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REEPHAM TO WRAGBY PIPELINE, TF047750 to TF134793 LINCOLNSHIRE:

AERIAL PHOTOGRAPHIC ASSESSMENT

REPORT No: 2005/4

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Commissioned by:
Lindsey Archaeological Services LLP
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Archaeological consultant for aerial photographic interpretation and accurate mapping.

REEPHAM TO WRAGBY PIPELINE,

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SUMMARY

This assessment of aerial photographs examined a corridor 1km wide centred on the pipeline route between Reepham (TF047750) and Wragby (TF134793). The aim was to provide archaeological context rather than precision mapping although details have been shown where they were identified.

Most of the features mapped show a landscape of medieval cultivation.

At three sites within that landscape are sites with former occupation features:

Barlings (TF079744) includes earthwork features that are likely to be of medieval date and, on two small lenses of different soil, parts of sites that may be of pre-medieval date and which may include a bronze age burial site.

Bullington Priory (TF100767) is now mostly plough-levelled but can be seen to have a group of buildings and associated ditch-and-bank-defined precincts.

Goltho (TF114776) is the site of a deserted medieval village that is now plough levelled.

Original photo interpretation and mapping was at 1:10000 level.

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Rog Palmer MA MIFA

INTRODUCTION

This assessment of aerial photographs was commissioned to examine a corridor 1km wide centred on the pipeline route between Reepham (TF047750) and Wragby (TF134793). The aim was to provide archaeological context rather than precision mapping although details have been shown where they were identified. The level of interpretation and mapping was to be at 1:10000.

ARCHAEOLOGICAL AND NATURAL FEATURES FROM AERIAL PHOTOGRAPHS

In suitable cultivated soils, sub-surface features – including archaeological ditches, banks, pits, walls or foundations – may be recorded from the air in different ways in different seasons. In spring and summer these may show through their effect on crops growing above them. Such indications tend to be at their most visible in ripe cereal crops, in June or July in this part of Britain, although their appearance cannot accurately be predicted and their absence cannot be taken to imply evidence of archaeological absence. In winter months, when the soil is bare or crop cover is thin (when viewed from above), features may show by virtue of their different soils. Upstanding remains, which may survive in unploughed grassland, are also best recorded in winter months when vegetation is sparse and the low angle of the sun helps pick out slight differences of height and slope.

Grass sometimes shows sub-surface features through the withering of the plants above them. This may occur towards the end of very dry summers and usually indicates the presence of buried walls or foundations. Such dry summers occurred in Britain in 1949, 1959, 1975, 1976, 1984, 1989 and 1990 (Bewley 1994, 25) and more recently in 1995 and 1996. This does not imply that every grass field will reveal its buried remains on these dates as local variations in weather and field management will affect parching. However, it does provide a list of years in which photographs taken from, say, mid July to the end of August may prove informative.

PHOTO INTERPRETATION AND MAPPING

Photographs examined

The most immediately informative aerial photographs of archaeological subjects tend to be those resulting from observer-directed flights. This activity is usually undertaken by an experienced archaeological observer who will fly at seasons and times of day when optimum results are expected. Oblique photographs, taken using a hand-held camera, are the usual products of such investigation. Although oblique photographs are able to provide a very detailed view, they are biased in providing a record that is mainly of features noticed by the observer, understood, and thought to be of archaeological relevance. To be able to map accurately from these photographs it is necessary that they have been taken from a sufficient height to include surrounding control information.

Vertical photographs cover the whole of Britain and can provide scenes on a series of dates between (usually) 1946-7 and the present. Unfortunately these vertical surveys were not necessarily flown at times of year that are best to record the archaeological features sought for this Assessment and may have been taken at inappropriate dates to record crop and soil responses that may be seen above sub-surface features. Vertical photographs are taken by a camera fixed inside an aircraft and adjusted to take a series of overlapping views that can be examined stereoscopically. They are often of relatively small scale and their interpretation requires higher perceptive powers and a more cautious approach than that necessary for examination of obliques. Use of these small-scale images can also lead to errors of location and size when they are rectified or re-scaled to match a larger map scale.

