping and the existing expertise, Northamptonshire was selected as one of the first NMP projects in 1994. This was the first attempt in the county to systematically plot all sites in a consistent and accurate manner and to bring together evidence from a wide range of photographs into one coherent whole.

From the start the Northamptonshire NMP project was operated through Northamptonshire County Council's Geographical Information System (GIS), which made the project unique at the time. This enabled the incorporation of existing data into the NMP project. The adoption of the NMP standards widened the sphere of interest for air photo mapping and interpretation in the county. The Northamptonshire NMP project was conceived as part of a broader digital environment information system.

1.2 Project Details

1.2.1 Project Area.

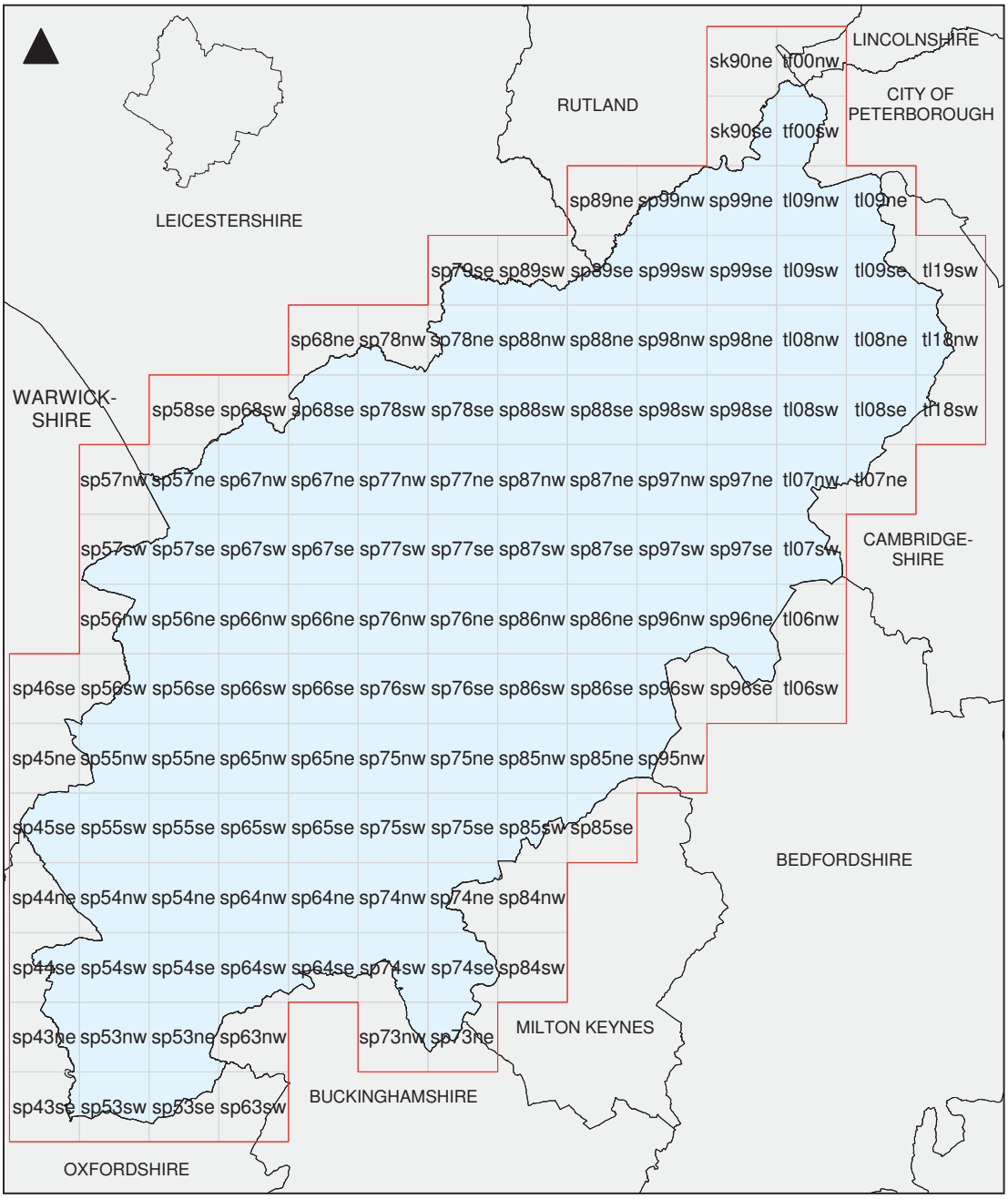
The Northamptonshire NMP project encompasses the modern county of Northamptonshire at the heart of England in the East Midlands. The project consists of 130 whole 0S 1:10, 000 scale quarter sheets totalling 3250 square kilometres. The project provides complete coverage of Northamptonshire. Sixty-six quarter sheets overlap into one or more of the neighbouring 8 counties and 2 unitary authorities, as detailed in and Table 1 and Figure 2.

Table 1. Relative coverage of the Northamptonshire NMP project area.

County/ Unitary Authority	**Percentage covered by this NMP project**	**As a percentage of this NMP project**	**Quarter sheet coverage**	**Other NMP project coverage**
Northamptonshire	100	73	64 whole, 66 partial	-
Oxfordshire	5	4	10 partial	Thames Valley
Buckinghamshire	5	2	8 partial	Thames Valley
Milton Keynes	33	3	9 partial	-
Bedfordshire	8	3	8 partial	Hertfordshire overlaps
Cambridgeshire	3	3	9 partial	Hertfordshire and Essex overlaps
Peterborough	7	1	5 partial	-
Lincolnshire	0	0	1 partial	Lincolnshire
Rutland	23	3	7 partial	Lincolnshire overlaps
Leicestershire	6	4	12 partial	National Forest, Lincolnshire and Nottinghamshire overlaps
Warwickshire	6	4	10 partial	-

Only the Lincolnshire NMP project immediately adjoins the Northamptonshire NMP project, and in fact there is a 1 quarter sheet overlap between the two projects (TF00NW). The neighbouring counties of Oxfordshire and Buckinghamshire have partial coverage from a pilot NMP project along the Thames Valley (Fenner and Dyer 1994). Leicestershire has partial coverage from the National Forest project, completed in 1993 (Macleod 1995). The contribution of this project to the coverage of other counties is minor. Furthermore this project's recording in the overlap areas is not completed to the same specification as the Northamptonshire data. As the air photographs held by collections in the overlap counties were not consulted for this project the mapping and interpretation in these areas is considered to be incomplete and has not been entered into the MORPH2.2 database. However the scope and quality of mapping and interpretation are consistent with the general NMP standards, and the maps are available for future NMP projects in these areas.

Figure 2. The Northamptonshire NMP Project Area.



As with others, the Northamptonshire NMP project was divided into blocks of contiguous quarter sheets for the management of National Monuments Record (NMR) photo loans and for monitoring purposes. The original organisation of blocks and its numerical sequence was established to reflect the mapping priorities at that time. By 1999 these priorities had changed and the remaining project area was reordered and renumbered anew.

Figure 3. The Northamptonshire NMP Blocks.

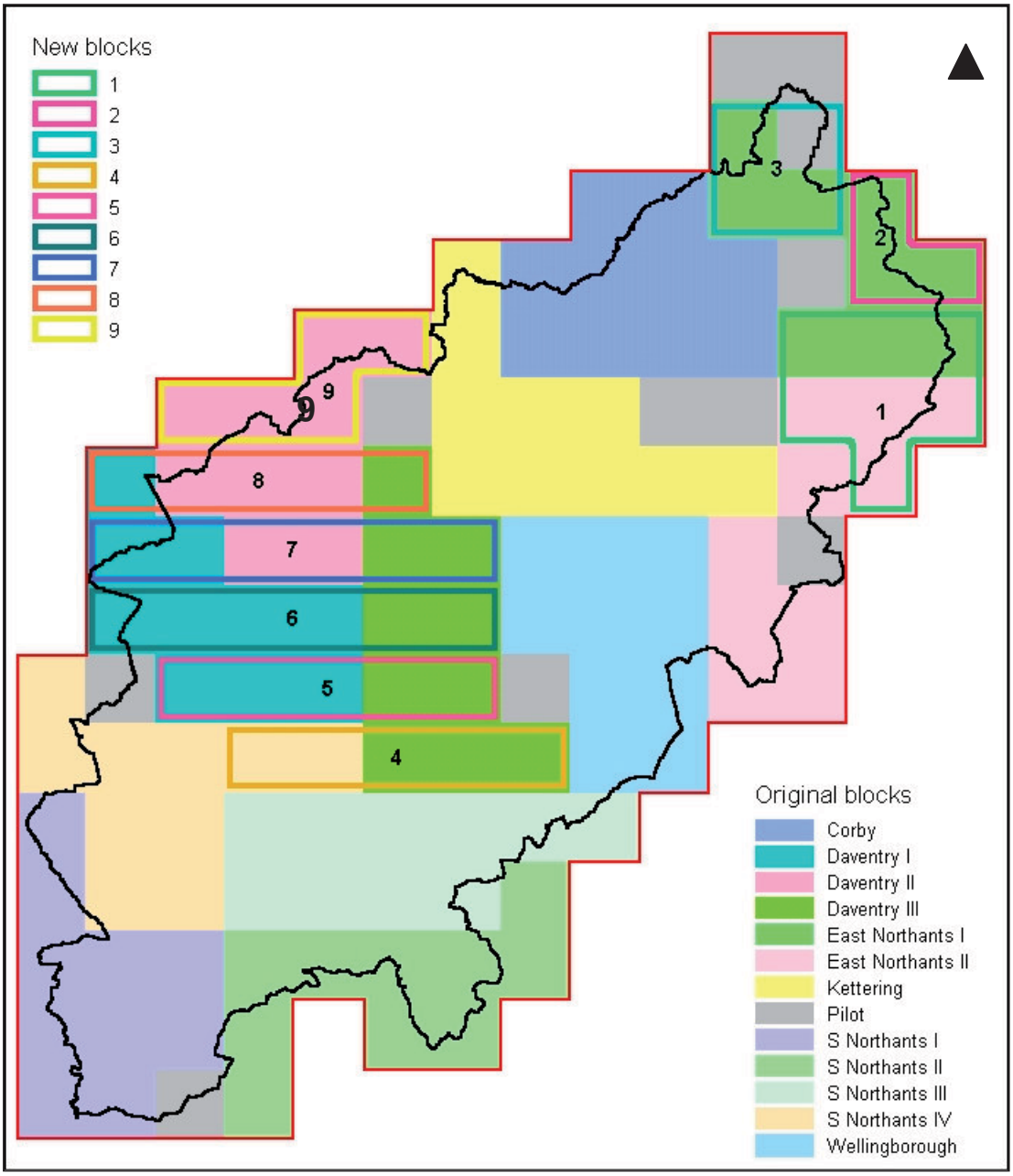
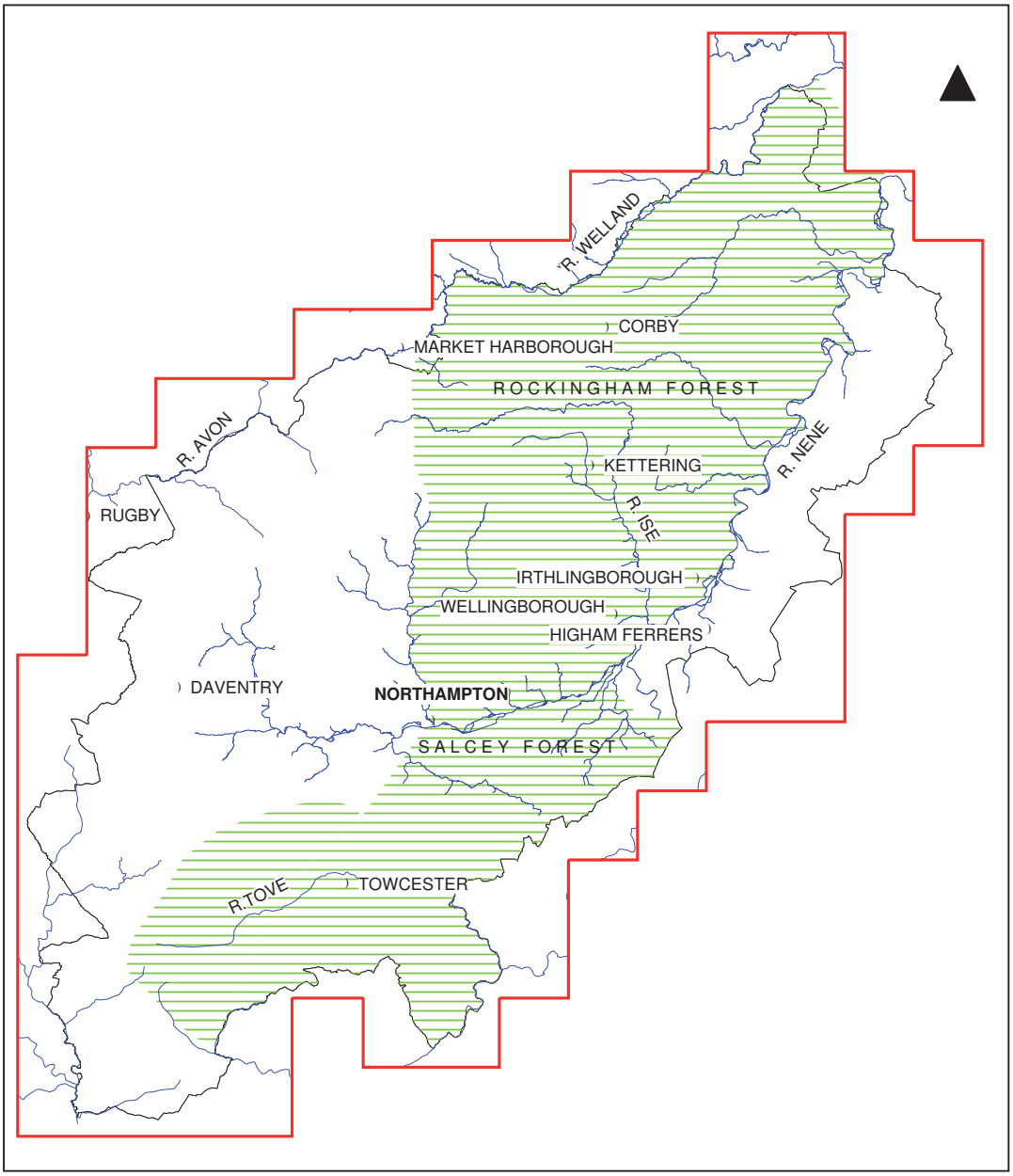


Table 2 Northamptonshire NMP Blocks 1994-1998 and 1999-2001.(Map sheets in bold were actually completed in the given period)

	Block title	**Quarter sheets**	**Total completed**
1994-1998 BLOCKS	Pilot	**SP53SE, SP56SW, SP78SW, SP86SW, SP98SW SP98SE, SK90NE, TL07SW, TL09SW, TF00NW**, TF00SW	10
	Block I Wellingborough	**SP85NE, SP86NW, SP86NE SP86SE, SP87SE SP87SW, SP95NW, SP95SW, SP96NW, SP97SW**	10
	Block II Corby	**SP88NW, SP88NE, SP89NE, SP89SW, SP89SE, SP98NW, SP98NE, SP99NW, SP99SE, SP99SW**	10
	Block III Kettering	**SP77NE, SP78NE, SP78SE, SP79SE, SP87NW, SP87NE, SP88SW, SP88SE, SP97NW, SP97NE**	10
	Block IV South Northamptonshire		
	South Northamptonshire I	**SP43NE, SP43SE, SP44NE, SP44SE, SP45SE, SP53NW, SP53NE, SP53SW, SP54SW, SP54SE**	10
	South Northamptonshire II	**SP63NW, SP63SW, SP64SW, SP64SE, SP73NW, SP73NE, SP74SW, SP74SE, SP84NW, SP84SW**	10
	South Northamptonshire III	**SP65SW, SP64NW, SP64NE, SP65SE, SP75SW, SP74NW, SP85SE, SP85SW, SP74NE, SP85SE**	10
	South Northamptonshire IV	**SP55SE, SP54NE, SP54NW, SP55NE, SP55NW, SP55SW, SP46SE, SP45NE**, SP65NW, SP65NE	8
	Block V Daventry	SP56NE, SP56NW, SP56SE, SP57NW, SP57SE, SP57SW, SP66NE, SP66NW, SP66SE, SP66SW, SP57NE, SP58SE, SP67NE, SP67NW, SP67SE, SP67SW, SP68NE, SP68SE, SP68SW, SP78NW, SP75NE, SP75NW, SP76NE, SP76NW, SP76SE, SP76SW, SP77NW, SP77SE, SP77SW, SP85NW	0
	Block VI East Northamptonshire		
	East Northamptonshire I	SK90SE, SP99NE, TL08NE, TL08NW, TL09NE, TL09NW, TL09SE, TL18NW, TL19SW	0
	East Northamptonshire II	**SP96NE, SP96SE, SP97SE, TL06NW, TL06SW, TL07NW**, TL07NE, TL08SW, TL08SE, TL18SW	6
1999-2001 BLOCKS	Block 1	**TL08NW, TL08NE, TL08SW, TL08SE, TL18NW, TL18SW, TL07NE**	7
	Block 2	**TL09NE, TL09SE, TL19SW**	3
	Block 3	**SK90SE, TF00SW, SP99NE, TL09NW**	4
	Block 4	**SP65NW, SP65NE, SP75NW, SP65NE, SP85NW**	5
	Block 5	**SP56SE, SP66SW, SP66SE, SP76SW, SP76SE**	5
	Block 6	**SP56NW, SP56NE, SP66NW, SP66NE, SP76NW, SP76NE**	6
	Block 7	**SP57SW, SP57SE, SP67SW, SP67SE, SP77SW, SP77SE**	6
	Block 8	**SP57NW, SP57NE, SP67NW, SP67NE, SP77NW**	5
	Block 9	**SP58SE, SP68NE, SP68SW, SP68SE, SP78NW**	5

Figure 4. Key locations in the Northamptonshire NMP Project Area.



1.2.2 Geology of the county.

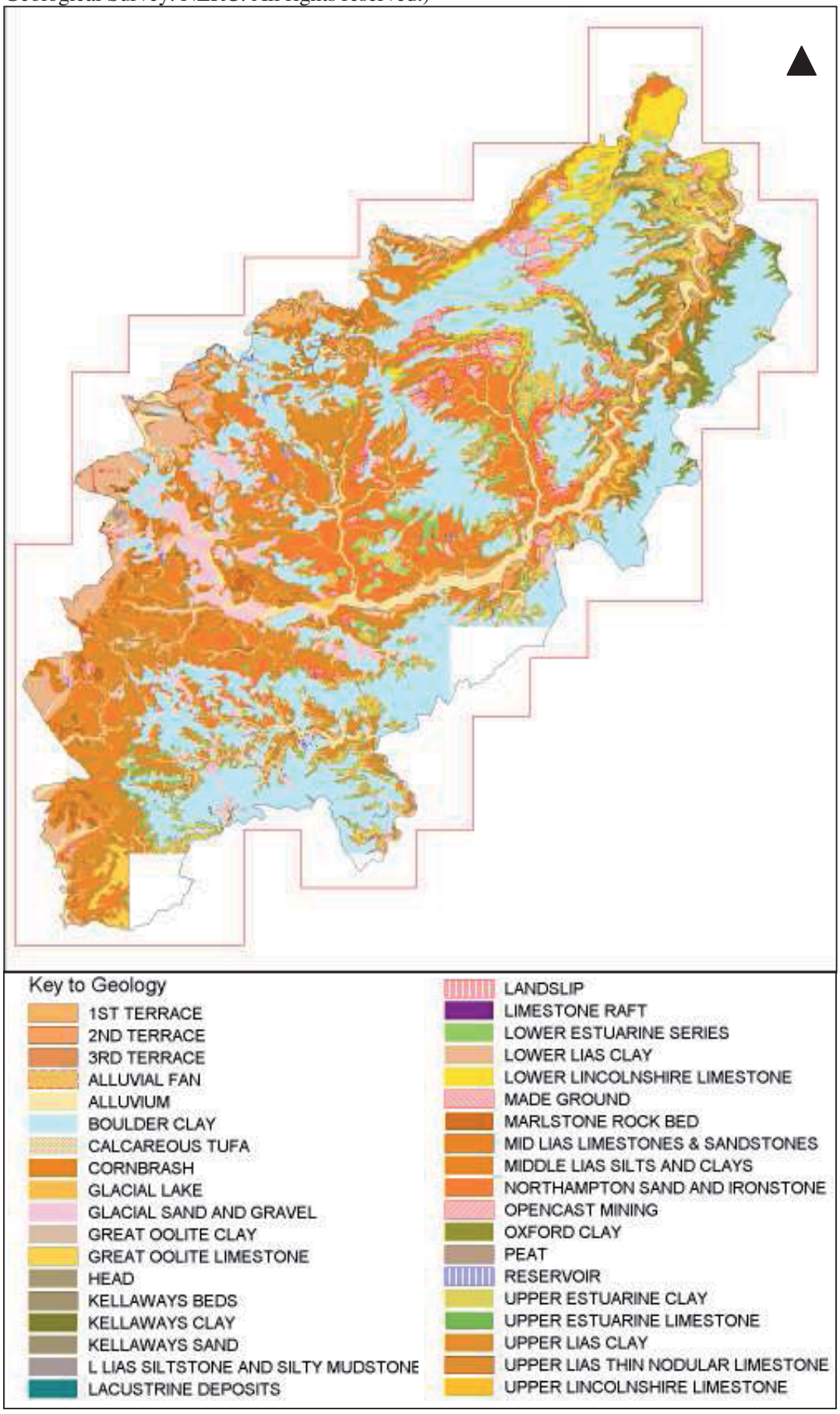
NCC has generated a digital dataset of the surface solid and drift geology from 1:10, 560, 1:10, 000 and, in small areas where the large scale survey is incomplete, at 1:50, 000 scale survey under licence from the British Geological Survey (BGS). These digital data are only available for the county of Northamptonshire and do not extend into the neighbouring counties overlapped by the NMP project area.

The modern county is founded on a south-west to north-east trend of Jurassic rocks of varying character overlain by later deposits (see Table 3).

Table 3. The stratigraphic sequence of the major geological strata outcropping in Northamptonshire and their attributes (based on Martin & Osbourne 1976)

Years BP	**Geological period**	**Geological strata**	**Geological sub-types**	**General attributes**
14, 000 approx.	HOLOCENE	Alluvium	Alluvial Fan	Generally impermeable but with some reworked gravel
		Terrace		Permeable
1.5 M	PLEISTOCENE	Head		Dependent on source material
		Boulder Clay		Impermeable
		Gravels		Permeable
		Glacial Lake Deposits		Permeable
65 M	TERTIARY			
135 M	CRETACEOUS			
		Oxford Clay		Impermeable. Heavy and tenacious clay.
		Kellaways Beds	Kellaways Sand	Permeable
			Kellaways Clay	Impermeable. Heavy and tenacious clay.
		Cornbrash		Permeable. Hard shelly limestone
		Great Oolite Series	Blisworth Clay	Impermeable. Heavy and tenacious clay.
			Blisworth Limestone	Permeable
			Upper Estuarine Series	Impermeable clay inter-leaved with permeable limestone
		Inferior Oolite Series	Lincolnshire Limestone	Permeable
			Lower Estuarine Series	Impermeable
			Northampton Sand	Permeable
		Upper Lias		Impermeable
		Middle Lias	Marlstone Rock Bed	Permeable
			Middle Lias Silts & Clays	Impermeable
195 M	JURASSIC	Lower Lias		Impermeable

Figure 5. Solid and Drift Geology in Northamptonshire (Licence 2001/004 British Geological Survey. NERC. All rights reserved.)



Geological uplift and the presence of the more resistant Jurassic formations, particularly the Marlstone Rock Bed, have resulted in higher ground to the west and north-west gently dipping to the south-east. The Oxford Beds, outcropping in the east of the county, are the most recent surviving solid formations because the Cretaceous and Tertiary deposits were all but removed by later events in this area. In the west and north-west of the county the Upper Jurassic and subsequent deposits were eroded from the higher ground and the Middle and Lower Jurassic strata outcrop.

In the Pleistocene these structures were overlain by glacial and periglacial deposits. Material suspended in the melt-water, dammed by the higher ground, was forced by the approaching ice sheet through the Watford Gap and along the lower ground now occupied by the River Nene. The ice sheets moved and redeposited large quantities of material that had been released from the land surface by periglacial events and glacial erosion. Boulder Clays of varying depth were laid down by the ice sheets. The nature of these deposits depends on their source but in Northamptonshire they are predominantly chalky in character. Head deposits of mixed sandstone and limestone rubble, created by solifluction events in periglacial conditions, are found on some slopes and dry valley floors. Sorted sand and gravels were deposited by melt waters in warmer periods.

Subsequent action by melt waters and later erosion cut through the glacial and earlier deposits, in parts exposing the various solid strata and re-working the gravels, resulting in a complex geological landscape.

In more recent times human activity has precipitated erosion and alluvial deposition along the river valleys.

It is the surface geology of today and the recent past that is most pertinent to understanding the archaeological evidence, rather than the deeply stratified structures themselves. It is the character of the exposed formations and the soils developed from them that has influenced human activity and affects the survival and visibility of remains.

Of the exposed permeable geologies the Northamptonshire Sand deposits are the most common, capping the higher land to the west and exposed in the incised river valleys in central parts. The Marlstone Rock Bed outcrops are limited to the west of the county. Lincolnshire Limestone outcrops in the north-east of the county, particularly around Collyweston and in the Welland valley. The Great Oolitic Limestone, known locally as Blisworth Limestone appears in the far south around Brackley and along valley sides in central and eastern Northamptonshire. The Cornbrash is exposed in the Nene valley, downstream of Irthlingborough, in the east of the county.

Glacial sands and gravels are found in a band arcing from the Watford Gap to the south of Northampton where they peter out and appear only sporadically in the River Tove basin and further down the Nene valley. Fragmentary terrace gravels are exposed downstream of Towcester on the River Tove and Northampton on the Nene, whilst larger expanses survive around the head waters of the Rivers Ise and Welland and north-east of Rugby on the River Avon, all in the north of the county.

In general the distribution of impermeable rocks is more extensive. The Lias clays outcrop in a series of bands from the west of the county predominating on all but the higher ground, where they are capped by Northamptonshire Sand or where glacial deposits survive. In the east of the county younger Jurassic rocks survive and outcrop along the river valleys, of note are the particularly heavy and tenacious Kellaways Clay and Oxford Clay.

In all but the far south-west of the county Boulder Clay blankets the plateaux between tributaries and watersheds between river systems. Alluvial deposits line the valley floors of the rivers and tributaries.

1.2.3 Soils

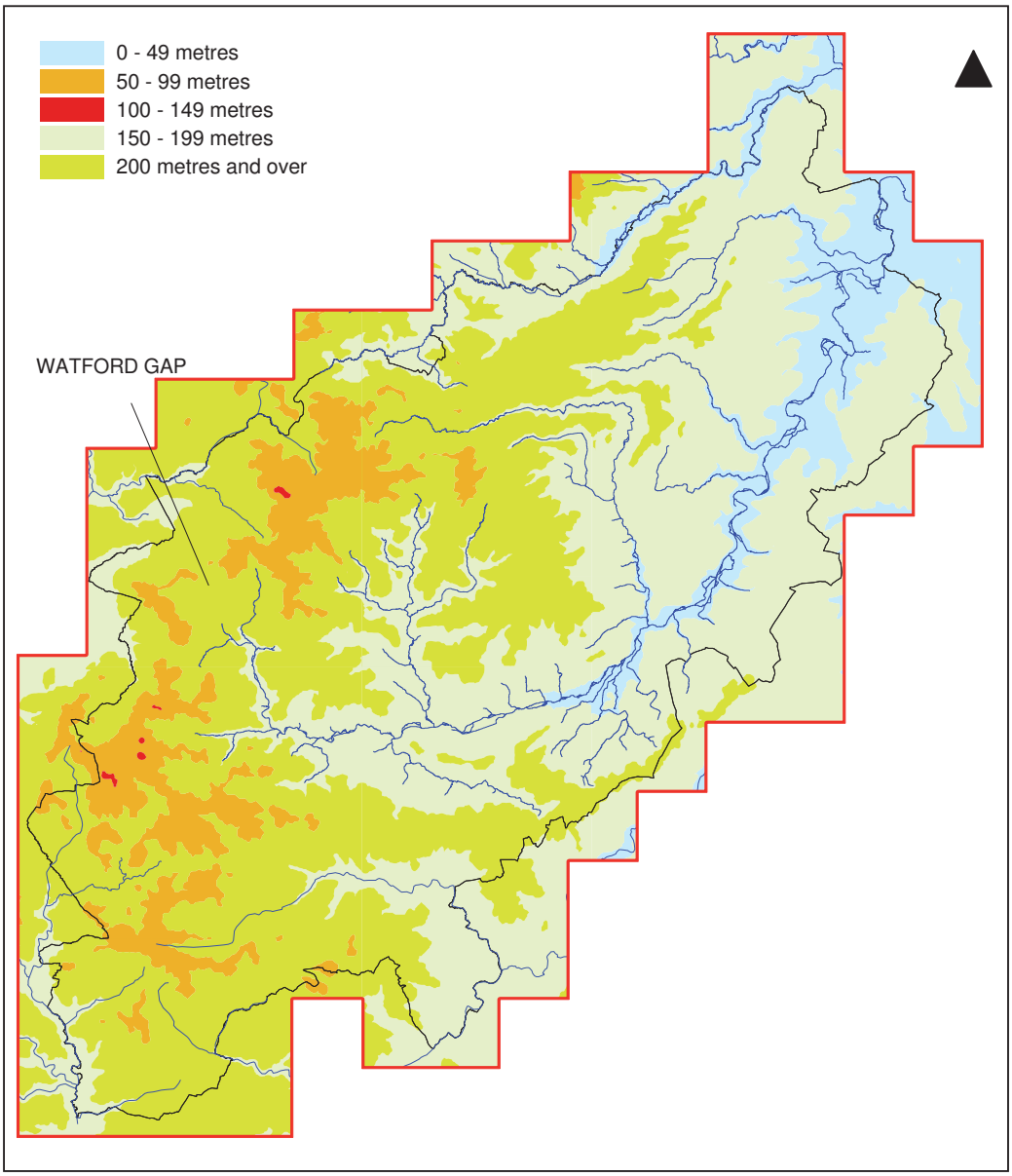
Table 4. The major geological formations and soil types in Northamptonshire (SSEW 1983).

Geology	**Soil association**	**SSEW unit**	**Permeability**
River valley floor	FLADBURY 1	813b	Poorly drained
Terrace	WATERSTOCK	573a	Well drained
	SUTTON 1	571u	Well drained
Head	Various		Mixed
Boulder Clay	RAGDALE	712g	Poorly drained
	HANSLOPE	411d	Poorly drained
	ASHLEY	572q	Poorly drained
	BECCLES 3	711t	Poorly drained
Gravels	WICK1	541r	Well drained
Glacial Lake Deposits	WICK1	541r	Well drained
Oxford Clay	OXPASTURE	572h	Poorly drained
Kellaways Sand	Various		Mixed
Kellaways Clay	Various		Mixed
Cornbrash	Moreton	511b	Generally well drained
Blisworth Clay	Various		Mixed
Great Oolitic Limestone	Moreton	511b	Generally well drained
	ABERFORD	511A	Well drained
Upper Estuarine Series	Various		Mixed
Lincolnshire Limestone	ELMTON 1	343A	Well drained
Lower Estuarine Series	Various		Mixed
Northamptonshire Sand	BANBURY	544	Generally well drained
Upper Lias Clay	WICKHAM 2	711f	Poorly drained
	DENCHWORTH	712b	Poorly drained
Marlstone Rock Bed	BANBURY	544	Generally well drained
Middle Lias Clays and Silts	WICKHAM 2	711f	Poorly drained
	DENCHWORTH	712b	Poorly drained
	OXPASTURE	572h	Poorly drained
Lowe Lias Clay	WICKHAM 2	711f	Poorly drained
	DENCHWORTH	712b	Poorly drained
	OXPASTURE	572h	Poorly drained

With the exception of sheet SP66, for which a 1:25, 000 survey is available, the largest scale soil survey coverage available for the whole of the county is at 1:250, 000 scale (SSEW 1983). Table 4 identifies the soils occurring on the more extensive geological outcrops and shows that these generally reflect the character of the immediate underlying strata. However the detail and accuracy of the soil survey is generally insufficient to relate the narrow bands of strata exposed in the river valleys to specific soil types.

1.2.4 Topography

Figure 6. Simplified relief map of the Northamptonshire NMP project area



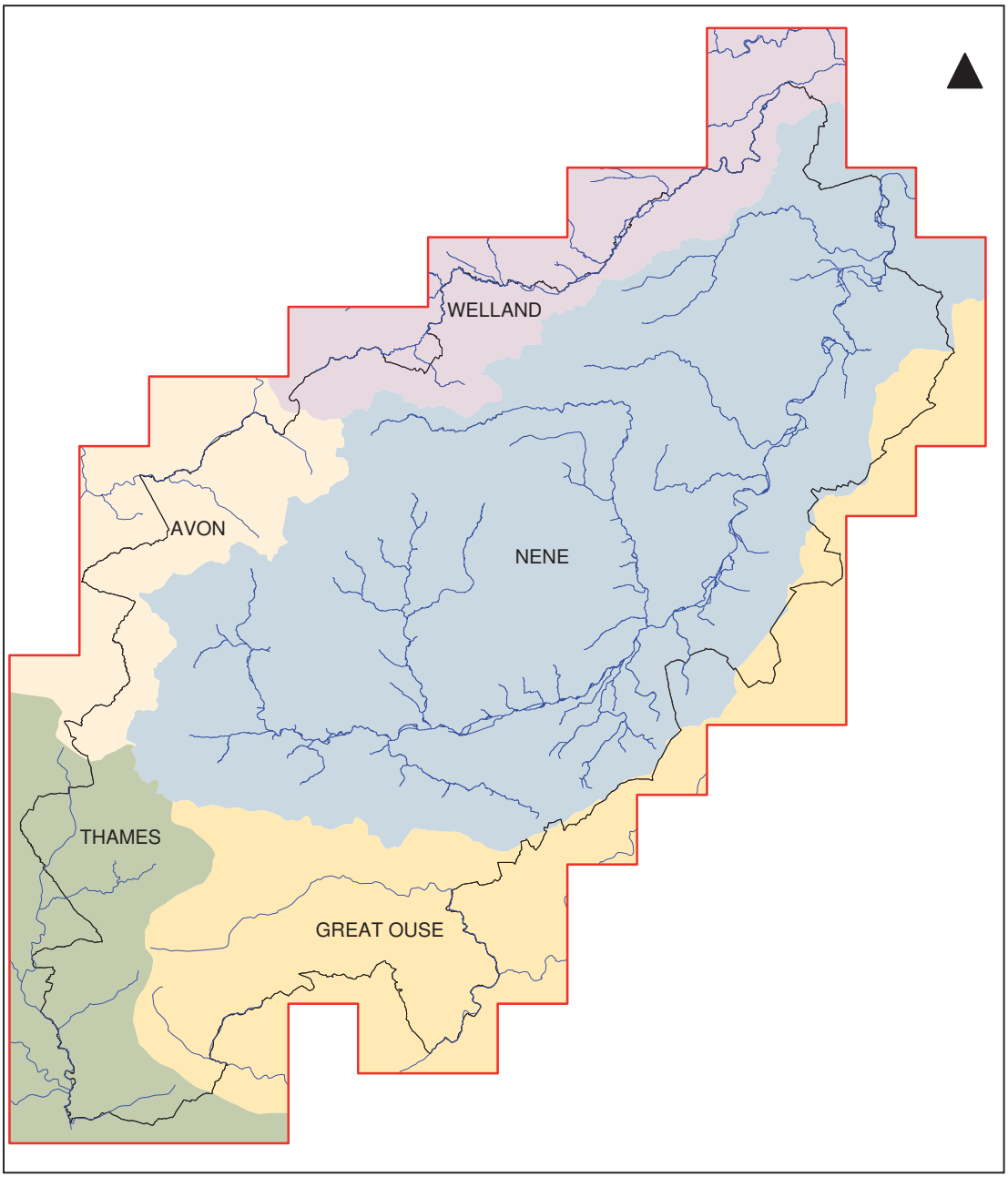
The project boundary coincides with major river valleys: the Great Ouse to the south-east, the Cherwell and Avon to the west and the Welland to the north. The eastern edge marks the opening of the Nene to the Fenland. The main topographic structures within the area are the south-west to north-east trend of resistant Jurassic rocks which form the higher ground to the west of the county and the Nene Valley.

In western and central parts the older rocks capped with boulder clay and incised by streams

and rivers have produced a landscape of rounded hills and plateaux interrupted by small valleys draining to the major river valley. In the area of Rockingham Forest the boulder clay plateau is particularly heavily dissected. Further east the valleys of the Nene and its tributary, the Ise, widen and the land is lower and less undulating.

1.2.5 Drainage

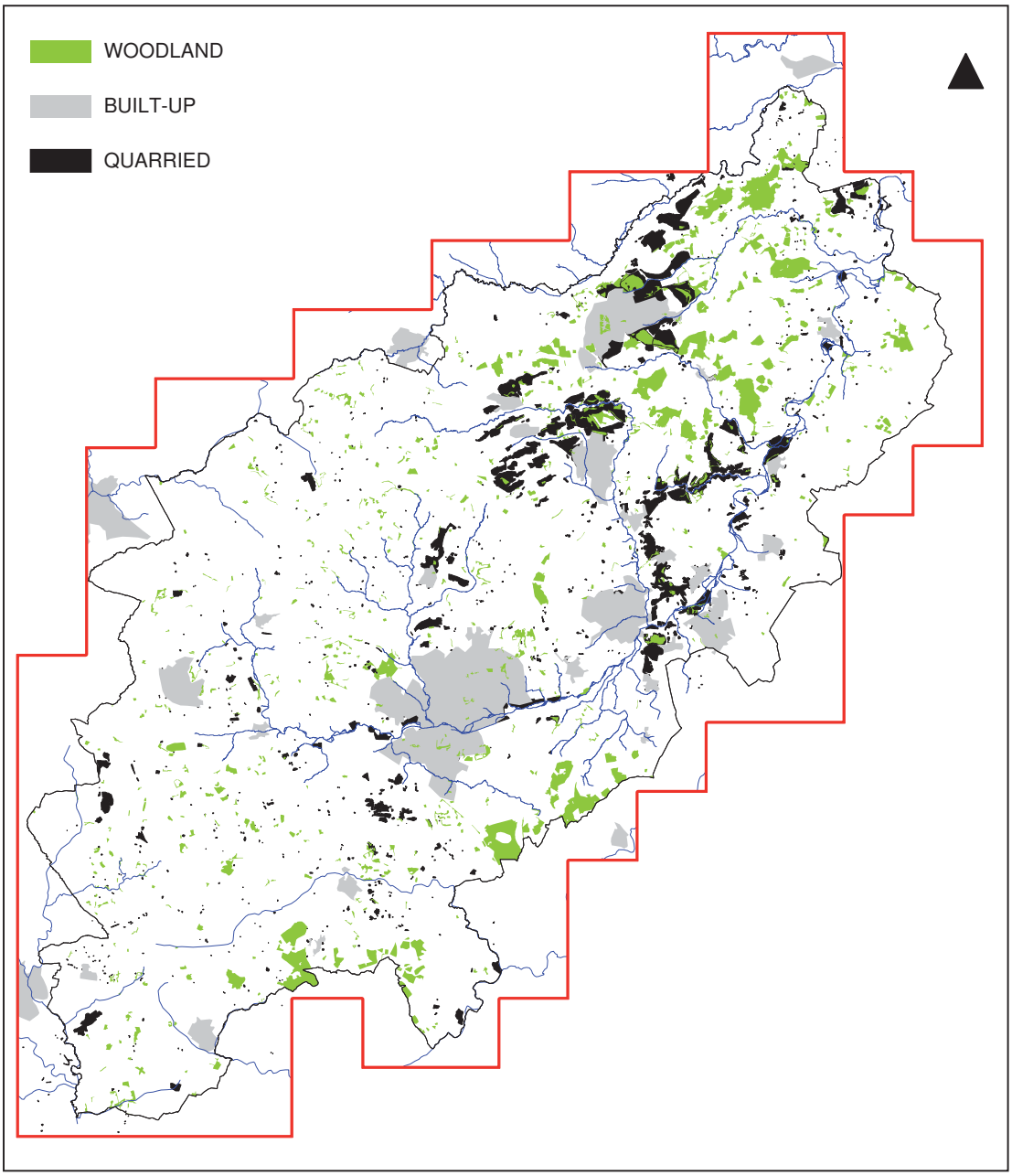
Figure 7. Major rivers and catchment areas in the Northamptonshire NMP project area.



The modern county of Northamptonshire encompasses much of the River Nene catchment and small parts of neighbouring river systems. The NMP project area, being slightly more extensive than the county, takes in greater parts of these catchment areas: the Welland Valley to the north and north-west, the upper reaches of the River Avon to the north-west, the River Cherwell to the south-west and the flanks of the Great Ouse Basin to the south and south-east.

1.2.6 Modern landuse.

Figure 8. Urban areas, quarried land and woodland cover in Northamptonshire.



The project area is predominantly rural in character. The major urban areas are Northampton, Daventry, Wellingborough, Kettering and Corby; the smaller towns are Higham Ferrers, Rugby (Leicestershire) and Market Harborough (Leicestershire). Beyond these centres there is a general pattern of small nucleated settlements.

The permeable geologies have attracted industry. In the latter half of the nineteenth and first half of the twentieth centuries, the Northamptonshire Sand and Ironstone has been the focus for quarrying and steel manufacture, particularly around Kettering and Corby, and gravel extraction has had a considerable impact on the river terraces. This amounts to a considerable loss of the lighter soils, much of which will have proved attractive to settlers in the past. However urban and other disturbed ground will not be exclusively devoid of archaeology in the NMP record as features observed on photographs predating development

or extraction have been fully mapped and recorded.

Just over one-twentieth of the county is currently under some form of woodland cover. This includes remnants of the medieval forests of Rockingham, Salcey and Whittlewood and modern planting. Woodland coverage is greatest in the areas of the ancient forests where it has a significant impact on the visibility of archaeological sites from the air.

Beyond the areas of modern settlement, extractions and woodlands most of the county is given over to agricultural activity: arable cultivation dominates on the freer draining geologies whilst some land on the heavier soils on the boulder clays remain as pasture for sheep and cattle.

2 PREVIOUS AND OTHER TRANSCRIPTION WORK IN THE COUNTY

2.1 Previous and other transcription work

In 1975 RCHME published the first of five inventory volumes dealing with the archaeological and historical sites of the county of Northamptonshire (RCHME 1975, 1979, 1981, 1982 and 1985). These inventories included sketch plots produced from unspecified air photographs of "archaeologically significant" features (RCHME 1975:xxi).

From its inception in 1974, the enhancement of the SMR with new information from aerial reconnaissance has been an integral part of the Northamptonshire County Council flying programme. Until 1979 this included manual plotting at 1:2500 scale of previously unrecorded sites, developing from the work of the RCHME.

A reassessment of plotting methodology, with particular reference to the RCHME plans and supported with results from excavations, concluded that the techniques employed were deficient (Foard 1980:12-14). The main criticisms were that sketch-plotting produced inconsistent data with unquantifiable errors in size, form and positioning and that whilst controlled plotting, for example using a "mobius network", produced more accurate plans the benefit was offset by the considerable cost in time. The routine processing of new sites from reconnaissance using these manual techniques was halted in 1979.

From the early 1980s new discoveries by the flying programme were transcribed with the Bradford AERIAL rectification program (hereafter AERIAL4) (Haigh 1993). When the NMP project started in 1994 the principle of rapid assimilation of new data into the SMR continued. As the project progressed new data for areas already completed by NMP was plotted when the resources were available.

Table 5. Summary of previous and other AP transcription work in Northamptonshire.

Author	**Date**	**Methodology, scale and extent**
Various (Job Creation Scheme)	c. 1979	Plotting with Mobius Grid, extent unknown
Taylor, C. RCHME	1970s	Sketch plotting published in the RCHME Archaeological Inventories of Northamptonshire (1975, 1979, 1981, 1982 and 1985)
Foard, G NH	1985	AERIAL4. 1:2500 scale. Raunds Area Project
Prior-Smith, A. Leicester University	1990-1991	By hand. 1:2500 scale. Stowe-Nine-Churches area
Foard, G. NH. *	1983-1990	AERIAL4. 1:2500 scale. Post-reconnaissance work
Addison, C. NH. *	1990-1992	AERIAL4. 1:2500 scale. Post-reconnaissance work
Markham, P NH. *	1992-1993	AERIAL4. 1:2500 scale. Post-reconnaissance work
Palmer, R. APS. *	1992	AERIAL4. 1:2500 scale. 1990 Post-reconnaissance work
Deegan, A. *	1999	AERIAL4. 1:2500 scale. Backlog c.1993 – 1998 post-reconnaissance work

* funded by RCHME/English Heritage

The above summary of previous and other air photo transcription work in the county is based

on the information provided in the original project design (Addison 1994).