Cover searches were obtained from the Cambridge University Collection of Aerial Photographs (CUCAP) and the National Monuments Record: Air Photographs (NMRAP), Swindon. Photographs included those resulting from observer-directed flights and routine vertical surveys.

Photographs consulted are listed in the Appendix to this report.

Base maps

Base maps at a scale of 1:10000 were provided by the client.

Study area

Photographs were examined within a corridor that extended some 500m each side of the pipeline route.

Photo interpretation and mapping

All photographs were examined by eye and under slight (2x) magnification, viewing them as stereoscopic pairs when possible. Two methods were used for mapping depending on the types of archaeological features being shown. Most medieval fields and headlands were sketched

schematically, although placement of some headlands and cultivation alignment was overdrawn directly from transformed photographs.

When there was greater detail present interpretations were made in two ways. Where copies of prints were available for scanning the digital copies were transformed to match either base map using the specialist program AirPhoto (Scollar 2002). All scanned photographs were enhanced using the default setting in AirPhoto before being examined on screen. Transformed files were set as background layers in AutoCAD Map, where features were overdrawn, making reference to the original prints, using standard conventions. Other photographs were interpreted on overlays to individual prints following procedures described by Palmer and Cox (1993). These overlays were then scanned and transformed to match the relevant-scale base map using AirPhoto. Resulting files were imported into AutoCAD Map where features were overdrawn using standard conventions.

The final figure has been provided to the client in digital form and reduced versions and 1:10000-scale extracts are printed in this report.

Accuracy

AirPhoto computes values for mismatches of control points on the photograph and map. In all transformations prepared for this assessment the mean mismatches were less than ±3.50m. These mismatches can be less than the survey accuracy of the base maps themselves and users should be aware of the published figures for the accuracy of large scale maps and thus the need to relate these mismatches to the Expected Accuracy of the Ordnance Survey maps from which control information was taken (OS 2005). Mapping originally undertaken at 1:10000 does not have the inherent accuracy to be used to locate features on the ground with precision.

COMMENTARY

Soils

The Soil Survey of England and Wales (SSEW 1983) shows the pipeline route crossing soils that are mostly clay-based chalky tills (soil association 712g: RAGDALE between Reepham and Barlings and 711r: BECCLES 1 for the remainder). A gravel deposit (soil association 512c: RUSKINGTON) extends south from Langworth and there is a possibility that it extends as far south as Barlings where it may be responsible for the crop-marked features mapped south of Abbey house Farm (figure 2). Narrow bands of alluvium (soil association 813: FLADBURY 2) are shown along streams crossed by the pipeline.

Other than on the gravel deposit, crops growing on these soils do not readily indicate sub-surface variations through differences in their growth.

Archaeological features (Figure 1)

The dominant features in the corridor are the remains of medieval cultivation mapped as ridge and furrow with, in places, their associated headlands. Most is now ploughed level and the only visible evidence on the ground may be slightly higher headlands. It has been noted elsewhere that the combination of clay-based soils and ridge and furrow can have a masking effect on any sub-surface pre-medieval features (Palmer 1996). The only aerial photographs that provide a rare chance of seeing 'through' this combination are likely to be those taken towards the end of a very dry summer. None of those examined was taken at such times. Field investigation in other parts of the country on similar soils has revealed ditches and other features of iron age and Romano-British date on land where air photos have shown only medieval cultivation. Within the mapped corridor it should be assumed that most of the pre-medieval landscape has been invisible from the air.

Among the ridge and furrow are two groups of what may be later steam ploughing. These were identified as close-spaced straight ridges and furrows on photographs and have been mapped with closer-spaced lines in fields centred TF088756 and TF112774.

Two 1:10000 extracts have been printed for this report:

Barlings area, TF079744 (Figure 2)
Features of (possibly) two different periods have been mapped in this area. Features contemporary with the medieval fields are the hollows and/or ditches that remain as earthworks in the field centred TF080743 immediately north of Barlings Hall. Mapping at 1:10000 from small-scale aerial photos for this Assessment is likely to have produced a minimal view which is likely to be enhanced if survey is undertaken on the ground.