2.2 Use of previous and other transcription work in the NMP project

All transcriptions generated with the AERIAL4 rectification software by Foard, Addison, Markham, Palmer and Deegan have been imported into the MAPINFO APplots table. Plots for quarter sheets that were imported prior to NMP mapping for that sheet will have informed the final NMP tables mapping and will thus be part of the NMP mapping. However the plots produced for previously completed NMP sheets, particularly those created by Deegan in 1999, will not be part of the NMP tables mapping because it was not within the remit of the project to return to previously mapped areas.

The crop marks site plans, published by RCHME (RCHME 1975, 1979, 1981, 1982, 1985), had repeatedly been demonstrated to be of limited value and were paid only cursory attention during the NMP process. For similar reasons the Job Creation Scheme plots and Prior-Smith's plots of the Stowe-Nine-Church and Bramptons areas were not consulted for the NMP project.

3 ARCHAEOLOGICAL SCOPE OF THE SURVEY

The project was undertaken in accordance with the general aims and objectives of the National Mapping Programme as laid down in the National Mapping Programme Guidelines (RCHME 1994) and latterly defined in the Sphere of Interest documents produced by English Heritage . These are to identify and transcribe "All probable and possible archaeological features showing as crop marks and soil marks and previously unsurveyed earthworks (with the exception of extensive systems of medieval ridge and furrow ploughing) up to the NMR terminal recording date of 1945". Some county-specific issues necessitated refinement of the general NMP scope. Moreover the scope of the working APplots table is slightly broader than that of the NMP tables and MORPH2.2 database, as noted below, though it is the latter two that equate with the NMP product of other projects.

The scope described here relate primarily to the NMP tables and presumes their inclusion within the APplots table unless specified otherwise.

3.1 Levelled feature (crop marks and soilmarks)

All archaeological features, levelled by subsequent ploughing or some other agency, that appear on the aerial photographs as crop marks, parchmarks or soilmarks were recorded by graphical representation of the observed ditches, banks, pits and/or surfaces and in the associated MORPH2.2 database. Levelled features were recorded as crop marks or soilmarks in the APplots table and in the NMPcropmark or NMPsoilmark tables as appropriate.

The APplots table may include features of less secure archaeological origin but, unless confidence was increased with evidence from other photographs, the dubious features were not included in the AP tables.

3.2 Earthwork features

All upstanding archaeological features visible on the aerial photographs were recorded by graphical representation of the observed ditches, banks, pits and/or surfaces in NMPearthwork table the and in the associated database.

In a departure from the general NMP scope, earthwork sites that had previously been surveyed on the ground were re-mapped in the NMP tables. RCHME has published the plans from many earthwork surveys across the county (RCHME 1981 etc). Geo-registered and digitised versions of these plans were used either as the basis of plotting or for reference in plotting anew.

Although the RCHME plans are widespread in their coverage of the county they are not necessarily inclusive of all the upstanding remains at any one site. To have plotted only those features that had not been surveyed on the ground would have resulted in a dataset of severely compromised integrity and very limited use.

Upstanding features transcribed from aerial photographs that were shown to have been levelled on subsequent photographs were nevertheless identified as earthworks in the APplots table. If crop marks or soilmarks revealed new features or greater detail then these were also plotted and added to the APplots table as such. If the accumulated evidence from the levelled features matched or exceeded that of the earthwork remains then that was transferred to the NMPcropmark or NMPsoilmark tables. However, earthworks recorded on good vertical photographs are often much easier to interpret than the crop marks or soilmarks

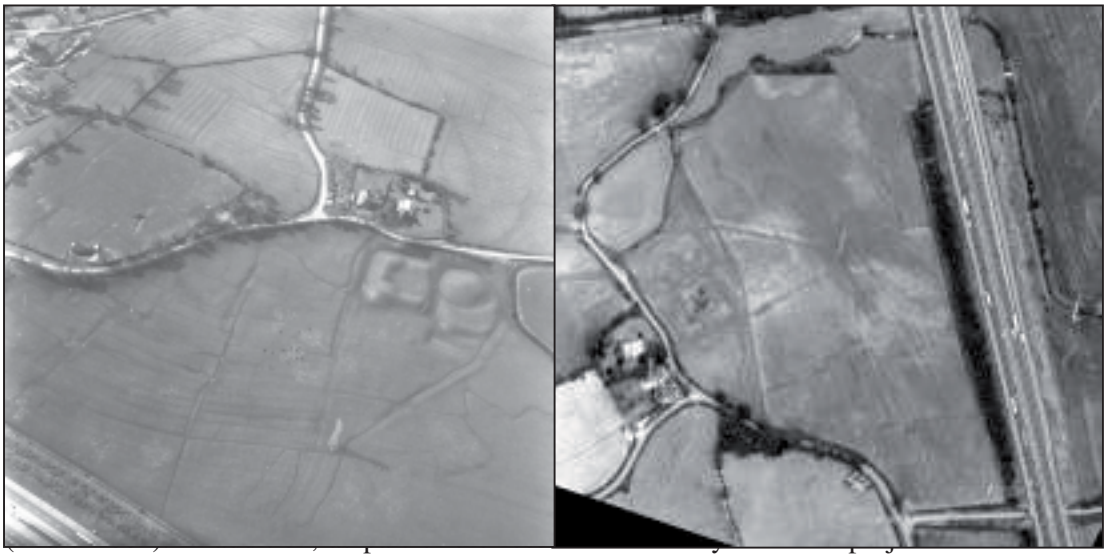
of newly levelled features in which case the earthwork plots were transferred to the NMPearthwork table and their reduced condition was recorded in the database.

Figure 9a (left). RCHME earthwork survey at Welford, rectified in AERIAL5.18 (RCHME 1981 Fig. 146 ©Crown copyright. NMR)

Figure 9b (right). NMP mapping at Welford (red indicates earthworks, green ridge and furrow) displayed against the rectified RCHME earthwork survey (RCHME 1981 Fig. 146 ©Crown copyright. NMR)

Plate 1a. Earthwork Motte and Bailey and field system a Lilbourne 29 March 1977(NCC Photo Index 5677/095 NMR SP5677/7 © Crown copyright. NMR).

Plate 1b. Earthwork Motte and Bailey and levelled field system at Lilbourne 26 July 1996(NCC Photo Index 5677/053 copyright NCC).



medieval periods, there will be a review and assessment of the strategies for recording field systems from air and ground survey.

3.4 Landscape parks and gardens

Areas of parkland and garden landscapes were not mapped however structural elements visible as crop marks soilmarks or abandoned earthworks were mapped as seen. Elements of parks and gardens still in use were not recorded by the NMP project but records of these features do form part of the broader historic landscape dataset created by NCC.

3.5 Industrial archaeology

Evidence of historic large-scale extraction industries such as ironstone mining and stone quarrying were recorded, normally by outlining the visible extents of the activity.

Historic small-scale extractions for local use were occasionally plotted but were generally only mapped and recorded in the database if there was considerable risk of confusion with nearby archaeological features.

Plate 2. Charcoal burning hearths and other soil marks at Brigstock. (NCC colour slide SP9385/020).

The remains of other specific industrial processes, in particular charcoal burning, were recorded by graphical representation and in the database (Plate 2).

Remains of the historic industrial infrastructure, such as railways, tramways and canals, were only recorded when seen to be abandoned before the NMR terminal recording date (1945) or where they could be confused with other archaeological features.

3.6 Twentieth century military archaeology

In line with the general NMP scope, former military sites and installations of this category were recorded. Discrete monuments, such as searchlight batteries and gun emplacements, were recorded.

Airfields and associated structures were recorded by a simple outline of the visible extent occasionally with the detail of runways and hardstandings. This information may have been

sketched from vertical photographs or derived from a map source. In most cases no attempt was made to distinguish the early airfield plans from any post-1945 expansion. Airfields and associated structures were mapped in the NMPstructure table.

3.7 Buildings

Upstanding buildings were not recorded for this project. The ruined or levelled remains of structures pre-dating 1945 were recorded.

3.8 Modern features

Where modern features, such as land drains and removed field boundaries, were visible alongside other archaeological features on photographs selected for transcription then those features were plotted. If there was considerable risk of confusion with nearby archaeological features or their presence was relevant to the condition of those features then the modern elements were mapped to the NMPmodern table but not recorded in the associated database.

3.9 Geological features

Where geological features, such natural pits, frost-cracks and palaeochannels, were visible alongside archaeology on photographs selected for transcription then those features were plotted. If there was considerable risk of confusion with nearby archaeological features or their presence was particularly relevant to the situation of those features then the geological elements were mapped to the NMPgeology table but not recorded in the associated database.

4.1 Aerial Photographs

4.1.1 Northamptonshire Sites and Monuments Record

The SMR maintains a database of the air photographic coverage of the county held in its own and other collections. The NCC Photo Index is a complete record of the photography produced by NCC and housed by the collection. It was updated with data from the other collections consulted throughout the NMP process and hence now includes some coverage of counties overlapped by the project. The NCC Photo Index currently contains over 30, 000 entries for air photographs held by the collections listed in Table 6.

Table 6. Collections listed in the Northamptonshire SMR NCC Photo Index.

Collection title	**Address**
Northamptonshire Sites and Monuments Record.	PO Box 163, County Hall, Northampton NN1 1AX
National Monuments Record Centre, English Heritage	English Heritage, Great Western Village, Kemble Drive, Swindon. SN2 2GZ
Cambridge University Committee for Aerial Photography	Mond Building, Free School Lane, Cambridge CB2 3RF
Nene Valley Research Committee	
Northampton Museum	Guildhall Road, Northampton
Buckinghamshire Museum	Church Street, Aylesbury, Bucks. HP20 2QP
Warwickshire Museum	The Butts, Warwick, CV34 4SS.
Private Collections	

Records of black and white oblique aerial photographs form the main component of the NCC Photo Index, but it also contains entries for ground shots, colour slides, colour prints, vertical black and white and colour photographs and infrared images.

The NCC Photo Index contains information for photographs taken by the bodies and individuals listed on Table 7. The majority of the photographs in the database were taken specifically for archaeological purposes.

The SMR holds over 20, 000 specialist black and white photographs and colour slides. A large proportion of the photographs result from many years intensive reconnaissance by NCC; others have been acquired over time either selectively copied from negatives held in other collections or as an archive deposition.

The prints are housed in box files in the Sites and Monuments Record offices and organised by kilometre square. Most prints have been examined for the post-reconnaissance programmes or during the NMP project.

The colour slide collection is largely the product of many years of intensive aerial reconnaissance by NCC although it does include some ground shots. It is organised by kilometre strip in suspension files.

The slides were not consulted systematically for Blocks I to VI. This under-use reflects the difficulty of using slides with the old AERIAL4 transcription methodology and the costs of producing print or digital copies of slides to work from at that time.

This was identified as a shortcoming in the project as the potential for these photographs to reveal otherwise unrecorded archaeological features was unknown and untested. In 2000 a pilot area of one quarter sheet (TL09SE) was selected for which all slide coverage was examined alongside the prints. All the slides for the selected quarter sheet were scanned commercially and written to CD-ROM.

An assessment of this procedure concluded that this was not an archaeologically profitable approach and it was amended accordingly. For Block 1-5 the AAA examined the relevant slides and those with potential to reveal further information were selected for scanning. Scanning was then undertaken on the flat bed scanner with a slide attachment. The image quality produced by this method was generally insufficient for accurate mapping and interpretation. The slide collection was not consulted for the remaining blocks.

Since the end of the mapping and interpretation stage the slide collection has been scanned and each image is available for consultation as a high-resolution TIFF format file. Although there are no plans to systematically update the NMP mapping with any new information that the scanned slides may now reveal, this resource will be consulted during the research and analysis stage of the project.

Table 7. Photographers listed in the Northamptonshire SMR NCC Photo Index

Specialist Photography			**Vertical Photography**
Ashmolean Museum	Hollowell	Poulton	Buckinghamshire
Baker	Leicester Museum	Private	CUCAP
Buckinghamshire Museum	Leicester University	RCHME	Crawford
Cowley	Lyall	Royal Air Force	Fairey Survey
Crawford	Moore	Rugby School	Milton Keynes Dev.Corp.
CUCAP	National Monuments Record	Upex S.	National Monuments Record
Department Of Environment	Northampton Museum	Warhurst	Northants Highways
East Northants District Council	Northamptonshire County Council	Williams J.	Ordnance Survey
Fairey Survey	Northants Highways		RCHME
Field	NVRC		Royal Air Force
Foster	Ordnance Survey		
Hartley F.	Pickering J.		

4.1.2 The National Monuments Record (NMR).

The NMR contains oblique and vertical aerial photographs covering the project area from the sources listed in Table 8.

Table 8. Sources of aerial photographs covering the Northamptonshire project held by the NMR.

Air Photo Services	National Monuments Record
Ashmolean Museum	Nene Valley Research Committee
Baker Collection	Northants County Council
Cambridge (CUCAP)	Ordnance Survey
Crawford Collection	Oxford City & County Museum
Field Collection	Pickering Collection
Hancock Collection	Riley Collection
Hollowell	Warwick County Museum
Jewry Wall Museum	Leicester Museum

The main source of oblique aerial photograph coverage is Northamptonshire County Council. As such, there is a large degree of duplication between the NMR and the Northamptonshire SMR collections. However, to mitigate against any gaps in the Northamptonshire SMR's holdings, all the oblique prints available for loan were borrowed and examined according to the stated methodology.

Most of the photographs in the specialist collection were taken for archaeological purposes.

The vertical collection contains photographs of various scales taken for mainly non-archaeological purposes: military and cartographic reconnaissance, civil engineering projects such as road schemes, census recording and environmental monitoring. As such, the volume of this photography is no indication of density of visible archaeological features.

All the large to medium scale (1:20, 000 minimum) vertical photographs that were accessioned to and available from the NMR at the time of mapping were borrowed and have been consulted for this project. The NMR supplied laser copies of restricted use prints. On average there were 250 vertical prints per quarter sheet (based on loan records for Blocks 1 to 9).

For the review and assessment of strategies for recording medieval field systems (see Section 3.3) a loan of 1940s RAF coverage for the county was re-issued to the project in 2002, after the main phase of mapping and interpretation has been completed.

The NMR coversearch and loan numbers and their date of issue are listed in Appendix B though this information is incomplete for the earlier years of the project.

4.1.3 Cambridge University Committee for Aerial Photography

This collection houses the oblique and vertical photographs taken since 1945. It includes a permanent loan of photographs taken with RAF support which are Crown Copyright.

The oblique photographs in this collection were taken often for archaeological purposes but also to record geological landscapes, modern townscapes and for environmental monitoring.

The photographs are available as contact prints from the large format (70 mm) negatives. Most of the oblique photographs were taken on black and white film.

The prints are organised by film and the films by date of photography but the collection can be searched via the film catalogues, a subject index or National Grid Reference (NGR) (held on card index but now available digitally on www-arcims.geog.cam.ac.uk).

Prior to 1999 oblique photographs taken by CUCAP up to 1985 were listed in the NCC Photo Index (NCC 1994). Only those oblique photographs listed in the NCC Photo Index were accessed and examined at CUCAP during the course of NMP mapping up to 1999.

In 1999, a rapid assessment of the NCC Photo Index information on the CUCAP oblique collection showed it to be lacking. As was expected, post-1985 photography was not included and only coverage within the county boundary was listed. Furthermore it was found to be incomplete for the pre-1985 Northamptonshire coverage. In order to facilitate consultation of the CUCAP collection for the rest of the project the PhotoIndex was updated from the CUCAP NGR card index for those quarter sheets yet to be mapped. At the end of the mapping and interpretation stage it was seen as necessary to complete this update for the rest of the project and new entries were created accordingly. As mentioned above it is assumed that these photographs were not consulted for the NMP project.

The NCC Photo Index now contains record of over 5000 CUCAP photographs, the majority are obliques, and most of those are black and white.

All the available photographs for Blocks 1 to 9 were consulted on site.

CUCAP has taken black and white and colour vertical photographs mainly at 1:2500 to 1:10, 000 scale but some smaller. It has also produced some infra-red images. Although prints of most of the black and white films are available, the colour and infra-red films, particularly if flown for external commissions, have not always been printed in full. Although CUCAP has the facilities for the user to view the films these are not really amenable to the NMP mapping methodology. For future reference, CUCAP can now produce high quality scanned images from film.

The collection currently holds coverage of 54 vertical sorties (c. 1709 frames) for the project area. The NCC Photo Index does not include comprehensive records of all the CUCAP vertical sorties.

It is unclear whether the CUCAP vertical photographs were systematically consulted prior to 1999. In the absence of any evidence to the contrary, it is probably best to assume these were paid no more than cursory attention for Blocks I to VI. All available vertical coverage was consulted on site for Blocks 1-9.

4.1.4 Other Collections

Local collections in the neighbouring counties were not consulted for the Northamptonshire NMP project.

4.2 Data sources

4.2.1 Sites and Monuments Record

Reference to the Northamptonshire Sites and Monuments Record was integral to the project's methodology. From 1994 to 1998 this information was accessed through the SMR's database (Oracle). From 1999-2001 data migration issues meant that only summary

information for each record was available but this was delivered directly through the GIS.

The SMRs of neighbouring counties were not consulted for this project.

4.2.2 National Monuments Record

The NMR has provided printouts, and latterly digital text files, of its records by quarter sheet and copies of the Record Maps for reference and concordance purposes.

4.3 Other sources

4.3.1 RCHME Inventories for Northamptonshire.

Although much of the information from these volumes is available in the SMR the actual plans and description were used directly in the mapping process (see Section 3.2).

5 METHODOLOGY AND STRATEGY

5.1 Mapping and interpretation

The methodology and procedures for interpretation, rectification and mapping were summarised in the original Project Design in 1994. This was further developed between 1994 and 1998 into the processes detailed in the Northamptonshire Heritage Air Photography System (Markham 1998).

In 1999 developments in the specialist software used for air photo rectification prompted a reappraisal and adjustment of procedures, which required significant changes in working practice.

5.2 Methodology 1994 - 1998

Between 1994 and 1998 the Bradford AERIAL Photograph Rectification System Version 4 (AERIAL4) was used for the rectification of information from oblique and vertical air photographs. Indeed the AERIAL software had been employed since the early 1980s and the resultant plots are integral to the NMP dataset.

The following provides an overview of the basic procedures outline in the Northampton Heritage Air Photography System (Markham 1998).

For each quarter sheet

- Organise NMR and NH oblique photographs by kilometre square, NMR vertical photographs by quarter sheet. Collate NMR record maps and record printouts. Prepare map note sheet.
- Organise existing digital records in a MAPINFO workspace with appropriate background map for cross-checking
- Select those images which provide new data and have sufficient control information for rectification

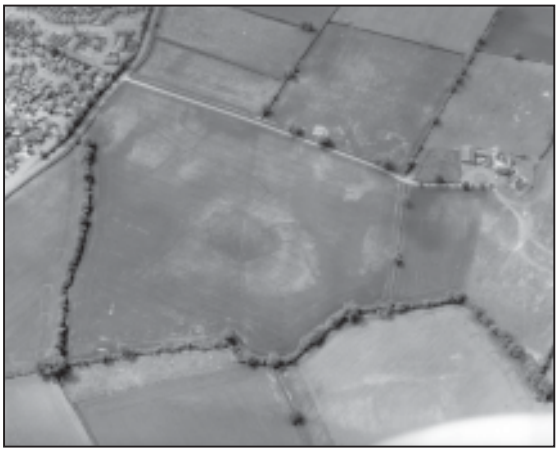


Plate 3. An aerial photograph selected for interpretation and rectification (NCC Photo Index 7062/069).

- Trace archaeological and relevant non-archaeological information onto acetate sheets firmly attached to selected photographs. Add control points. Add photo number, parish and photo date.

Figure 10. The Archaeological features and control points traced onto acetate film attached to the photograph (NCC Photo Index 7062/069).

- Prepare a paper copy of the relevant area of the background map and mark on the same control points.

- Processing through AERIAL4. Register the paper map on a digitising tablet. Digistise the map control points and then the corresponding photo control points. Note the given error readings, if these exceed 3m for any one point amend accordingly

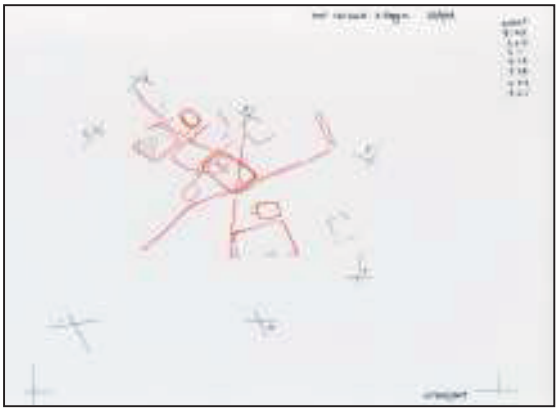


Figure 11. The acetate film, detached from the photographs and completed for archiving.

- When a transformation with acceptable errors is achieved note the errors against a list of the control points on the acetate sheets. Then digitise features with the standard headings.

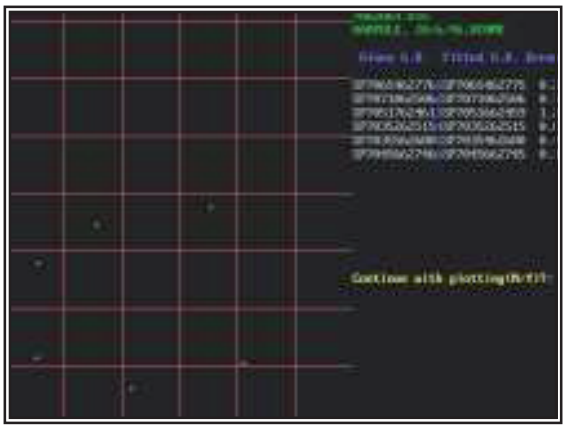


Figure 12. AERIAL4 screen showing position of the control points and their errors.

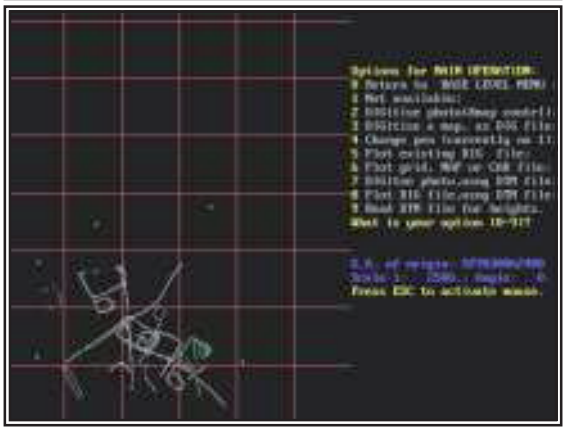


Figure 13. AERIAL4 screen showing the features digitised in different pen colours.

- Import plots into the Cropmark MAPINFO table using AERIAL4.X and MapBasic procedures.
- Produce composite interpretations in the NMP tables.
- Create records for the archaeological features in NMPsoilmark, NMPcropmark and NMPearthwork tables in MORPH2.2 and create objects from those features that correspond with each record.
- CUCAP prints were examined on site and if necessary the above procedures were repeated.

Between 1994 and 1998 the SMR Assistant: Aerial Archaeology undertook most of this work (Phil Markham).

The same methodology was employed in late 1998 and early 1999 for quarter sheets in Block 1. During this period an assessment of the AERIAL5.12 rectification system and a comparable package (AIRPHOTO) and their use within the NCC GIS was undertaken by the APC. These new packages offered rectification of scanned photographic images as an alternative to the old system of transforming of vector data input from a digitising tablet.

5.3 Updated methodology (February 1999- August 2001)

After liaison with the system's author John Haigh, minor adjustments to the upgraded AERIAL software resulted in version AERIAL5.14 which met the specific requirements of the Northamptonshire Heritage NMP project. AERIAL5.14 outputs rectified photographic images which can be automatically geo-registered in MAPINFO.

This new rectification technique, together with changes to the NMP team structure, required new procedures and methodology for air photo interpretation rectification and mapping. A

full step-by-step record of the processes, methodology and rationale is given in Appendix C, this is intended as a record for Blocks 2 to 9 and as a manual for future work. The following is an overview of the key stages NMP mapping procedures and their allocation between the NMP team 1999-2001.

AAA - Aerial Archaeological Assistant (John Robinson)

APC – Air Photo Consultant (Alison Deegan)

For each quarter sheet

- Prepare the data (AAA)
- Select photographs for interpretation (APC with AAA)
- Select photographs for rectification (APC with AAA)
- Scan the photographs (AAA)
- Prepare maps for AERIAL5.14 in MapInfo (AAA and checked by ACP)
- Rectify the photographs with Aerial5.14 (AAA and checked by ACP)
- Georegister the image in MapInfo (AAA and checked by ACP)
- Plot features to the APplots table (AAA and checked by ACP)
- Interpret and map features in the NMP tables (APC)
- MORPH2.2 database recording (APC)
- Concord SMR, Morph2 and NMP table mapping (APC)

The CUCAP collection was examined on site, generally after Stages 1 to 9 were completed for each Block. If necessary, Stages 2 to 9 were repeated for information from the CUCAP photographs by the APC except overlays were created and scanned as the photographs were subject to copyright restrictions. Stages 10 and 11 were then completed for the quarter sheets in each Block.

5.4 Post-mapping tasks

A period of data checking and consolidation followed the completion of the mapping and interpretation stage in August 2001. Specific tasks were identified by the APC for each of the NMP data sets and were undertaken with the assistance of the AAA. These tasks are detailed in Appendix D.

6 PROJECT MANAGEMENT

6.1 Project personnel

Head of Aerial Survey (EH)	Bob Bewley	1994 -
Project Coordinator (RCHME)	Vicki Fenner	1994- Jan 1996
Project Coordinator (RCHME/EH)	Simon Crutchley	Jan 1996 -
SMR Assistant: Aerial Archaeology (NCC)	Phil Markham	1993-Nov 1998
Aerial Archaeological Assistant (NCC)	John Robinson	Jan 2000 - 2002
SMR Officer (NCC)	Chris Addison	1994 -
County Archaeologist (NCC)	Glenn Foard	1994 - 2002
Project Manager (external)	Glenn Foard	2002 - 2003
AP consultant (external)	Alison Deegan	Feb 1999 - 2003

6.2 Project team structure

The project is under the overall control of the Head of the Aerial Survey and throughout the project has been supervised and monitored by a Project Coordinator from EH (and formerly RCHME).

Between 1994 and 1998 the work of the project was undertaken by the SMR Assistant: Aerial Archaeology under the supervision of the SMR Officer and management of the County Archaeologist. Between 1999 and the end of the mapping and interpretation stage in 2001 the project's work was undertaken by the AAA and the APC. Work was supervised, monitored and managed jointly by the APC, SMR Officer and County Archaeologist.

Work by the APC on the research, dissemination and archive stages of the project continues under the guidance of the SMR Officer and County Archaeologist and with support from the AAA.

Additional support has been provided during the course of the project by Susan Freebey (SMR Assistant), , Ruth Howden (Branch Administrator), Phil Sydee (IT Services) and NCC IT Services. Greg Phillips (NH Archaeological Planning Officer) a specialist in GIS, was instrumental in ensuring the effective implementation of the project.

6.3 Project time-scale

6.3.1 Project Design 1994

When the original project design was discussed in 1993 Northamptonshire County Council estimated that the 130 quarter-sheets in this project would require c. 1150 person days to map and create MORPH records to NMP standards (Addison 1994). With just one interpreter this would take five years. These estimates were based directly on the density of the air photo coverage held by NCC at the time and ranged from 3 days for those sheets with the lowest density of coverage to 15 days for those with the highest. This gave an average of just less than nine days per quarter sheet.

However this estimate was rejected as too long by RCHME because significant amounts of

transcription had already been funded and undertaken as part of the post-reconnaissance work (see Section 1.1.2). To reduce the time-scale the number of days allocated for mapping was halved for those quarter-sheets lying entirely within the county and therefore having benefited the most from the post-reconnaissance work. The days allocated for MORPH2.2 recording remained the same for all quarter sheets. This revised time-scale estimated the project would require c. 910 person days, four years with one interpreter, reducing the average number of days per quarter sheet to seven. The Northamptonshire NMP project was initially funded on this basis.

6.3.2 Updated Project Design 1999

In 1999 a revised Project Design was produced for the completion of the remaining 46 quarter sheets (Foard 1999). In recognition that the previous estimates were too low each quarter sheet was allocated an average of 11 days for all tasks. This allowance took account of the work already undertaken during that year for Blocks 1 to 5 (see Section 6.4.2).

6.4 Time allocation

6.4.1 May 1994 to November 1998

During this period the SMR Assistant :Aerial Archaeology worked approximately 796 days on NMP mapping and recording and 96 days on the associated tasks this requires. For those quarter sheets for which sufficient records are available, the ratio of database recording to mapping days was 1:4 (see Figure 14). A total of 86 quarter sheets were completed (or near completed) in this period. This work accounts for approximately two-thirds of the project area.

During this period a further 119 days were allocated to tasks that were not directly related to the NMP project.

6.4.2 January 1999 to November 1999

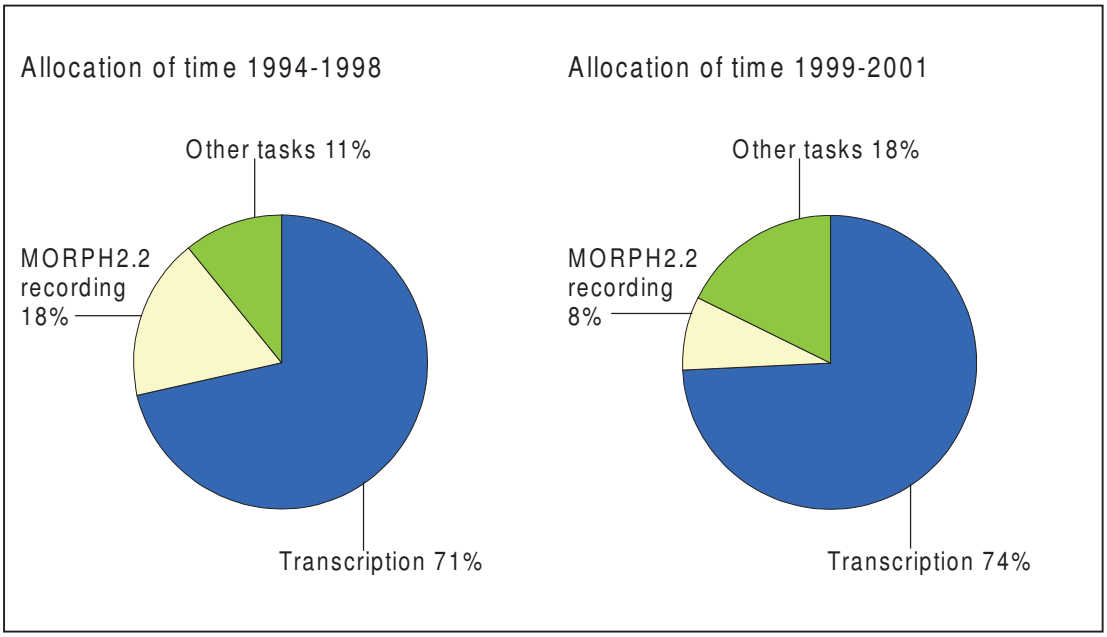
During this period full NMP operations were suspended. In the first and second quarters the APC undertook post-reconnaissance plotting from new photographs for those sheets completed in the preceding period. In 46 days *circa* 485 AERIAL4 plots were produced and added to the APplots table. These plots were not assimilated into the NMP tables as the NMP mapping had already been completed for these sheets.

In the third quarter the APC began plotting from NH-held photographs those areas for which NMP had not yet started. Over 41 days the information from the NH photographs for Blocks 1 to 5 (21 quarter sheets) was processed: *circa* 450 plots were produced and added to the APplots table.

6.4.3 November 1999 to August 2001

During this period the AAA and the APC worked a total of 541 days on the project. A total of 46 quarter sheets, including those in Blocks 1 to 5 that had been started in the preceding period, were completed to the full Northamptonshire NMP specification. Transcription accounted for 391 days, MORPH2.2 recording for 47 days and other related tasks took 103 days (see Figure 14). This work accounts for approximately one-third of the project area.

Figure 14. The allocation of time in the periods 1994-1998 and 1999-2001



6.5 Productivity

As the table below shows there was a slight variation in productivity between the two main phases of the project.

Table 9 Relative productivity

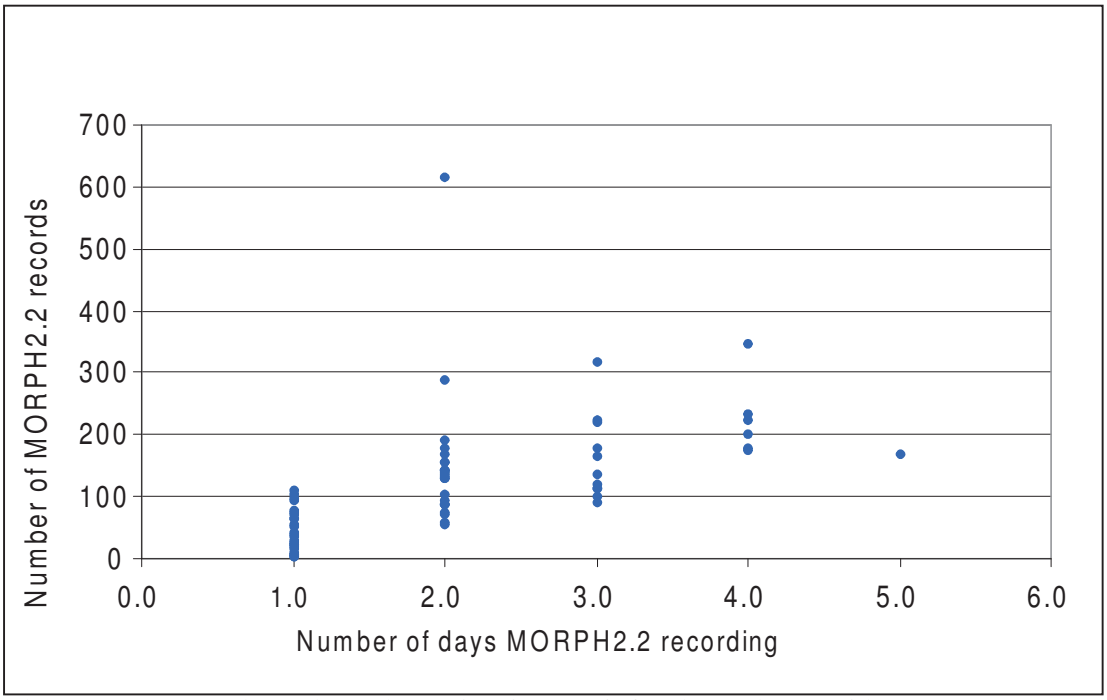
Period	**No. of NMP days**	**No. of 1/4 sheets**	**Average days/sheet**	**MORPH2.2 records**
05/1994-11/1998	892	84	10.5 days	8974
11/1999-08/2001	541	46	12 days	4684
[7/1999-08/2001	*582*	*46*	*12.5 days*	*4684]*
Overall	**1474**	**130**	**11.5 days**	**13 658**

The 46 quarter sheets mapped and interpreted by the AAA and AP consultant took on average slightly longer than those processed by the Aerial Archaeologist.

The actual time to complete a quarter sheet ranged from 1 to 27 days. The precise figures for days per sheet are not available for the early stages of the project however most sheets took between 5 to 10 days and very few took less than 3 or more than 20 days.

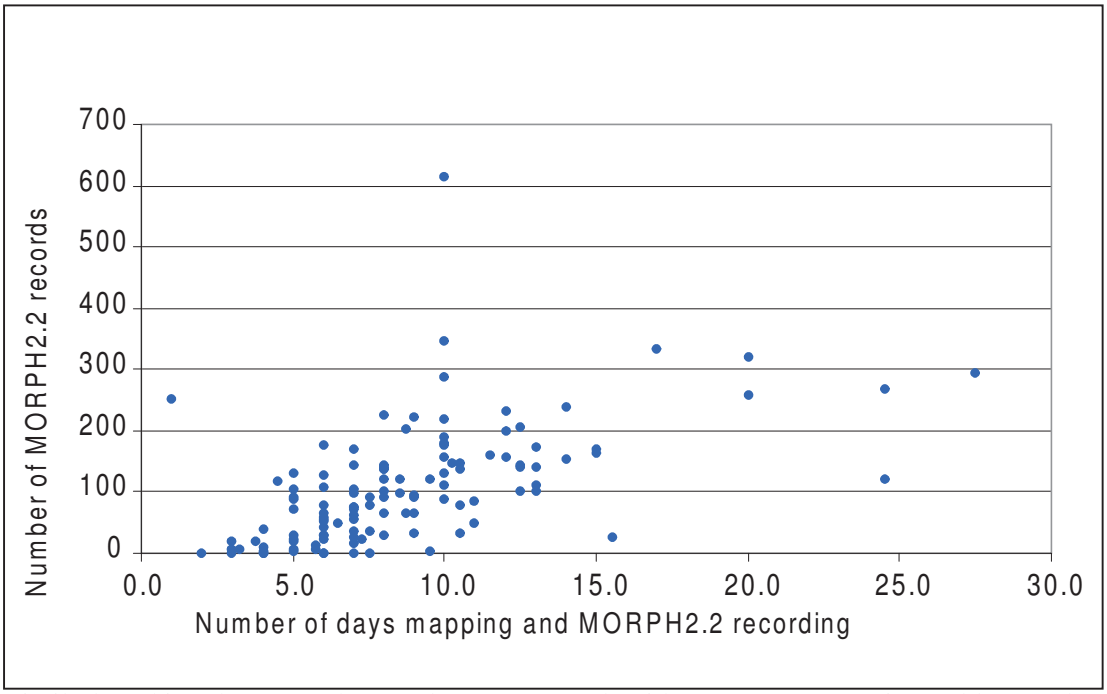
The reasons for the variation in time taken between quarter sheets are manifold. Figure 15 suggests only a loose relationship between the number of MORPH2.2 records per quarter sheet and the number of days required to create them. It is often the case that areas of complex articulated systems such as extensive settlements require considerable thought to produce archaeologically rigorous records but that these will probably be few in number. Conversely large numbers of disparate features can be recorded more quickly and result in a large number of unrelated records.

Figure 15. The relationship between the quantity of MORPH2.2 records per quarter sheet and the number of days taken to create them (based on data from 65 quarter sheets).



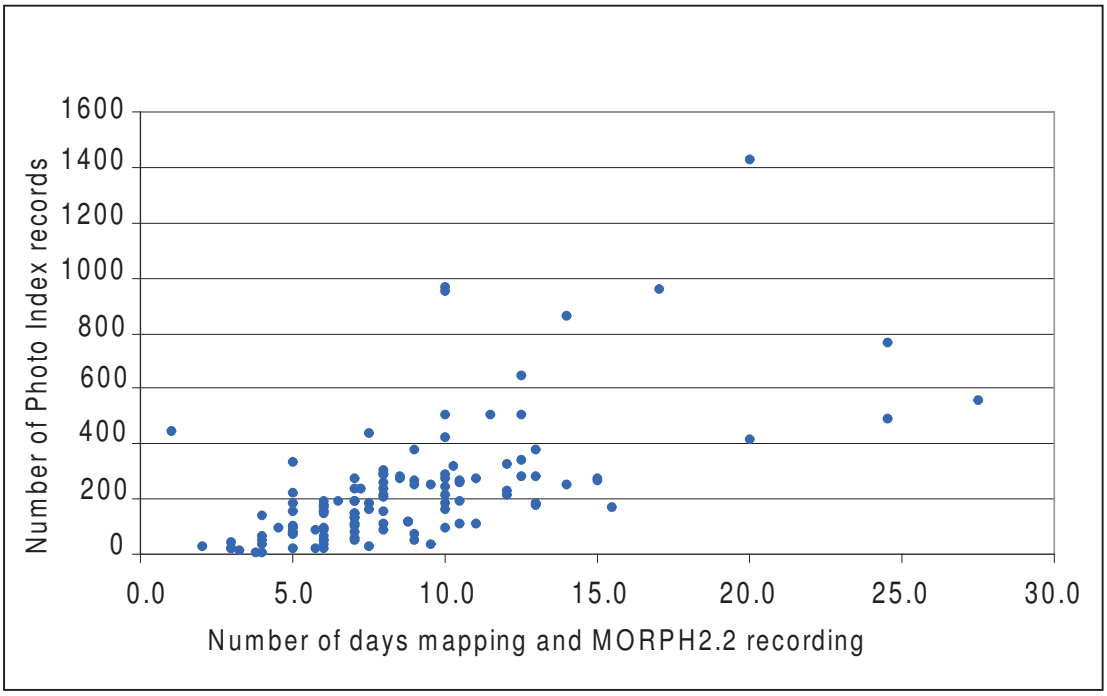
There was a general trend, as shown in Figure 16, for those sheets with more MORPH2.2 records to take longer overall to map and interpret but this is by no means a consistent relationship.

Figure 16. The relationship between the number of MORPH2.2 records created and the overall number of days taken per quarter sheet (based on data from 119 quarter sheets)



Similarly, taking the NCC Photo Index as a general guide to AP coverage, it would seem that density of coverage is a factor and that it was appropriate to use this as a guide in the initial project design (see Figure 17).

Figure 17. The relationship between the number of NCC Photo Index records and the overall number of days taken per quarter sheet.



Other factors are clearly relevant. Seven of the quarter sheets took longer than 15 days to map. Of these, one was not only an original pilot sheet but also had probably the greatest density of coverage. Four were amongst the first sheets tackled by the AAA with the APC during a period of intensive ongoing training and monitoring coupled with the refinement of the methodology and procedures. The other two sheets covered particularly rich archaeological landscapes in Block 6 and, unlike previous blocks, the NH-held photographs had not been previously processed by the APC.

The time spent on associated tasks appears to be greater in the latter stage of the project. However this probably reflects different ways of allocating this time in the project documentation rather than any real difference in productivity. The NMP-related tasks include loan arrangement, loan check-in, loan check-out, organisation of photographs from loans and NH collection, data copying and backup, reporting, ongoing training, system development and dealing with software/hardware issues. All are essential to the day-to-day operation of the NMP projects.

The average number of days actually taken to map and record each quarter-sheet and all the associated tasks exceeds initial estimates by nearly 28% and the estimates on which the projects was initially funded by more than 64%. Other projects have been similarly underestimated. The Lincolnshire NMP project, which followed a sketch plotting methodology and was initiated just one year previous to this project, for example, was originally allocated an average of 11 days per quarter-sheet for all tasks (RCHME 1993). At the end of the project it was demonstrated that the average time to complete each quarter sheet had exceeded sixteen days (Kershaw 1997). This was attributed in the main to a lack of appreciation of the time cost of the associated non-mapping NMP tasks. Whilst the same is true of this project there is also the overestimation of the contribution of the existing mapping to consider.

Post-reconnaissance mapping was an essential element of the rapid assimilation of new information into the SMR. However the plots produced from each year's new results do suffer from having been based on a limited range of photographs. Reconnaissance recording is no substitute for the considered and exhaustive examination of **all** the available photographs in the manner of the NMP. It is the experience of the author that very few of the existing plots, when considered against the broadest spectrum of photographs during the NMP processes, could be considered accurate and complete as they stood. Furthermore, developments in the rectification software brought qualitative improvements to the plotting. On-screen plotting from rectified photographs allowed for more confident rectification and editable drafting which was a significant improvement on the earlier system of data inputting though a digitising tablet. In the period 1999 to 2001 very few of the existing plots encountered could be worked into the higher interpretation tables without significant re-plotting and/or reinterpretation.

7.1 Understanding the data sets

The following outlines the key aspects of the Northamptonshire NMP datasets, bought together here from other sections of the report for a rapid overview. Table 10 lists the various files that constitute the core NMP dataset and the former filenames by which they were referred to in earlier documentation.

Table 10 Summary of the core NMP data.