East of the road air photos taken in 1975 showed two small lenses of different soil – possibly the gravel noted in *Soils* above – upon which crops were responding to sub-surface differences. Within the areas of the soil lenses were three groups of features that appear likely to be of pre-medieval date. One lens south of Abbey House Farm included parts of what may be a near-square ditched enclosure (TF07797462) with pits visible inside and outside. East of this (at TF07937456) and in a second lens of soil are two arcs that may form part of a circle, possibly indicating a bronze age burial site while to the south (at TF08027444) are short lengths of ditch, some of which align with earthwork features to their west, and three pits. Superimposition of features occurs and may indicate more than one phase of activity.

Bullington Priory, TF100767 (Figure 3)
The figure shows now-levelled features of the priory and its environs. North of the building foundations (at TF10067666) are a series of rectangular 'courts' most of which are defined by double ditches or double banks. Plough-spreading of the banks has partly masked and softened the clarity of the remains but the mapping provides an indication of the general plan of the priory and its associated features.

Goltho DMV, TF114776 (Figure 1)
The site of the deserted medieval village of Goltho has been comprehensively plough levelled and the mapped details show only what information could be recovered from air photographs

which include some taken when it survived in earthwork form. At that date lanes and properties were defined by low banks and it is those that provided most of the information in Figure 1.

Non-archaeological features

Two pipelines have been mapped. Other recent and natural features were not identified for this Assessment.

Many fields in this area have had field drains laid since the 1940s. These were not noted in detail or mapped for this Assessment.

Land use

Most fields have been in arable use on all dates of photography. A very small number have been in permanent pasture in which survives earthwork ridge and furrow.

REFERENCES

Bewley, R. H., 1994. *Prehistoric Settlements.* Batsford/English Heritage, London.

OS, 2005. http://www.ordnancesurvey.gov.uk/productpages/landline/positional-background.htm

Palmer, R., 1996. A further case for the preservation of earthwork ridge and furrow. *Antiquity* 70, 436-440.

Palmer, R. and Cox, C., 1993. *Uses of aerial photography in archaeological evaluations. IFA Technical Paper* 12.

Scollar, I., 2002. Making things look vertical, in Bewley, R.H. and Rączkowski, W., (ed). *Aerial archaeology: developing future practice.* NATO Science Series, Vol **337**, 166-172.

SSEW, 1983. *Soils of England and Wales: sheet 4: Eastern England (1:250,000).* Soil Survey of England and Wales, Harpenden.

APPENDIX

Aerial photographs examined

Source: Cambridge University Collection of Aerial Photographs

Oblique photographs (web search 30 January 2005)

TF101768	
LH 68-72	21 April 1953
ZX 15-18	8 July 1959
AKN 117-120	29 March 1965
BBA 63-67	18 March 1970
BZL 65-77	9 July 1976
CAA 16-20	20 July 1976
TF116774	
PE 89-95	28 March 1955
AKN 121-123	29 March 1965
BFH 75-77	13 May 1971
BMB 65-67	27 March 1973

Vertical photographs

RC8-CN 83-86	5 April 1978	1:15000
RC8-CN 97-101	5 April 1978	1:15000
RC8-FH 15-18	25 May 1983	1:10500
RC8-FO 148-150	1 July 1983	1:10500
RC8-MC 201-202	4 December 1990	1:7500
RC8-MC 217-222	4 December 1990	1:7500
RC8-MC 225-228	4 December 1990	1:7500
RC8-MC 246-247	4 December 1990	1:7500
RC8-MC 248	4 December 1990	1:7500
Z-MX 54-55	23 June 1995	
Z-MX 63-66	23 June 1995	

Source: National Monuments Record: Air Photographs (cover search 74928)

Specialist collection

TF0774/1	19 July 1971
TF0774/2	29 July 1979
TF0774/3-5	31 May 1994
TF0774/6-21	13 July 2004
TF0873/68	17 February 1988
TF0874/1-3	30 October 1980