Data name	**Old name**	**Format**
NCC Photo Index	*Photo Index*	MapInfo Table
Applots	*Cropmark*	MapInfo Table
NMPearthwork	*APewks*	MapInfo Table
NMPcropmark	*APcrop*	MapInfo Table
NMPsoilmark	*APsoil*	MapInfo Table
NMPgeology	*APgeol*	MapInfo Table
NMPmodern	*APmod*	MapInfo Table
NMPr&f	*APr&f*	MapInfo Table
Rchmekey	-	MapInfo Table
Ewk_interpret	-	MapInfo Table
Scanned RCHME plans	-	Raster images – TIFF format
Rectified RCHME plans	-	Raster images – TIFF format (geotiff)
Scanned photographs	-	Raster images – TIFF format
Rectified photographs	-	Raster images – TIFF format (geotiff)
RDA files	-	Ascii text
Dig files	-	Ascii text
Cad files		Ascii text
Record_NMP dates	-	MapInfo Table
Morph	-	MapInfo Table
Morphpnt	-	MapInfo Table
NMP_info	-	

7.1.1 The NCC Photo Index

The SMR maintains a database of the air photographic coverage of the county held in its own and other collections. This a complete record of the photography produced by NCC and housed by the collection. By 1994 it also included records for most CUCAP photographs taken up to 1985 and various other photography. During the course of the NMP project, photographs from other collections were added to the NCC Photo Index, predominantly

those that were used in the transcription processes.

For each previously unrecorded photograph a new entry was created with a unique Photo Number. The Photo Number is based on the format *[EENN]/[nnn]* where *[EENN]* is the kilometre square in which the centre of the photograph (or the centre of the subject) falls and *[nnn]* is a sequential numeral, 001, 002, 003, …, 998, 999, unique within each kilometre square.

The Photo Number identifies all the files and data generated from the source photograph.

In the Checked Field of the NCC Photo Index the entry "NMP" indicates those photographs that were consulted for the NMP project. This may not be complete because to cross-check every single photograph examined to the Index is a time consuming task that was often overlooked. Furthermore this cannot provide a definitive list of all of the photographs examined as not all are listed in the NCC Photo Index. For example, the many thousands of NMR vertical photographs examined were not recorded in the NCC Photo Index unless used directly in the plotting processes.

The entry "NMP/AD99" in the Checked field indicates those photographs examined and plotted by the ACP in 1999 in areas where NMP mapping was complete. Thus some of the photographs that show features plotted to the APplots table but not in AP table can be identified as unavailable to the NMP project. New codes should be created to identify the sources of plots generated for future projects.

The entry "Plotted" in the Plotting Check field indicates the photographs that have been used to plot features. This is complete for all plotting carried out since 1999, but may not be definitive for areas mapped earlier than 1999.

The Digital_Archive_Check field indicates those photographs held digitally, either as scanned images only, or, if the Plotting Check field is also positive, as scanned and rectified images.

7.1.2 Photograph overlays

Information from aerial photographs was transferred to tracing paper or acetate sheets in pencil or permanent pens for processing through AERIAL4. These have been retained and are organised by km square.

In 2000, a change in methodology, by which photographs were scanned and rectified, removed the need to produce photograph overlays. However, for photographs for which permission to scan was not forthcoming from the copyright holder, overlays were created and scanned and processed through AERIAL5.14 as if they were photographs. The original overlays have not been retained. Instead the scanned image files are archived as if they were photographs (see Section 7.1.4 and 7.1.5).

Standards for the information included on the overlays developed during the course of the NMP project. These required that all overlays be clearly marked with the source photograph photo_number, the date and the author. Each of the control points were numbered and the error values encountered in AERIAL4 listed alongside. All archaeological and other information to be transcribed was traced through from the photograph to the overlay. Some overlays contain information not recorded elsewhere such as notes made by the interpreter or dubious features that were not digitised.

These materials are not of archive standard. After they have been arranged satisfactorily,

handling should be kept to minimum.

7.1.3 AERIAL4 files - .dig and .cad

Prior to 2000, rectification of photographic details was undertaken through AERIAL4. AERIAL4 produced simple ASCII text files, called .dig files, that contained a title line, focal length and photo centre, the map control points (in OS coordinate system), the photo control points (in photo dimensions) and strings of 2-D coordinates. The latter were the digitised points of features preceded by commands of either pen up (starts a new line) or pen down (draws a line from the last point). These commands and coordinates were input from a puck and digitising tablet.

Features were digitised by form: earthworks (black pen), crop marks (black pen), soilmarks (black pen), ridge and furrow (green pen), modern features (magenta pen) and geological features (yellow pen). Before features of each different form were digitised, the pen was changed to the colour convention and a message or header line was inserted. Into this the form description was entered. When loaded into MAPINFO the headers were written to the Table field of the APplots table for each feature.

AERIAL4 also generated a generic CAD format file (.cad) from the .dig files to transfer transcription data to other systems. The .cad files contain 3-D coordinate information, for instances where digital terrain models were employed. Otherwise they are similar to the .dig files.

Both .dig and .cad files were named with reference to the source photograph Photo Number in the format *[EENNnnn]*. Note the forward slash in the original Photo Number is an inadmissible character in filenames and was omitted.

The .cad files were loaded into MAPINFO with the Map Basic script CAD3MI.MBX which wrote the filename to the Photo Number field of the APplots table for each feature. Problems encountered with leading zeros in the filenames required that a leading dash prefixes all references in the Photo Number field, that is *[_EENNnnn]*. The original .dig and .cad files have been retained for a great many plots in the APplots table, these can be distinguished by those that have dates. Undated entries indicate that the original plots are unavailable.

The user may wish to refer to the original .dig files to check the error readings for plots in the APplots table. This can be done through the original AERIAL4 software and now through the AERIAL5.18 version. The error readings are also recorded on the acetate overlays.

7.1.4 The scanned APs

There is a large volume of digital images archived to DVD_RAM by quarter sheet. These have been generated since 2000 for AERIAL5.14 rectification and for reference. These are uncompressed TIFF format files of aerial photographs scanned at a minimum resolution of 300dpi. These can be viewed in any imaging package and in MAPINFO as display-only raster images. All these image files are named with reference to the Photo Number in the format *[GGEENN]_[nnn],* where *[GGEENN]* is the kilometre square preceded by the OS alphabetic key to the 100 kilometre square.

All scanned images that have also been rectified should be read-only. Any alteration to the parameters of the original image will negate the RDA files.

7.1.5 The RDA files

The AERIAL5.14 RDA files store the origin, scale, size and control points of each rectification. These tiny ASCII text files are stored alongside and have identical filenames to the source images but with the extension .rda.

The user may wish to read the RDA files back into AERIAL5.14 to re-rectify an image, to check the error readings of a rectification or to adjust the parameters of rectification. Instructions on this and other operation can be found in the AERIAL5.12 manual (no manual was issued for version 5.14) (Haigh 1999)

7.1.6 The rectified APS

The rectified images have been archived for future use alongside the straight scans. However if the RDA files and original image are retained this is not strictly necessary. The rectified image filename is the same as the original but is suffixed with the letter *r.* These files are GEOTIFFS and they can be viewed in MAPINFO in their correct geographic position. They must first be loaded with *Tools, Georeg, Register a raster image* commands. This will create a *.tab* file that can be used to open the image on subsequent occasions through the *File, Open table* commands. The *.tab* file is not to be retained.

It is important to note that the area of accurate rectification will not cover the whole photograph. If an archived rectified image is to be reused to position other features then the user must consult the original image and RDA files in AERIAL5.14 to identify the spread of control points and the errors.

7.1.7 APplots table

The APplots table is a seamless layer of AP plotting for the whole of the Northamptonshire NMP project area. The APplots table contains plots created either from AERIAL4 or AERIAL5.14. It may also contains some data digitised from non AP sources, but most of this now resides in the EWK_Interpret table. AERIAL4 created simple ASCII .dig files that were converted to a generic CAD file format and bulk loaded into MAPINFO using the Map Basic script CAD3MI.MBX. In contrast, AERIAL5.14 rectifies actual photographic images. Features were traced from the rectified images into temporary files that were appended to the APplots table after checking.

Vitally the APplots table forms the link between photographs, plots and AP table mapping. Each and every plotted element is tagged with a reference corresponding to the Photo Number of a record in the NCC Photo Index. There are however slight discrepancies in the format of the photo number within the APplots table, and between the APplots table and the NCC Photo Index formats.

The scope of features plotted in the APplots table slightly exceeds that of the Northamptonshire NMP project specification (see Section 3). Archaeological features visible as crop marks, soilmarks and earthworks and some structures were plotted in this table and tagged with the "layer" appropriate to their condition on the source photograph. Modern and geological features that were observed on photographs used for plotting may also have been transcribed into this table. These have been labelled accordingly, as was ridge and furrow over or underlying archaeological features. Dubious archaeological features were also plotted into this table to be accepted or dismissed with the evidence of other photographs. Unfortunately there has been no convention in the labelling of these features to distinguish them from more confidently identified crop marks soilmark or earthwork archaeological

features. There are also a number of non-standard "layer" entries used before the NMP procedures were formalised.

The APplots table contains data created from the early 1980s through to 2001, and it will continue to be used as the repository for new plots. Data created from 1985 until 1998 is attributed to the Aerial Archaeologist (PJM) although several individuals including Christine Addison and Glenn Foard contributed to this work especially before 1992. Rog Palmer (RP), Air Photo Services has been identified as the author of some plots produced in 1992. Since 1999 data has been produced by Alison Deegan (AD) and John Robinson (JR).

In the period 2000-2001 the AAA carried out rectification and plotting under the supervision of the APC. It was important for training and quality control purposes that misinterpretations were noted and understood, and to this end the APC amended any erroneous layer entries created by the AAA and added their initials to the Author field. If there were errors in other aspects, such as in the graphic representation of a feature, the original plots were retained and a new plot simply added. No plots were deleted in this process and only those plots created by the AAA have been amended in this way.

In general, plots in the APplots table stand as an accurate record of the original transcriptions.

The accumulative nature of the APplots table produces certain problems. In the past it has not been possible to distinguish between those features excluded from the higher level interpretation because of their dubious nature from those which were added after NMP mapping. To resolve this a field to record the date of plotting has been added to the APplots table and entered retrospectively where this information existed elsewhere (see Appendix D APplots table). For dated plots it is now possible to compare the date of creation with the quarter sheet NMP completion date. All future additions to this table must be dated.

Figure 18a and b. The accumulated evidence in the APplots table (left) could be misinterpreted to mean 2 pit aligments however as the APcrop table (right) shows there is only one

The APplots table does not appear to have any correlates in other NMP projects past and present but it is an essential component of the Northamptonshire NMP data set.

7.1.8 The scanned and rectified ground survey plans

During the course of the project, ground survey plans published by the RCHME in the Northamptonshire Inventory volumes were routinely used to assist mapping and interpretation of earthwork monuments. To optimise this resource, from January 2000 onwards, all available earthwork plans by RCHME and others were scanned and georegistered in MapInfo as and when they were needed. In the absence of any precise location information, such as grid cuts, the modern features mapped on the plans were used to rectify the images, in AERIAL5.14, to the modern map data. The remaining plans were processed in late 2001 and 2002.

Both the original and rectified images of the survey plans are available. The former can be viewed as display-only raster images in MapInfo whilst the latter are GEOTIFFS, which can be viewed in their correct geographic position as described above.

All files are named in a standard format to assist reference to the original publications. This format for the RCHME plans being *[Parish][site number]_[volume]p[page number]*.

7.1.9 The RCHME Key table

This is a key outlining the limits of the published survey plans that have been scanned and geo-registered. Each polygon is labelled with the filename of the relevant rectified image.

7.1.10 The EWK_Interpret table

This table was created in 1999 to clarify the distinction between vector mapping originating from air photo plots and that generated from a variety of ground survey plans. This absorbed another table, NMPewks, which had contained only a few objects anyway. Where required, the rectified raster images of the ground survey plans, and some other sources, were traced into this table and referenced with the source filename. These plots were then available for use, alongside the APplots table, for mapping into the NMP table.

This table includes ground survey plans that had originally been plotted into the APplots table. To date, not all of the rectified ground survey plans have been traced but it will continued to be used as the repository for new plots of this type.

7.1.11 The NMP tables; NMPcropmark, NMP earthwork, NMPsoilmark and NMPstructure tables

The NMP tables are seamless layers of AP mapping for the whole of the Northamptonshire NMP project area. However this mapping has been undertaken by OS 1:10, 000 scale quarter sheet with earliest completed in 1994 and the last completed in 2001. The completion dates for all quarter sheets are available in the NH_NMP_info table (reproduced in Appendix E).

The NMP tables contain the higher level interpretations which form the primary NMP product and are the digital equivalent of the hand-drawn acetate overlays produced by early NMP projects or the layered AUTOCAD drawings produced by English Heritage today. These are based on the accumulated evidence in the APplots Cropmark and EWK_interpret tables at the time of mapping. Features in the NMP tables are of relatively secure archaeological origin even where information on date and function is unforthcoming. A scale of values in the Validity field of the MORPH2.2 database provides further qualification.

Archaeological features are added to the appropriate tables according to their condition and the manner of their visibility. When features have been observed on different photographs in different states, for example as earthworks on early vertical photographs but subsequently as

soilmarks and crop marks, then a basic principle of recording the evidence to its fullest was followed. In many cases earthworks are more revealing than either the crop marks or soilmarks of the same site once it is levelled. In these circumstances, the earthwork evidence was added to the NMPearthwork table but the last seen state of the site is recorded in the MORPH2.2. database.

There is a low representation of features in the NMPstructure table because standing buildings were not part of this project's sphere of interest. The main features in this table are outlines of airfields.

All mapping in the NMP tables should be based upon evidence in the APplots or Ewk_Interpret tables; there should be no mapping in these tables that has not been previously plotted. As such, all features mapped in these tables can be traced back to the originating photograph or ground survey plan through the Applots or Ewk_Interpret tables.

The NMP tables do not include features from the APplots table which are of dubious archaeological origin nor those that have been plotted since the time of mapping.

Unlike the APplots table, which is accumulative, it has been usual for NMP mapping to be a single event activity. It is not within the remit of the NMP projects to revisit areas previously completed when new information becomes available. As outlined in Section 7.1.7, this did lead to some specific problems for this project which are now partially resolved. However the accommodation of future mapping, as opposed to plotting, needs to be addressed. New sites or features can be added to the NMP tables and the database, but these are not designed to document the changes or enhancement of existing mapping and interpretation that may arise from new photography or reappraisal of existing material. This issue needs to be resolved in the near future before a less desirable *ad hoc* approach becomes customary.

Until such a mechanism and funding for updating the NMP tables is in place it is still possible to track new data: new photographs accessioned to the collection will be added to the NCC Photo Index and new plotting will be added with dates to the APplots table.

All features in these tables are concorded to their corresponding MORPH2.2 records with the Complex, Groups and Site numbers, which in combination are unique to each Site.

Features are also concorded to SMR Complex, Groups and/or Elements.

7.1.12 The NMPr&f table

This table contains outlines of the extent and trend of areas of ridge and furrow that over or underlie other visible archaeological features. This relationship is most likely to have been observed from a single photograph, for example levelled furrows overlying a prehistoric enclosure or an upstanding searchlight battery sited on surviving ridges. However occasionally this relationship may have been observed over many years of photography, for example recent oblique photographs may show only the prehistoric enclosure but earlier vertical photographs may have demonstrated that the area was once under ridge and furrow.

Only features that had been previously plotted in either the APplots or Ewk_Interpret tables appear in this table. Ridge and furrow was not recorded in the MORPH2.2 database and hence the mapped objects have no concordance with it.

7.1.13 The NMPgeology and NMPmodern tables

Geological and modern features have been mapped to the appropriate NMP table only in specific situations: where there was considerable risk of confusion with nearby

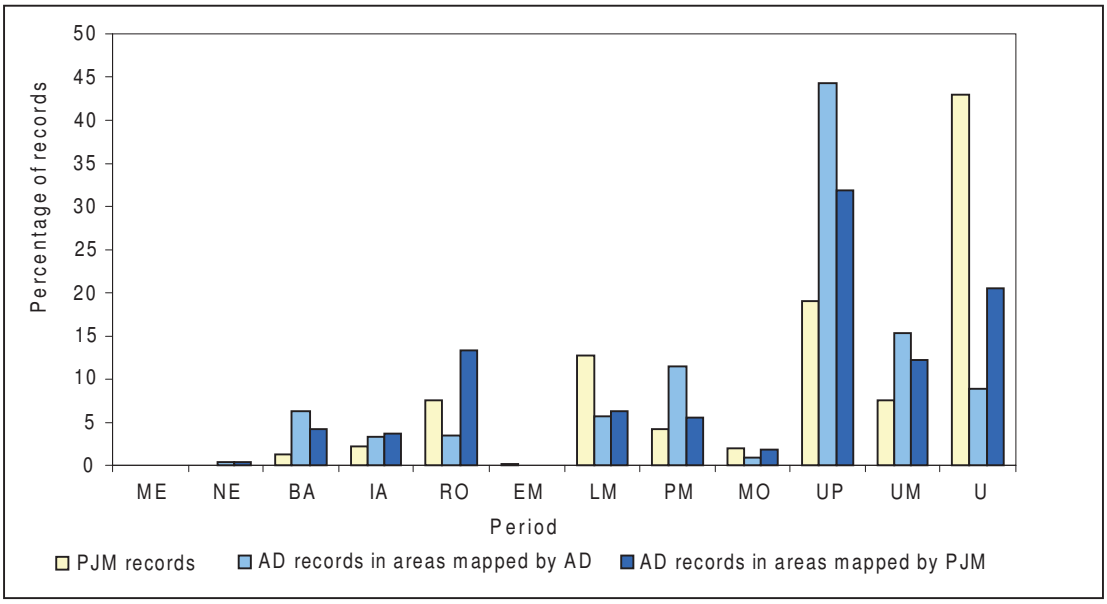
archaeological features, where the presence of modern or geological features was relevant to the condition of the archaeological features or where the presence of geological features was particularly relevant to the siting of the archaeology. Only features that had been previously plotted in either the APplots or Ewk_Interpret tables appear in these tables. Modern and geological features are not recorded in the MORPH2.2 database and hence the mapped objects have no concordance with it.

7.1.14 MORPH2.2 database

The MORPH2.2 database is a recording module, custom-designed for the RCHME in 1989, for use by the National Mapping Programme (Edis et al. 1989). MORPH2.2 was designed "as a systematic recording tool to allow for rapid retrieval and analysis" of NMP data (Bewley 1998:12). The database records information on the location and morphology of archaeological sites and the date and function of those sites as deduced by the interpreter. Invariably the date and function of archaeological features recorded from the air have not been verified by excavation and these interpretations should be treated with caution. All interpretations are qualified in the "Validity" field in which the interpreter has indicated their level of confidence in their assessment of the evidence. The MORPH2.2 manual, provides a full account of the structure of the database and its content.

Two different interpreters have input to the Northamptonshire database, Phil Markham and Alison Deegan. This has resulted in some internal variability. Usually consistency can be maintained between co-workers on a project by monitoring and dialogue. However in the case of this project the two interpreters did not overlap and had no opportunity to confer.

Figure 19. The relative percentage of records attributed to each period by each of the air photo interpreters.



The most obvious discrepancy between the two interpreters is the variable use of the period values, as illustrated by the above bar chart (Figure 19). PJM created 8887 MORPH2.2 records between 1994 and 1998. Of those, 43% are recorded as being of unknown date. Compare this to the records created by AD for the areas she mapped of which only 9% of sites were considered undateable. A higher percentage of the records produced by AD in areas mapped by PJM were given date Unknown because they were created without

reference to the original photographs and interpretation relied on the mapping and inference from existing PJM records for neighbouring features.

In contrast AD attributed significantly higher percentages of the records to the narrower Unknown Prehistoric (which includes Roman period) or Unknown Medieval classes than PJM. The ongoing analysis of the project's data would have benefited considerably from the use narrower period ranges, particularly for Neolithic/Bronze Age and Iron Age/ Roman. The current NMP recording module has acknowledged this issue and is more flexible.

7.1.15 Morph and Morphpoint tables

To bring the MORPH2.2 database into wider usage NCC linked the data directly to the MAPINFO objects via the unique MORPH2.2 Complex, Group and Site strings. This MAPINFO table enables all users to directly interrogate the database without recourse to the now outdated database applications which previously supported it. Moreover this system allows real time access to the actual archaeological features returned from a specific database query, a task not yet easily done through the current EH NMP system.

In addition a distribution plot version has also been created, based upon the centroid of each graphic object, rather than the central NGR given in the MORPH2.2 database.

7.1.16 The NH_NMP_info table

This MAPINFO table contains key information about the NMP for each quarter sheet and summarises some of the results. This information includes for each quarter sheet the original blocks names and those used since 1999, the date of completion, days taken for mapping, morphing and overall (where this information is available), NMR loan coversearch number (where known), author(s), presence/absence of MORPH2.2 record sheets and Map Note sheets and number of MORPH2.2 records. This is reproduced in Appendix E.

7.2 Overview of results.

The Northamptonshire NMP project has produced a database recording the location, size, morphology, interpretation and date of 14, 142 archaeological sites linked to graphic representations of those sites plotted at a nominal scale of 1:2500. In addition the project has produced a large number of graphic objects that record selected ridge and furrow, modern and geological features and sites in the project area that lie outside Northamptonshire.

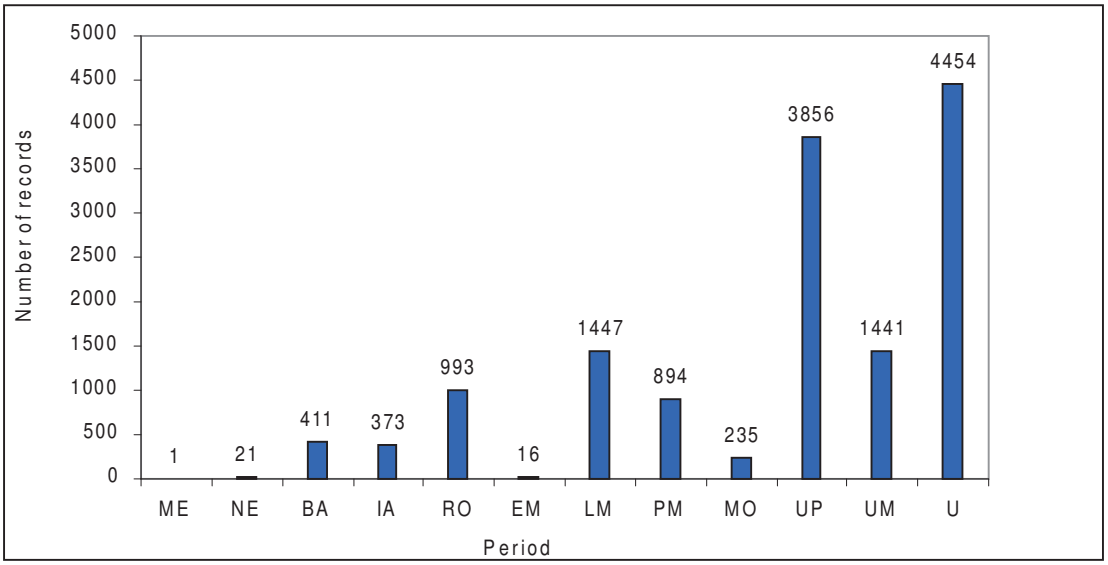
Of the 14, 142 sites recorded more than 57% were new to the NMR at the time of mapping, based on the number of records with no concordance to the NMR. However, as would be expected given the history of post-reconnaissance work in Northamptonshire, fewer than 15% of the MORPH2.2 are new to the county Sites and Monuments Record on the same basis. In fact the number of new sites is probably lower still as difficulties in relating the SMR point data to the NMP graphical objects led to a conservative approach to monument concordance.

This project has recorded evidence of archaeological activity from the Neolithic period through the modern day. There is a wealth of information on the levelled sites of the Iron Age and Roman landscape but other aspects, in particular Anglo-Saxon archaeology are probably significantly under represented.

The project has recorded a very diverse range of features and landscapes from funereal monuments to military installations. A full inventory of the site types is not appropriate to this Management Report an instead will be dealt with in the future web and formal

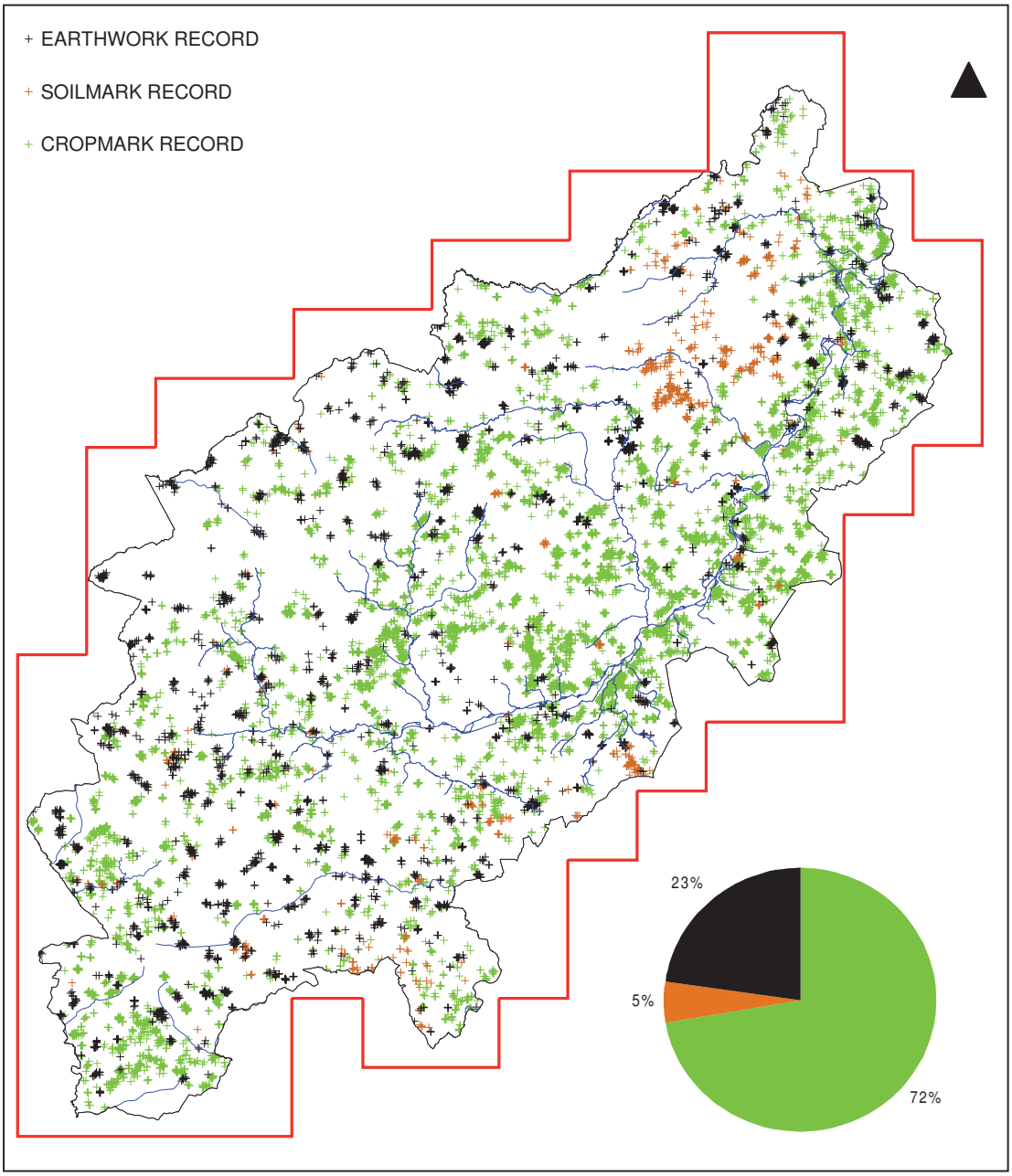
publications (see Section 8.4) (Deegan & Foard 2002).

Figure 20. The percentage of records attributed to each period.



Nearly a quarter of sites recorded by this project survive as earthworks. However the majority of the sites recorded were visible as crop marks (72%), a small but significant proportion of the sites were visible as soilmarks. A full assessment of the distribution of crop marks, soilmarks and earthworks and the implications for archaeological interpretation will be the first task in the further research and analysis for publication (Deegan & Foard 2002).

Figure 21. The distribution of crop mark, soilmark and earthwork records.



8.1 Copyright

The copyright of the Northamptonshire NMP data is held jointly by Northamptonshire County Council and English Heritage. This arrangement covers the NMP tables and MORPH2.2 database and any digital data or hard copy derived from them. The NCC Photo Index and APplots table are the copyright of Northamptonshire County Council.

8.2 Integration to the SMR

As has been the case since the early 1980s there is an emphasis on the rapid dissemination of data from the air photographs to the planning archaeologists and other NCC users.

During the course of the project the NMP tables were serially updated and replaced in the individual's GIS workspace so that the data for each block was available for all to use as and when it was completed. In addition the information in the MORPH2.2 database was attached to the mapped graphic objects so that that data was and continues to be readily accessible. The stand-alone MORPH2.2 database was not suitable for general use.

The preferred delivery route for the NMP data is via full integration into the SMR but this is a long term rather that short term objective in view of current software issues and existing backlogs.

8.3 Integration to the NMR

The project data will be transferred to the NMR as a set of AutoCAD compatible graphical objects and the MORPH2.2 database. The NewHIS HOB UID Collection No. for this project is 1059503 and the Event No. is 1225207. Currently there are no NewHIS records associated with the project data and, as there is currently no link between HSIS and MORPH, there is no existing route for incorporating the data into standard NMR data supply flowlines. As a result, at this juncture, the primary dataset, with fully functioning relationships between graphical and textual data, will lie with ADS (see below).

8.4 Wider dissemination

The exciting digital data set for the Northamptonshire NMP demands an ambitious and innovative approach to synthesis, dissemination and long-term preservation. With these objectives NCC has formulated a comprehensive and integrated package consisting of a management report, a formal publication, internet publication, web delivery of the project data and digital data archiving (Deegan & Foard 2002).

8.4.1 Management Report (this document)

The Management Report is required as an account of the project. The Northamptonshire NMP is a project of some longevity during which there have been developments in methodology and changes in personnel. This document, in conjunction with the metadata, serves as a manual to the various NMP data sets, which is essential to enable users to make full and appropriate use of the project data.

This report has been completed to a draft stage in advance of any archaeological analysis. The draft version will be made available online. Towards the end of the project the

Management Report will be updated to encompass other issues arising from the archiving and dissemination processes.

8.4.2 Formal Publication

The Northamptonshire NMP data has mapped and recorded over 14, 000 archaeological features that together reflect the diverse nature of settlement, agriculture, industry, defence and recreation in the county. There is enormous potential for this data to contribute to current archaeological research and heritage resource management issues. The East Midlands Research Frameworks have identified particular themes and problems that aerial photography and the NMP in particular may be able to address (2001).

The formal publication is intended as a series of papers themed on current research objectives to be presented together in a monograph publication, working title *Ancient Landscapes of Northamptonshire: An Aerial Survey*.

8.4.3 Internet Publication

The internet publication will develop from the research work on the archaeological and methodological themes and will explore the potential of the flexible, non-linear structure to take archaeological information to a wider audience. Web-enabled documents will be produced concurrently with the formal publication texts and will illustrate, with selected case studies, the route from data to analysis and synthesis. In particular this will be the platform on which to demonstrate the GIS-enhanced analytical techniques in a way that will not be possible in the formal publication.

Draft versions of each thematic paper will come online as they are completed. Final versions will be made available after the editing process at the end of the project.

8.4.4 Web delivery of the NMP project data

Northamptonshire County Council is keen to promote dissemination of the Northamptonshire NMP mapping and interpretation data. The core digital map data will be made available through a GIS-enabled web interface displayed against licensed map data and for download. In addition NCC's resource for the identification of air photo coverage, the NCC Photo Index, will be made available, as will a large selection of air photograph images (NCC copyright only).

The Northamptonshire NMP project was the first to employ a digital methodology and will be the first to explore and utilise the web for the dissemination of NMP data.

The Archaeological Data Services (ADS) has been identified as the provider for the web delivery of the Northamptonshire NMP data .

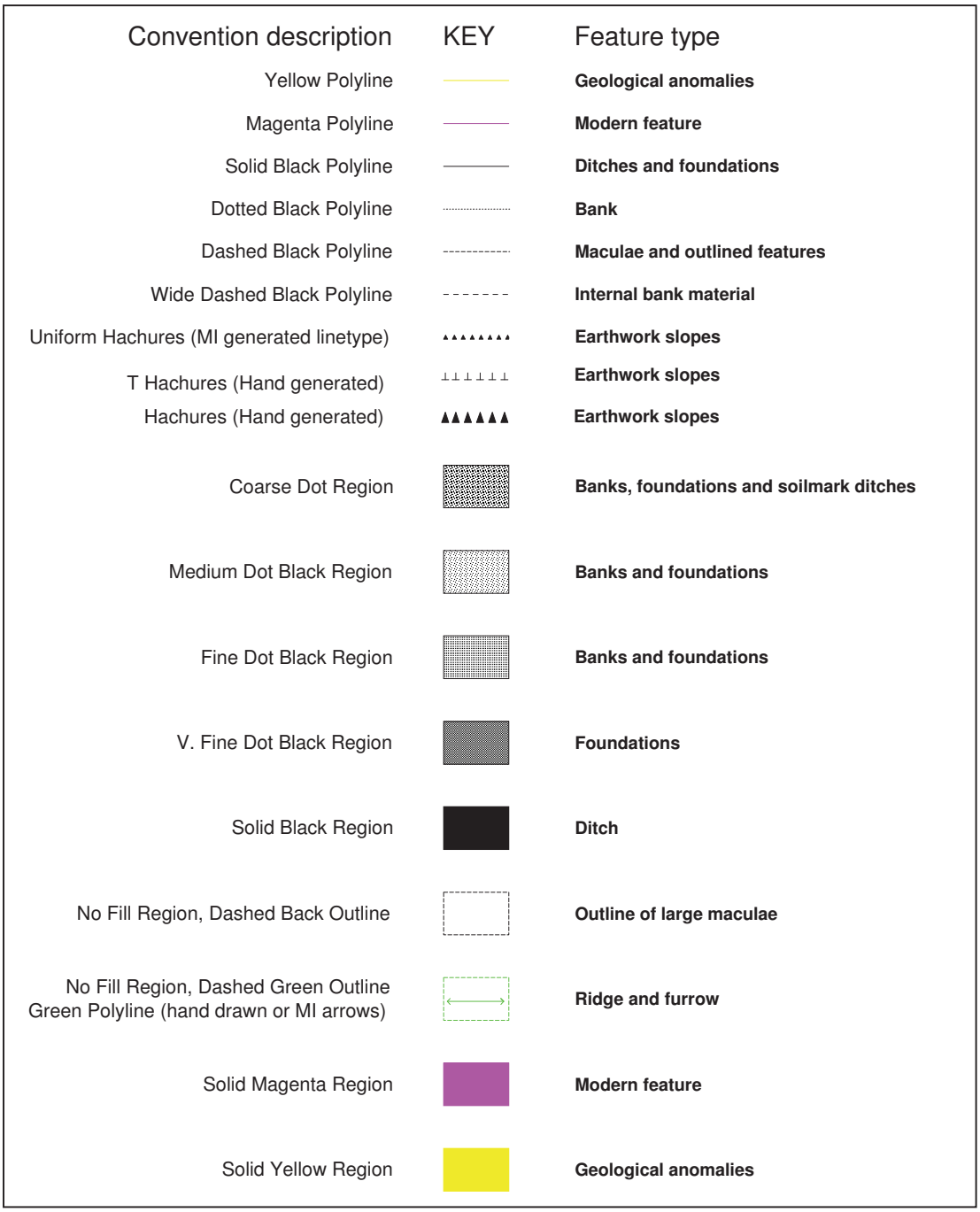
9 ARCHIVES

NCC & English Heritage recognise the necessity of archive provision for the Northamptonshire NMP digital data and has identified the Archaeological Data Service as the appropriate depository. ADS will undertake and ensure the long-term curation and accessibility of the data files.

APPENDIX A. CONVENTIONS USED BY THE PROJECT

These are the line and fill types used in the depiction of archaeological and non-archaeological features for the Northants NMP project in the NCC GIS (MAPINFO). This was a project of some longevity and developments in mapping techniques and changes in personnel inevitably resulted in some variation in the conventions used. NCC users can access a detailed key of the line and fill types used at *key_template.doc*. This general overview of the major conventions should satisfy the needs of most users.

Figure 22. Overview of conventions used for Northamptonshire NMP mapping.



APPENDIX B. SUMMARY OF NMR COVERSEARCHES AND LOANS

Table 1 NMR coversearches and loans 1994 to 1998 (incomplete)

Area	Block	NMR loan number	Date of loan (or coversearch)	Verticals	Obliques
SP53SE	Pilot	fem 93/10/904ek	CS 29/10/93	?	?
SP56SW	Pilot	fem93/10/9041ek		?	?
SP78SW	Pilot	fem93/10/9042ek		?	?
SP86SW	Pilot	fem93/10/9043ek		?	?
TL07SW	Pilot	fem93/10/9044ek		?	?
TL09SW	Pilot	fem93/10/9045ek		?	?
TL98SW	Pilot	fem 94/213/531ek	CS 8/2/94	?	?
TL98SE	Pilot	fem 94/213/532ek		?	?
BLOCK 3?		pjr 94/8/517 1	24/8/94	1549	1191
SP95NW, SP96SW & NW, SP97SW	Wellingborough	fem 95/2/1524 1	Obs 13/3/95, vs 20/3/95	1115	919
89NE, 99NW	Corby	fem 95/2/1524 2	Obs 13/3/95, vs 20/3/95	478	228
Prints reissued for Corby block		fem 95/2/1524 2	15/6/95	185	115
SP800850 TO TL100950	Corby	pjr 95/4/71	6/6/95	1565	1010
SP77NE, SP78NE & SE, SP79SE	Kettering	fem 95/6/2501fb	14/8/95	1091	751
SP87NW, SP88SW & SE	Kettering	fem 95/6/2502fb	27/2/96	1132	431
SP87NE, SP97NW & NE	Kettering	fem 95/6/2503fb	25/1/96	1383	313
SP63NW & SW, SP64SW & SE	South Northants II	286/96 block a	CS 8/8/96	c. 859	c. 241
SP73NW & NE, SP74SW & SE	South Northants II	286/96 block b	CS 8/8/96	867	c.406
SP84NW & SW	South Northants II	286/96 block c	CS 8/8/96	758	116
SP43NE & SE, SP44NE & SE, SP45SE	South Northants I	96/2/1797fb1	7/6/96	1744	510
SP53NW, NE & SW, SP54SW & SE	South Northants I	96/2/1797fb2	?		
Block4C?		2087/97	9/5/97	1396	1362
SP45NE, SP46SE	South Northants IV	5038/97a	3/10/97	255	148

Area	Block	NMR loan number	Date of loan (or coversearch)	Verticals	Obliques
Block 4D PART B SP54NW & NE	South Northants IV	5038/97b	5/12/97	293	412
Block4D 55NW, NE, SW and SE	South Northants IV	1222/9798a	CS 28/11/97	603	789
Block4D SP65NW & NE		1222/9798b	CS, no loan?	c.599	718
6B SP96NE & NE, TL06NW & SW	East Northants II	787/9899	4/6/98	805	494
SP97SE, TL07NW?	East Northants II	787/9899	17/8/98	678	967

Table 2 NMR coversearches and loans 1999 to 2001

Block	NMR loan number	Date of coversearch	Laser copies	Total Verticals consulted	Total Obliques consulted
1	AP7546 99/00	7/10/99	0	1672	1292
2	AP10606 99/00	18/01/00	18	1119	853(852)
3	AP15484 99/00	08/05/00	65	671	637
4	AP16550 00/01	05/06/00	45	1426	1314
5	AP18233 99/00	26/07/00	67	2052	1075
6	AP18800 00/01	10/08/00	27	1432	1158
7	AP21574 00/01	25/10/00	0	894	638
8	AP24363 00/01	18/01/01	36	807	831
9	AP28670 01/02	25/04/01	43	1238	321

Table 3. RAF vertical loan requested in 2001 for assessment and appraisal.

NMR loan number	Date of loan	Total Verticals consulted
AP37916/0102	13/12/2001	1398
AP41296/0102	05/04/2002	651

APPENDIX C. PROCEDURES FOR NMP RECORDING 1999-2001. (DEVELOPED FOR USE WITH AERIAL5.14)

This is a step-by-step record of the procedures employed for air photo interpretation, rectification and mapping for Blocks 2 to 9. It may also be used as a manual for future work of a similar nature although continuing developments in the AERIAL system may impact on the methodology.

Stage 1 Prepare the data

Step 1 Collate oblique photographs from NMRC and NH collections by km square. NMRC vertical photograph are arranged in overlapping stereo runs and should only be divided into quarter sheet coverage.

Step 2 Prepare a MAPINFO workspace that contains the APplots, Landline, SMR and 100m grid tables. Also have to hand the NMR record maps and record printouts for the quarter sheet.

Step 3 In an organised and consistent manner compare the information of the photographs with that of the APplots and SMR tables and the NMR.

Stage 2 Select photographs for further interpretation

Step 4 Identify from the photographs either sites or landscapes for which the APplots mapping is of insufficient quality or accuracy, where the photographs show additional information or for which there is no existing mapping.

Note *When there is a high volume of coverage for a relatively small area it is often necessary to rationalise the photographs which will be used directly for interpretation and mapping as in Step 5.*

Step 5 Examine each of the photographs, select those which appear to show the archaeological features to the fullest with greatest clarity, if they are not the same also select those which show the features to the fullest with the greatest options for control, select also the best examples from each occasion of photography. Then check each of the remaining prints against the selection to ensure they have nothing further to contribute to the interpretation and mapping process, if they have add them to the selection, if not put them aside and note them as having been examined.

Step 6 Examine the vertical photographs, ideally after the oblique coverage, in their runs stereoscopically and under magnification. Select those with improved, additional or new information as above.

Note *The next stages of the process can be undertaken either after each km square, part of or whole quarter sheet depending on the volume of new, additional or improved material to be interpreted, rectified and mapped.*

Stage 3 Select photographs for rectification

Note *All current and earlier versions of AERIAL compare corresponding control points*

on photographs and maps to correct for the distortions of the photographic image. Both oblique and vertical photographic images contain the distortions of perspective. Though these are considerably less marked in vertical photographs even the very slight difference in the angle to the ground between the centre and the edge of the photograph introduces some distortion.

Note *The most suitable control points are distinctive and discrete features visible on a photograph which correspond to the same feature on a map. Preferred control points are the intersection of field boundaries but other features such as the corners of buildings, road intersections, or, if used with care any abrupt changes in direction of any linear features.*

Note *If features do not physically intersect at a single point then lines can be projected from two converging straight elements to locate a distinct and corresponding point on map and photograph.*

Note *In difficult cases rectified photographs can help rectify a second photograph with poorer control. The rectified image can be used to position control points visible on both photographs but not featured on the map. In this case the errors shown for the second image will be compounded by those of the first.*

Note *Successful rectification requires a photograph with at least five control points which give a good surround of the area of interest. AERIAL5.14 will process images with only four points but any errors will not be qualified and are likely to be large. Although AERIAL5.14 allows for the selection of up to twelve control points operation is best with 5 to 8 points. The selection of 3 or more control points in any one line will not improve and can decrease accuracy. Ideally control points should be positioned at the apices of an imaginary regular polygon encompassing the area of interest.*

Note *Whilst AERIAL5.14 qualifies the accuracy of each control point and this can be extrapolated to the area of the imaginary polygon, the area beyond will not necessarily be rectified to the same accuracy.*

Note *Select images for rectification with the availability of control points in mind. Ideally the selected photograph will be that showing the features to their fullest with the best surrounding control. In practise it is often necessary to select several photographs which together show the features to their fullest and provide sufficient control to attain the accuracy required.*

Stage 4 Scan the photographs

Step 7 Scan the selected photographs on a flat bed scanner at 1:1. A resolution of 300dpi is generally sufficient for larger "scale" oblique images. Higher resolutions may be appropriate for the small CUCAP oblique contact prints and good quality but smaller scale (1:10, 000 – 1:15, 000 scale) vertical prints.

Step 8 Create all scanned images in the uncompressed TIFF (Tagged Information File Format, also .tif) format.

Note *AERIAL5.14 supports only the TIFF format. Images which have previously been*

saved or created in other formats can be converted to the TIFF format in applications such as CorelPhotoPaint or Adobe Photoshop but this will not reverse some of the image loss and interference associated with some compressed formats such as JPEG.