TF0874/4	31 May 1994
TF0874/9-10	14 April 2003
TF0973/66	17 February 1988
TF0976/1	undated, probably 1930s
TF1076/1	undated, probably 1930s
TF1076/7-13	30 October 1980
TF1076/14-15	9 July 2003

Vertical collection

RAF/CPE/UK/1880: 1259-1261	6 December 1946	1:12000
RAF/CPE/UK/1880: 2249-2252	6 December 1946	1:10000
RAF/CPE/UK/1880: 3256-3263	6 December 1946	1:10000
RAF/CPE/UK/1880: 5255-5256	6 December 1946	1:10000
RAF/CPE/UK/2012: 4166-4170	16 April 1947	1:9800
RAF/CPE/UK/2541: 3424-3425	25 March 1948	1:10000
RAF/CPE/UK/2541: 4423-4426	25 March 1948	1:10000
RAF/541/185: 3098-3100	19 October 1948	1:9960
RAF/541/185: 3114-3115	19 October 1948	1:9960
RAF/541/185: 3118-3120	19 October 1948	1:9960
RAF/541/185: 3188	19 October 1948	1:9960
RAF/541/185: 4089-4090	19 October 1948	1:9960
RAF/541/185: 4116-4118	19 October 1948	1:9960
RAF/543/2843/F64: 85-86	5 May 1964	1:10000
RAF/543/2843/F65: 84-85	5 May 1964	1:10000
RAF/543/2843/F66: 82-83	5 May 1964	1:10000
OS/66126: 73-74	3 June 1966	1:7500
OS/66128: 400-405	3 June 1966	1:7500
OS/69217: 705	8 June 1969	1:7500
OS/69217: 724-725	8 June 1969	1:7500
OS/72250: 12-14	18 July 1972	1:7500
OS/73029: 126-128	23 March 1973	1:7500
OS/73029: 190-193	23 March 1973	1:7500
OS/73029: 208-210	23 March 1973	1:7500
OS/73030: 303-305	23 March 1973	1:7500
OS/73030: 310	23 March 1973	1:7500
OS/73030: 311-316	23 March 1973	1:7500
OS/75304: 167-172	13 July 1975	1:7500
MAL/77033: 75	11 October 1977	1:10000
OS/93199: 13	29 May 1993	1:7600

Most informative photographs

PE 91
AKN 117
BBA 65
BFH 77
BZL 65, 74
CAA 16
RC8-CN 84, 86, 98, 100, 101
TF0774/2
TF0874/4
TF0976/1
TF1076/1
RAF/CPE/UK/1880: 2249-2252, 3263, 5255-5256
RAF/CPE/UK/2012: 4166-4170
RAF/CPE/UK/2541: 4425
RAF/541/185: 3118-3119, 4089, 4116
RAF/543/2843/F65: 84-85
RAF/543/2843/F66: 82-83
OS/66126: 73
OS/69217: 705
OS/72250: 12
OS/73029: 126, 190-193, 208-210
OS/75304: 167, 170-172
OS/73030: 303, 312-314

TERMS AND CONDITIONS

Air Photo Services have produced this assessment for their clients, Lindsey Archaeological Services, subject to the following conditions:

Air Photo Services will be answerable only for those transcriptions, plans, documentary records and written reports that it submits to the clients, and not for the accuracy of any edited or re-drawn versions of that material that may subsequently be produced by the clients or any other of their agents.

That transcriptions, documentation, and textual reports presented within this assessment report shall be explicitly identified as the work of Air Photo Services.