Step 9 Prior to the scanning stage pay particular attention to the control point options, if they are limited but can be supplemented by projecting beyond the photograph image then be sure to create images with "room" to accommodate this. If not copy and paste the photographic image into a blank white image of the required size. Use the drawing tools in Adobe PhotoShop or Corel PhotoPaint to add projecting lines across and beyond the photograph where necessary.

Step 10 The photographic image is now ready to be opened in AERIAL 5.14.

Stage 5 Prepare a mapbase for AERIAL5.14 in MapInfo

Step 11 Prepare a MapInfo window with the OS Landline Data and the 100m grid which covers the area of the control points.

Note *As MapInfo creates relatively low resolution raster images the window should be set at least to the mapping scale of 1:2500 to achieve an image of sufficient quality. The window must also include the NE, NW, SW and SE points of a square of known origin (SW corner), which covers most or all of the chosen control points. The 100m grid is most useful for this.*

Step 12 Type the full OS coordinates of the origin and the size of the square's sides into the cosmetic layer alongside the SW corner to be exported with the map.

Step 13 Select *File*, *Save Window As,* type in a file name and select TIFF as the output format. These are only temporary file, they do not form part of the archive and should be deleted after use.

Stage 6 Rectify the photographs with Aerial5.14

Note *There are a few basic mouse operations associated with the map or photograph windows in AERIAL5.14. Mouse tracking moves the cross-hair cursor about the windows. In the absence of any previous commands a left click will result in a measured zoom in on the image, this allows points to be positioned with greater accuracy, however if the zoom is too great a blank screen will appear. A right click will return the view to a set scale. If a selection command is actioned such as* Control Point, Select Point no 1, Control Point, Select Map origin *or* Map_image, Select SW corner of Map square *then the next left click will select the current cursor position as a point.*

Step 14 Register the map image. Select *Map_Image, Open a new map image file* , locate and open the map image.

Step 15 Select *Map_Image, Define origin (SW) of Map square*. Type in the easting, northing and the width of square.

Step 16 Select *Map_Image, Select SW corner of Map Square*. Position the cursor over the

SW corner of the square and left click.

Step 17 Select *Map_Image, Select SE corner of Map Square*. Position the cursor over the SE corner of the square and left click.

Step 18 Repeat for NE and NW corner

Step 19 Select *Map_Image, Register the Map square.* This will now geo-register the map to the OS coordinates supplied.

Step 20 Check the registration by placing the cursor over a point of known coordinates (e.g. a grid intersection not used as the corners of the Map Square) and check the Map coordinates displayed at the bottom of the screen.

Step 21 Select *Map_Image, Save registered map image as*. Once saved a registered map can be closed and reopened without need to repeat the above process.

Step 22 Arrange map and photograph images on screen. Select *Tif_File, Open Original Tif file*, locate and open the scanned photograph image.

Step 23 Select *View, Tile Vertically*. This will arrange the photograph and the map side by side

Step 24 Mark on the control points

Note *The control points may be marked on the photograph and map in any order, AERIAL5.14 will detect whether control points are placed on the map or the photograph and colour-code them accordingly. The only requirement is that corresponding control points on the map and photograph are numbered the same.*

Step 25 Select *Control Point, Select Point no 1*. Position the cursor above the chosen control point then left click.

Step 26 Select *Control Point, Select Point no 2*. Position the cursor above the chosen control point then left click.

Step 27 Repeat until all control points on the photograph and map are marked

Step 28 To correct a misplaced control point repeat the *Control Point, Select Point no* commands for the erroneous control point number

Step 29 Check the rectification. Select *RDA_data, view current RDA data.*

Note *In the RDA window there will be a row for each of 12 control points. Those that have been used will have (from left to right) columns for "8" (an internal command), PhoX, PhoY (the internal photo coordinates in pixels), East (map), North (map) (the map coordinates), East (fit) and North (fit) (the rectified photograph coordinates), Error and Height (only displays values when DTM is employed).*

Step 30 Check the given Error values are below 3 metres.

Step 31 If error values exceed 3 metres for any one control point either

Step 32 Remove any one point from the calculation type a letter "p" after the "8". Delete

the "p" to reverse this. Select *Recalculate* to display recalculated values and/or

Step 33 Add one or more extra control points. Select *Return to program menu* and mark the additional points as above.

Step 34 Repositioned control points as in Step 27.

Note *Even when errors of less than 3 metres are returned a visual check should be made. This is best done after Stage 12.*

Step 35 Select *Recalculate (project)* then *Continue/Rectify* this will display the rectified images within the set parameters (see below).

Step 36 Select *Overlays, Map image on rectified image,* and select a distinct pen colour. AERIAL5.14 will then overlay the map image on to the rectified photograph image and the correspondence between the two can be checked.

Step 37 Prepare the rectified image. Select *Return to Program menu*.

Step 38 Select *Control Point, Select Map Origin*. On the map image select an appropriate point to form the SW corner of the rectified image (i.e. so that all essential coverage lies north and east).

Step 39 Select *RDA_data, Current RDA data*

Step 40 The title line may be input with photograph information.

Note *Line 2 this is for use with dtm only*

Step 41 The third line should read "6 2500.0 300.0 000000.00 000000.00". Where 6 is an internal command, 2500.00 is the output scale of the rectified image, 300.00 is the output resolution (alter if original resolution differs). The last two columns contain the easting and northings of the Map Origin.

Step 42 The fourth line is for the user to define the pixel size of the output rectified image.

Step 43 When the rectified image is accurate and of appropriate scale, resolution and image size proceed to Step 44

Step 44 Save the information. Select *RDA_data, Recalculate, Continue/Rectify*

Step 45 Select *Tif_File*, *Save rectified Tif File as* (use the same filename with the suffix r to indicate it is a rectified image.)

Step 46 Select *RDA_data, Save RDA_data as* (use the same file name as the corresponding rectified image.)

Note *Further information on the use of AERIAL5.14 can be found in the software manual (Haigh 1999)*

Stage 7 Georeference the rectified image in MapInfo.

Step 47 Open MapInfo and an appropriate workspace.

Step 48 Select *Tools*, *Georeg, Register a Raster Image.*

Step 49 This will register and open the rectified raster image in its correct position, orientation and scale in a new window.

Note *(If the Georeg command is not shown select Tools, Tool Manager, scroll down for the Georeg toll and tick the loaded box then OK)*

Step 50 Change the blank areas in the raster image which surrounds the rectified photograph from black to transparent so as not to obscure surrounding map data.

Step 51 Select Table, Raster, Adjust Image Style and check the Transparent box and OK.

Step 52 Return to the window in which you wish to work i.e. the one with maps and add the rectified image layer. Check again that there is good correspondence between map and photograph features such as field boundaries.

Stage 8 Plot features to the APplots table

Note *Under the previous methodology interpretations were traced onto an acetate overlay, digitised and rectified simultaneously in AERIAL4 and the resultant plots were then imported into the MapInfo APplots table. With AERIAL5.14 the rectification and plotting stages are separated and the tracing is done straight into the APplots table (or temporary tables of the same structure).*

Note *All on screen interpretation should be undertaken with reference to the original prints. It is possible with the greater flexibility of the on screen image to magnify an image and over-interpret. If a feature is not visible on the original prints then it does not exist.*

Step 53 Trace archaeological and non-archaeological features from the photo image into the APplots table using the Polyline Tool.

Note *Levelled archaeological features should be drawn as "open" polygons to represent their full widths rather than single lines, however in this table they should not be drawn as regions as applied and override fill styles could obscure other interpretations of the same features from other photographs in the APplots table. Earthwork archaeological features may be indicated by a single line along the break of slope (usually the top). The point drawing tool should not be used in this layer, for example to represent pits or pit alignments.*

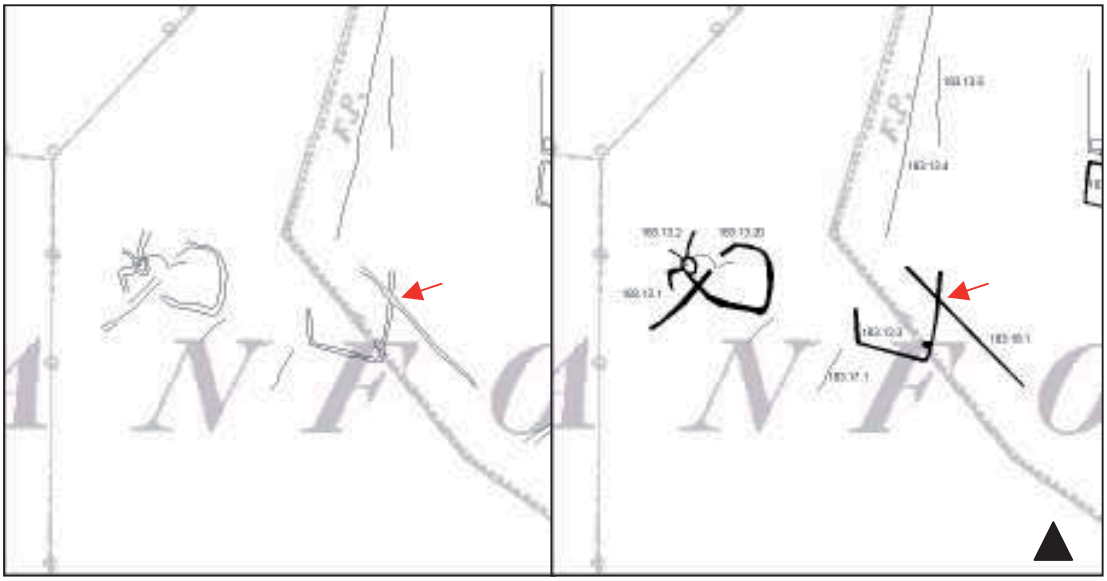
Step 54 Use the colour conventions as defined in the previous methodology. Black for crop mark, soilmark and earthwork features, magenta for modern features, green for ridge and furrow and yellow for geology.

Note *A further convention was used as part of the training and checking processes between API and APC between 1999-2001. This is cyan for features which may have been identified as archaeology by the API but which the APC believed to have been of non-archaeological origin, nor geology, modern or ridge and furrow. In general these tended to be superficial variations in crop growth and development or the result of over interpretation of the on-screen image.*

Note *It is important that the actual archaeological interpretation processes start with this stage of work rather than being left to the APlayer mapping. Features should*

be drawn with attention to their integrity and relationship to each other. This stage is not simply tracing around all the visible features as these will often be unrelated features which will then have to be split or completely redrawn for the final mapping stages.

Figure 23a and b. Enclosure and ditch plotted as one continuous feature in the APplots table (left) but interpreted and recorded as two distinct features in the APcrop table (right).



Step 55 Record the features mapped in the APplots table. Certain details must be recorded for each and every line drawn in the APplots table. For each line drawn a corresponding row is produced in the table's database. It is most efficient to update the APplots table on completion of transcription of each photograph.

Step 56 Select all features derived from the same photograph. Select Window, New Browser, Selection. This will display the rows for the selected features. Type the NH photo number in the first row in the Photo_no. column, copy then paste this to the same column in all of the remaining rows of the selection. Type the author's initials in the first row in the Author column, copy then paste this to the same column in all of the remaining rows of the selection. Return to the map window.

Step 57 Select all features for which the layer should read Cropmark using the most appropriate Select Tool. Select Window, New Browser, Selection. This will display the rows for the selected features. Type "Cropmark" in the first row of the Layer column, copy then paste this to the same column in all of the remaining rows of the selection. Repeat for each Layer attribute. Return to the map window.

Step 58 Experienced MapInfo users can use the Update Column commands to speed up these tasks.

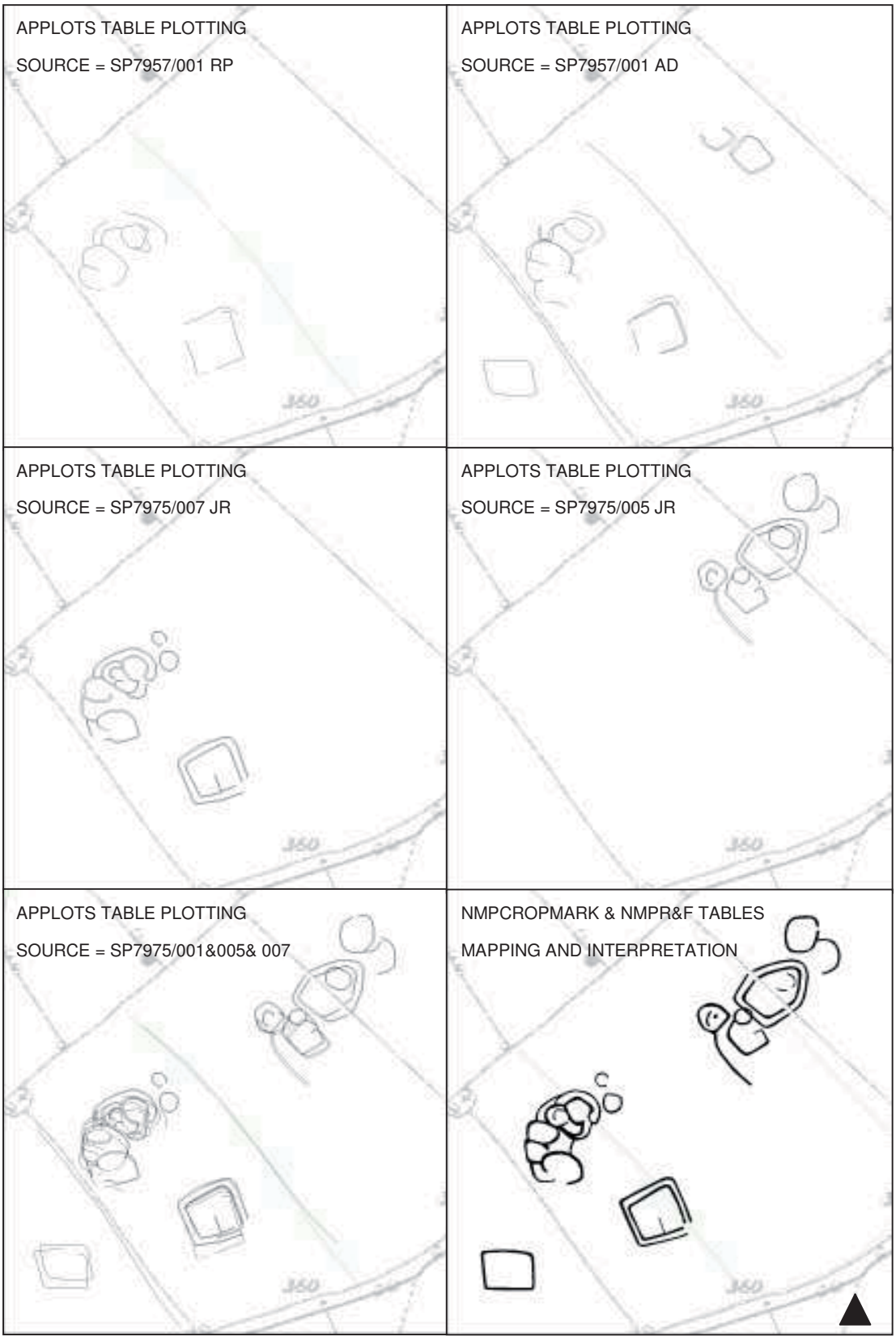
Step 59 When every photograph has been transcribed for the quarter sheet the APplots table should be checked for complete recording and correct use of line conventions.

Stage 9 Interpret and map features in the APlayers

Note *A full description of the NMP tables and their distinction from the APplots table can be found in Section 7 Understanding the data.*

Step 60 Final interpretations of the archaeological features are drawn into the APlayers with reference to as many of the source photographs as possible.

Figure 24. Individual plots of rectilinear and curvilinear enclosures from different photographs in the APplots table (top left and right, middle left and right), the composite plots in the APplots table (bottom left) and the final mapping and interpretation of in the NMP tables (bottom right).



Step 61 In many cases the final interpretation will be compiled from more than one plot in the APplots table and should accommodate any minor differences in positioning, shape and size of features and should encompass all the accumulated evidence from different photographs.

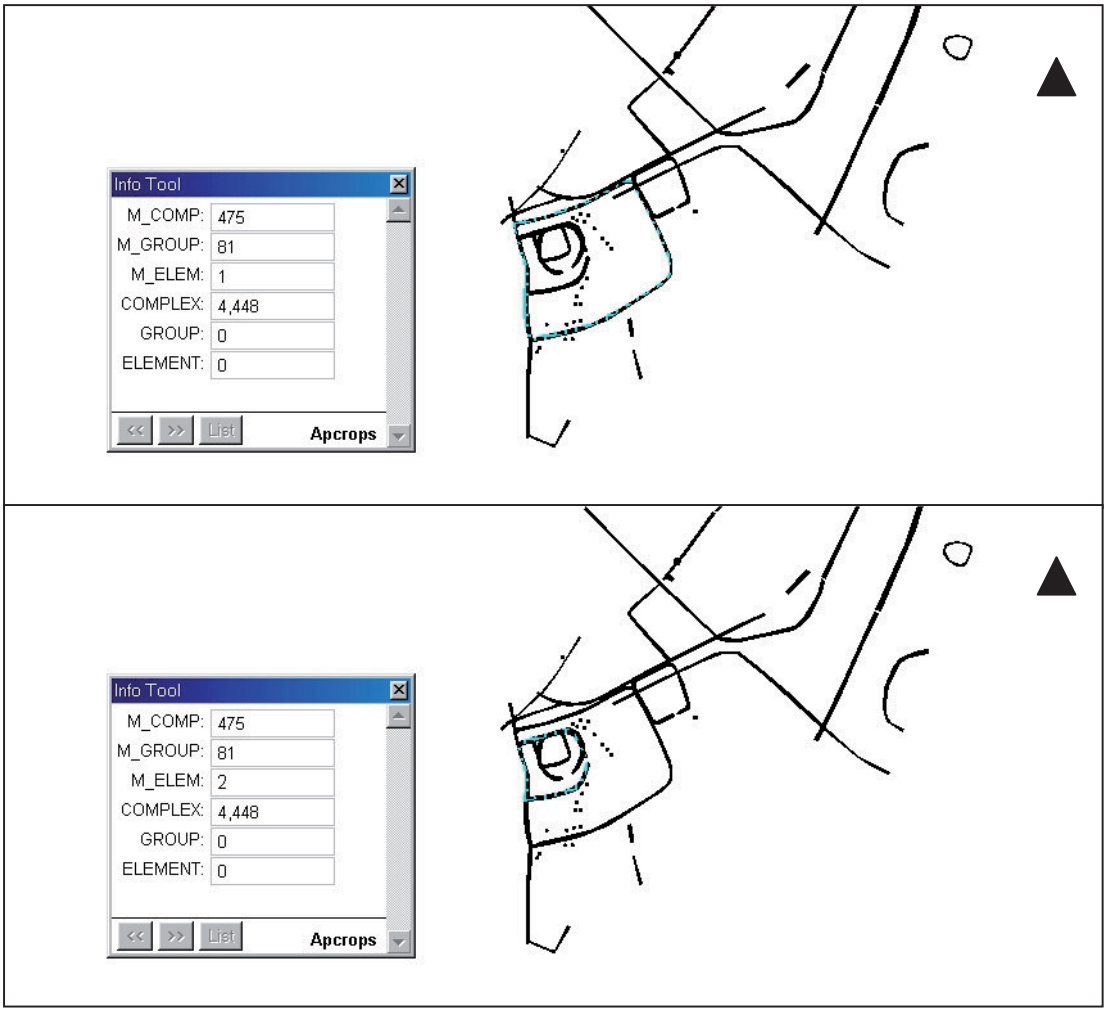
Step 62 The final interpretation should represent as accurately as possible the location, shape and size of all the visible buried and upstanding archaeological features and their spatial relationship to one another.

Step 63 Where the final interpretation is generated from a single plot in the APplots table and that plot is of sufficient graphic quality the relevant features may be copied directly into the NMP tables instead of being redrawn.

Step 64 The final interpretation should follow the conventions set out in APPENDIX A

Note *It is essential that features are mapped intelligently and that elements shared between features are fully represented. In this example one side of the enclosures (highlighted in a) is abutted by a smaller internal enclosure (highlighted in b) both a drawn in full so their integrity is not compromised if they are examined out of context.*

Figure 25a and b. The circuit ditches of both enclosures are drawn in full even though the smaller probably abuts the larger along one side.



Stage 10 MORPH2.2 database recording.

Step 65 Enter records to the MORPH2.2 database according to principles and procedures in the MORPH2.2 manual.

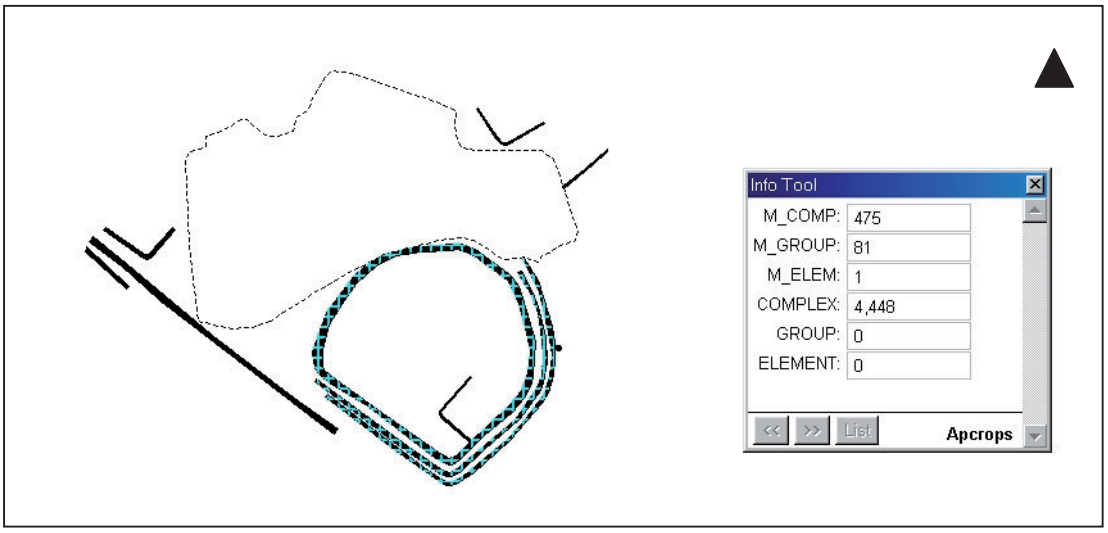
Stage 11 Concord the SMR, Morph2.2 records and NMP mapping.

Note *These steps are easiest when carried out concurrently with Stage 10.*

Step 66 Each of the graphic objects in the NMP tables should correlate with a MORPH2.2 Site.

Step 67 If two or more graphic objects of the same convention and in the same table constitute a single Site then they should be combined to produce a single object. For example the inner and outer ditches of a double-ditched enclosure should be combined to produce a single Site.

Figure 26. The inner and outer ditches of the enclosure have been combined to produce a single graphic object for the MORPH2.2 Site



Step 68 To combine objects select *Object, Combine.*

Step 69 Once all the graphic objects are rationalised into archaeological objects in this way they should be updated with the MORPH2.2 Complex, Group and Site numbers and concorded with the SMR Complex, Group and element numbers when appropriate.

Note *If objects cannot be combined because they have different conventions (e.g. embanked and ditched elements of the same feature) or are in different tables (upstanding and levelled sections of the same feature) then the same values should be applied to each object.*

Check Stages 9 to 11.

A period of data checking and consolidation followed the completion of the mapping and interpretation stage in August 2001. Specific tasks were identified by the APC for each of the NMP data sets and were undertaken with the assistance of the AAA.

NMP tables

The two main issues regarding the NMP tables concerned work produced prior to 1999: the backlog of object creation for an area in the north of the county and incomplete MORPH2.2 recording and concordance in all other areas. Of the total of 50474 objects in the NMPcropmark NMPsoilmark, NMPearthwork and NMP structure more than 20240 had incorrect or no concordance with the MORPH2.2 database.

The process of combining mapped elements to produce objects corresponding to the MORPH2.2 sites had not been undertaken at the time of mapping quarter sheets in the Corby Block and SP79SE, SP78NE, SP98SW, SP98SE, TL09SW, SK90NE and TL00NW. This work was completed by the APC with reference to the original printouts of the mapped data, on these the MORPH2.2 numbers had been written alongside each feature.

The concordance between the NMP objects and the MORPH2.2 records was carefully checked. These tables and the database are combined to produce the MORPH table. Objects from these tables that lay within the county boundary, which should all have had valid MORPH2.2 record numbers, were selected from the MORPH table. A separate, temporary table was imported directly from the MORPH2.2 Primary Record Index (PRI table) and points created for each site at the given NGR.

Both sets of data were then viewed simultaneously and PRI table points and Morph table objects were labelled with the MORPH2.2 Complex, Group and Site numbers. All the data was visually examined, in a systematic manner, for erroneous concordance in the MORPH table objects and erroneous NGR information in the PRI table. Where errors were found these were amended in the MORPH2 database and NMP tables as appropriate. Once this process was completed new MORPH and MORPHPNT tables were generated from the corrected NMP tables and MORPH2.2 database.

The second stage of checks concentrated on those objects in the MORPH table with no apparent corresponding MORPH2.2 records. Again all those objects which should have had records were selected. Then, in a systematic manner, all those without concordance were checked against an updated PRI table. If a record was found to exist then the appropriate fields were updated in the NMP tables. If no record was found to exist a new record was created in MORPH2.2 and then the appropriate fields were updated in the NMP tables. It is important to note that over 670 new records were created between August 2001 and March 2002 as a result of checks on areas mapped prior to 1999. In many cases new records had to be created without reference to the original photographs so interpretation relied on the mapping and inference from records for neighbouring features. In such cases, a value of 0, which indicates “Unconfirmed Overlay”, was used in the Source field of the MORPH2.2 database, and usually low values were entered in the Validity field.

All post-mapping work on the NMP layers was undertaken by the APC.

NCC Photo Index

The NCC Photo Index had not been available for reference or editing when the project

restarted in full, in November 1999, until early 2000 because of the migration of the SMR from Oracle to new software. This was not a problem for NCC-held photographs as these were already entered into the Index and labelled with their respective Photo Numbers. However NMRC and CUCAP photographs used in the rectification and plotting processes had to be identified by temporary references. At the end of the mapping and interpretation stages all those temporary references, which followed through in filenames and layer attributes in the APplots table, had to be identified and updated with valid photo numbers. The ACP generated a list of the temporary references from the APplots table. From the list the AAA created new NCC Photo Index entries, referring back to the original cover searches for data where necessary.

At the reinstatement of the project in 1999, a rapid assessment of the NCC Photo Index information on the CUCAP oblique collection had showed it to be lacking. In order to facilitate consultation of the CUCAP collection for the rest of the project the Photo Index was updated from the CUCAP NGR card index for those quarter sheets yet to be mapped. At the end of the mapping and interpretation stage it was seen as necessary to complete this update for the rest of the project and new entries were created accordingly. All CUCAP's oblique coverage listed on its in-house NGR card indexes should now be listed in the NCC Photo Index.

APplots table

The main problems in the APplots table were the inclusion of ground survey plans, the use of non-NCC Photo Index references and the absence of author and date attributes.

The problems created by the latter are described in Section 7.1.7. A field for author was added to the APplots table in 2000 and was entered for all subsequent plotting. When the mapping and interpretation was completed a further field was added to this table to record the date of plotting, to be entered retrospectively where possible and for all future work. For work since 2000 this information was generated from the AERIAL 5.14 .rda files, these being the closest stage in the plotting process that could be? dated retrospectively.

For plots produced prior to 2000 the date created and interpreter was generated from the original .dig files, which are stored by author. These files were available for all work undertaken by the ACP and Rog Palmer, but not all of the original files created by Northamptonshire Heritage have been found. All plots in the APplots table not identified with any other interpreter have been attributed to the Aerial Archaeologist (PJM) although several individuals including Christine Addison and Glenn Foard contributed to this work but at that time adequate metadata was not being recorded. Plots remain undated if the original files are unavailable.

Plots identifiable as ground survey plans by their photo numbers and content were moved to the EWK_interpret table where their references were converted to a consistent format.

Many plots were found to be referenced by numbers which were not consistent with the standard NCC Photo Index Photo Number, which meant that the source photographs could not be easily traced. All plots created by Rog Palmer were referenced by an independent system but, fortunately, Rog had maintained the key to this system, which he provided as a text file. This was used to update all of his plots with valid NCC Photo Index Photo Numbers.

As described above plots produce in late 1999 and early 2000 from non-NCC held

photographs were referenced by temporary numbers. When records for these temporary references were finally created in the NCC Photo Index the APplots table was updated with the valid Photo Numbers

Of 5374 different sources referenced in the APplots table only 193 still have identities inconsistent with NCC Photo Index system, all were produce prior to 1999. Most of these references appear to be in the NMRC AP indexing format but some are typographical errors. It has not been possible, in the available time-scale, to validate and update this small portion of the data set.

The scanned and rectified ground survey plans and RCHME key table

Ground survey plans published by RCHME in areas of mapping undertaken since January 2000 had been scanned and rectified. After mapping was completed all remaining plans were processed in the same way and the RCHME key table was updated.

EWK_interpret table

Plots in the APplots table, identifiable as ground survey plans by their photo numbers and content, were moved to the this table and their references were converted to a consistent format.

Scanned images, rectified image and RDA files.

The ACP and AAA renamed all of the image and .rda files that had temporary references with the standard format filenames based on the NCC Photo Index Photo Numbers.

The ACP scanned RAF verticals sorties for the ridge and furrow assessment and the NCC colour slide collection.

APPENDIX E. QUARTER SHEET INFORMATION

SHEET	ORIGINAL BLOCK	BLOCK	DATE COMPLETED	NO. MAPPING DAYS	NO MORPH DAYS	TOTAL NO. DAYS	NMRC LOAN NUMBER	OVERLAP	AUTHORS	MAP NOTE-SHEET	MORPHSHEET
SK90NE	Pilot		01/01/94				?	YES	PJM	NO	NO
SK90SE	East Northants I	3	04/08/00			15.50	AP15484 99/00	YES	AD+JR	NO	NO
SP43NE	S Northants I		28/06/96	5	1	6	9621797(1)	YES	PJM	YES	YES
SP43SE	S Northants I		19/06/96	3	1	4	9621797(1)	YES	PJM	YES	YES
SP44NE	S Northants I		23/07/96	8	1	9	9621797(1)	YES	PJM	YES	YES
SP44SE	S Northants I		09/07/96	6	1	7	9621797(1)	YES	PJM	YES	YES
SP45NE	S Northants IV		29/10/97	4		4	503897(A)	YES	PJM	YES	YES
SP45SE	S Northants I		09/08/96	8	2	10	9621797(1)	YES	PJM	YES	YES
SP46SE	S Northants IV		06/11/97	4		4	503897(A)	YES	PJM	YES	YES
SP53NE	S Northants I		01/10/96	8	4	12	9621797(2)	YES	PJM	YES	YES
SP53NW	S Northants I		28/08/96	7	3	10	9621797(2)	NO	PJM	YES	YES
SP53SE	Pilot		06/05/94				FEM 93/10/904EK	YES	PJM	NO	YES
SP53SW	S Northants I		05/09/96	3	2	5	9621797(2)	YES	PJM	YES	YES
SP54NE	S Northants IV		12/01/98	9	2	11	503897(B)	NO	PJM	YES	YES
SP54NW	S Northants IV		19/12/97	12	3	15	503897(B)	YES	PJM	YES	YES
SP54SE	S Northants I		10/02/97	5	3	8	9621797(2)	NO	PJM	YES	YES
SP54SW	S Northants I		20/01/97	9	4	13	9621797(2)	YES	PJM	YES	YES
SP55NE	S Northants IV		04/02/98	6	2	8	12229798(A)	NO	PJM	YES	YES
SP55NW	S Northants IV		21/11/98	11	2	13	12229798(A)	YES	PJM	YES	YES
SP55SE	S Northants IV		08/05/98	6	1	7	12229798(A)	NO	PJM	YES	YES
SP55SW	S Northants IV		12/02/98	4	2	6	12229798(A)	NO	PJM	YES	YES
SP56NE	Daventry I	6	13/02/01			10.50	AP18800 00/01	NO	AD+JR	NO	NO
SP56NW	Daventry I	6	14/02/01			7.50	AP18800 00/01	YES	AD+JR	NO	NO
SP56SE	Daventry I	5	16/11/00			10.50	AP18233 99/00	NO	AD+JR	NO	NO
SP56SW	Pilot		15/06/94				FEM93/10/9041EK	YES	PJM	NO	YES
SP57NE	Daventry II	8	05/07/01			11	AP24363 00/01	YES	AD+JR	NO	NO
SP57NW	Daventry I	8	05/07/01			7	AP24363 00/01	YES	AD+JR	NO	NO
SP57SE	Daventry I	7	02/05/01			5	AP21574 00/01	YES	AD+JR	NO	NO

SHEET	ORIGINAL BLOCK	BLOCK	DATE COMPLETED	NO. MAPPING DAYS	NO MORPH DAYS	TOTAL NO. DAYS	NMRC LOAN NUMBER	OVERLAP	AUTHORS	MAP NOTE-SHEET	MORPHSHEET
SP57SW	Daventry I	7	02/05/01			5	AP21574 00/01	YES	AD+JR	NO	NO
SP58SE	Daventry II	9	03/08/01			7.50	AP28670 01/02	YES	AD+JR	NO	NO
SP63NW	S Northants II		13/12/96	2	1	3	28696A	YES	PJM	YES	YES
SP63SW	S Northants II		01/11/96	6		6	28696A	YES	PJM	YES	YES
SP64NE	S Northants III		17/06/97	4	2	6	?	NO	PJM	YES	YES
SP64NW	S Northants III		28/05/97	6	1	7	?	NO	PJM	YES	YES
SP64SE	S Northants II		11/12/96	6	1	7	28696A	YES	PJM	YES	YES
SP64SW	S Northants II		29/11/96	5	3	8	28696A	YES	PJM	YES	YES
SP65NE	S Northants IV	4	12/09/00			8	AP16550 00/01	NO	AD+JR	NO	NO
SP65NW	S Northants IV	4	12/09/00			12.50	AP16550 00/01	NO	AD+JR	NO	NO
SP65SE	S Northants III		10/07/97	6	2	8	?	NO	PJM	NO	YES
SP65SW	S Northants III		25/06/97	4	1	5	?	NO	PJM	YES	YES
SP66NE	Daventry I	6	12/02/01			8.50	AP18800 00/01	NO	AD+JR	NO	NO
SP66NW	Daventry I	6	12/02/01			9	AP18800 00/01	NO	AD+JR	NO	NO
SP66SE	Daventry I	5	15/11/00			10.50	AP18233 99/00	NO	AD+JR	NO	NO
SP66SW	Daventry I	5	16/11/00			11.50	AP18233 99/00	NO	AD+JR	NO	NO
SP67NE	Daventry II	8	04/07/01			12.50	AP24363 00/01	NO	AD+JR	NO	NO
SP67NW	Daventry II	8	04/07/01			7	AP24363 00/01	NO	AD+JR	NO	NO
SP67SE	Daventry II	7	01/05/01			6.50	AP21574 00/01	NO	AD+JR	NO	NO
SP67SW	Daventry II	7	02/05/01			6	AP21574 00/01	NO	AD+JR	NO	NO
SP68NE	Daventry II	9	06/08/01			5.75	AP28670 01/02	YES	AD+JR	NO	NO
SP68SE	Daventry II	9	03/08/01			7.25	AP28670 01/02	YES	AD+JR	NO	NO
SP68SW	Daventry II	9	06/08/01			8.75	AP28670 01/02	YES	AD+JR	NO	NO
SP73NE	S Northants II		20/03/97	5	1	6	28696B	YES	PJM	YES	YES
SP73NW	S Northants II		18/03/97	6	1	7	28696B	YES	PJM	YES	YES
SP74NE	S Northants III		12/08/97	4	2	6	?	YES	PJM	YES	YES
SP74NW	S Northants III		04/08/97	10	3	13	?	NO	PJM	YES	YES
SP74SE	S Northants II		24/03/97	6	1	7	28696B	YES	PJM	YES	YES
SP74SW	S Northants II		10/04/97	5	1	6	28696B	YES	PJM	YES	YES
SP75NE	Daventry III	4	08/09/00			7.50	AP16550 00/01	NO	AD+JR	NO	NO

SHEET	ORIGINAL BLOCK	BLOCK	DATE COMPLETED	NO. MAPPING DAYS	NO MORPH DAYS	TOTAL NO. DAYS	NMRC LOAN NUMBER	OVERLAP	AUTHORS	MAP NOTE-SHEET	MORPHSHEET
SP75NW	Daventry III	4	17/09/00			9.50	AP16550 00/01	NO	AD+JR	NO	NO
SP75SE	S Northants III		03/10/97	6	4	10	?	NO	PJM	YES	YES
SP75SW	S Northants III		12/09/97	5	2	7	?	NO	PJM	YES	YES
SP76NE	Daventry III	6	06/02/01			20	AP18800 00/01	NO	AD+JR	NO	NO
SP76NW	Daventry III	6	09/02/01			17	AP18800 00/01	NO	AD+JR	NO	NO
SP76SE	Daventry III	5	13/11/00			8	AP18233 99/00	NO	AD+JR	NO	NO
SP76SW	Daventry III	5	14/11/00			12.50	AP18233 99/00	NO	AD+JR	NO	NO
SP77NE	Kettering		13/12/95	8	2	10	FEM9562501	NO	PJM	YES	YES
SP77NW	Daventry III	8	03/07/01			13	AP24363 00/01	NO	AD+JR	NO	NO
SP77SE	Daventry III	7	30/04/01			14	AP21574 00/01	NO	AD+JR	NO	NO
SP77SW	Daventry III	7	01/05/01			12.50	AP21574 00/01	NO	AD+JR	NO	NO
SP78NE	Kettering		20/12/95	5	2	7	FEM9562501	YES	PJM	YES	YES
SP78NW	Daventry II	9	06/08/01			5.75	AP28670 01/02	YES	AD+JR	NO	NO
SP78SE	Kettering		18/12/95	10	2	12	FEM9562501	NO	PJM	YES	YES
SP78SW	Pilot		16/06/94				FEM93/10/9042EK	NO	PJM	NO	YES
SP79SE	Kettering		01/12/95	4	1	5	FEM9562501	YES	PJM	YES	YES
SP84NW	S Northants II		21/04/97	6		6	28696C	YES	PJM	YES	YES
SP84SW	S Northants II		23/04/97	2		2	28696C	YES	PJM	YES	YES
SP85NE	Wellingborough		23/01/95	3	2	5	?	YES	PJM	YES	YES
SP85NW	Daventry III	4	07/09/00			10.50	AP16550 00/01	NO	AD+JR	NO	NO
SP85SE	S Northants III		20/10/97	4	1	5	?	YES	PJM	YES	YES
SP85SW	S Northants III		10/10/97	3	2	5	?	YES	PJM	YES	YES
SP86NE	Wellingborough		20/01/95	10	5	15	?	NO	PJM	NO	YES
SP86NW	Wellingborough		13/02/95	1		1	?	NO	PJM	YES	YES
SP86SE	Wellingborough		03/02/95	6	4	10	?	NO	PJM	YES	YES
SP86SW	Pilot		13/06/94				FEM93/10/9043EK	NO	PJM	NO	YES
SP87NE	Kettering		20/03/96	6	2	8	FEM9562503	NO	PJM	YES	YES
SP87NW	Kettering		09/02/96	5	2	7	FEM9562502	NO	PJM	YES	YES
SP87SE	Wellingborough		25/01/95	8	2	10	?	NO	PJM	YES	YES
SP87SW	Wellingborough		30/12/94	7	3	10	?	NO	PJM	NO	YES

SHEET	ORIGINAL BLOCK	BLOCK	DATE COMPLETED	NO. MAPPING DAYS	NO MORPH DAYS	TOTAL NO. DAYS	NMRC LOAN NUMBER	OVERLAP	AUTHORS	MAP NOTE-SHEET	MORPHSHEET
SP88NE	Corby		10/07/95	3	1	4	PJR95471	NO	PJM	YES	YES
SP88NW	Corby		24/07/95	5	3	8	PJR95471	NO	PJM	YES	YES
SP88SE	Kettering		29/02/96	5	3	8	FEM9562502	NO	PJM	YES	YES
SP88SW	Kettering		19/02/96	5	1	6	FEM9562502	NO	PJM	YES	YES
SP89NE	Corby		24/05/95	4	1	5	FEM9521524(2)	YES	PJM	YES	YES
SP89SE	Corby		29/06/95	3	1	4	PJR95471	YES	PJM	YES	YES
SP89SW	Corby		27/06/95	2	1	3	PJR95471	YES	PJM	YES	YES
SP95NW	Wellingborough		28/03/95	6	1	7	FEM9521524	YES	PJM	YES	YES
SP96NE	East Northants II	0	20/08/98	8	4	12	7879899	YES	PJM	YES	YES
SP96NW	Wellingborough		03/05/95	8	2	10	FEM9521524	YES	PJM	YES	YES
SP96SE	East Northants II		15/06/98	5	1	6	7879899	YES	PJM	YES	YES
SP96SW	Wellingborough		11/04/95	8	2	10	FEM9521524	YES	PJM	YES	YES
SP97NE	Kettering		04/06/96	6	3	9	FEM9562503	NO	PJM	YES	YES
SP97NW	Kettering		20/05/96	7	3	10	FEM9562503	NO	PJM	YES	YES
SP97SE	East Northants II		30/09/98	17	3	20	7879899	NO	PJM	YES	YES
SP97SW	Wellingborough		07/06/95	4	4	8	FEM9521524	NO	PJM	YES	YES
SP98NE	Corby		05/09/95	7	2	9	PJR95471	NO	PJM	YES	YES
SP98NW	Corby		08/08/95	5	2	7	PJR95471	NO	PJM	YES	YES
SP98SE	Pilot		19/08/94				FEM 94/213/532EK	NO	PJM	NO	YES
SP98SW	Pilot		26/08/94				FEM 94/213/531EK	NO	PJM	NO	YES
SP99NE	East Northants I	3	04/08/00			8.50	AP15484 99/00	YES	AD+JR	NO	NO
SP99NW	Corby		21/05/95	4	2	6	FEM9521524(2)	YES	PJM	NO	YES
SP99SE	Corby		26/09/95	5	1	6	PJR95471	NO	PJM	YES	YES
SP99SW	Corby		13/09/95	4	1	5	PJR95471	NO	PJM	YES	YES
TF00NW	Pilot		12/08/94				?	YES	PJM	NO	YES
TF00SW	Pilot	3	03/08/00			9	AP15484 99/00	YES	AD+JR	NO	NO
TL06NW	East Northants II		04/08/98	5	1	6	7879899	YES	PJM	YES	YES
TL06SW	East Northants II		18/06/98	3		3	7879899	YES	PJM	YES	YES
TL07NE	East Northants II	1	19/04/00			3.25	AP7546 99/00	YES	AD+JR	NO	NO
TL07NW	East Northants II		26/01/98	8	2	10	7879899	YES	PJM	YES	YES

SHEET	ORIGINAL BLOCK	BLOCK	DATE COMPLETED	NO. MAPPING DAYS	NO MORPH DAYS	TOTAL NO. DAYS	NMRC LOAN NUMBER	OVERLAP	AUTHORS	MAP NOTE-SHEET	MORPHSHEET
TL07SW	pilot		24/06/94				FEM93/10/9044EK	YES	PJM	NO	YES
TL08NE	East Northants I	1	19/04/00			10.25	AP7546 99/00	NO	AD+JR	NO	NO
TL08NW	East Northants I	1	19/04/00			14	AP7546 99/00	NO	AD+JR	NO	NO
TL08SE	East Northants II	1	19/04/00			8.75	AP7546 99/00	YES	AD+JR	NO	NO
TL08SW	East Northants II	1	19/04/00			27.50	AP7546 99/00	NO	AD+JR	NO	NO
TL09NE	East Northants I	2	21/06/00			24.50	AP10606 99/00	YES	AD+JR	NO	NO
TL09NW	East Northants I	3	03/08/00			7.50	AP15484 99/00	YES	AD+JR	NO	NO
TL09SE	East Northants I	2	21/06/00			24.50	AP10606 99/00	YES	AD+JR	NO	NO
TL09SW	Pilot		16/05/94				FEM93/10/9045EK	NO	PJM	NO	YES
TL18NW	East Northants I	1	19/04/00			4.50	AP7546 99/00	YES	AD+JR	NO	NO
TL18SW	East Northants II	1	19/04/00			3.75	AP7546 99/00	YES	AD+JR	NO	NO
TL19SW	East Northants I	2	21/06/00			9.50	AP10606 99/00	YES	AD+JR	NO	NO

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