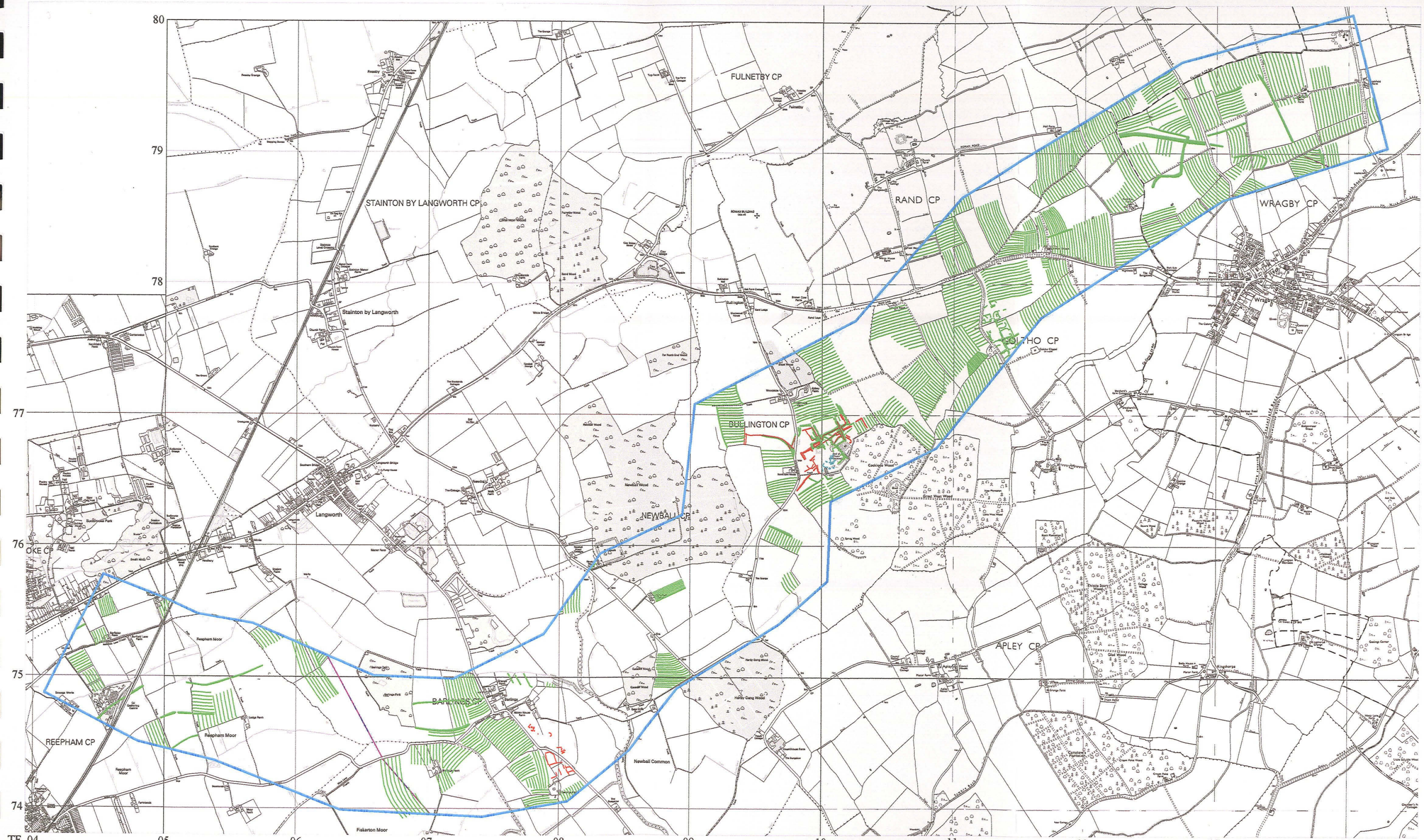
Air Photo Services has consulted only those aerial photographs specified. It cannot guarantee that further aerial photographs of archaeological significance do not exist in collections that were not examined.

Due to the nature of aerial photographic evidence, Air Photo Services cannot guarantee that there may not be further archaeological features found during ground survey which are not visible on aerial photographs or that apparently 'blank' areas will not contain masked archaeological evidence.

We suggest that if a period of 6 months or more elapses between compilation of this report and field evaluation new searches are made in appropriate photo libraries. Examination of any newly acquired photographs is recommended.

That the original working documents (being interpretation overlays, control information, and digital data files) will remain the property of Air Photo Services and be securely retained by it for a period of three years from the completion date of this assessment after which only the digital files may be retained.

It is requested that a copy of this report be lodged with the relevant Sites and Monuments Record within six months of the completion of the archaeological evaluation.



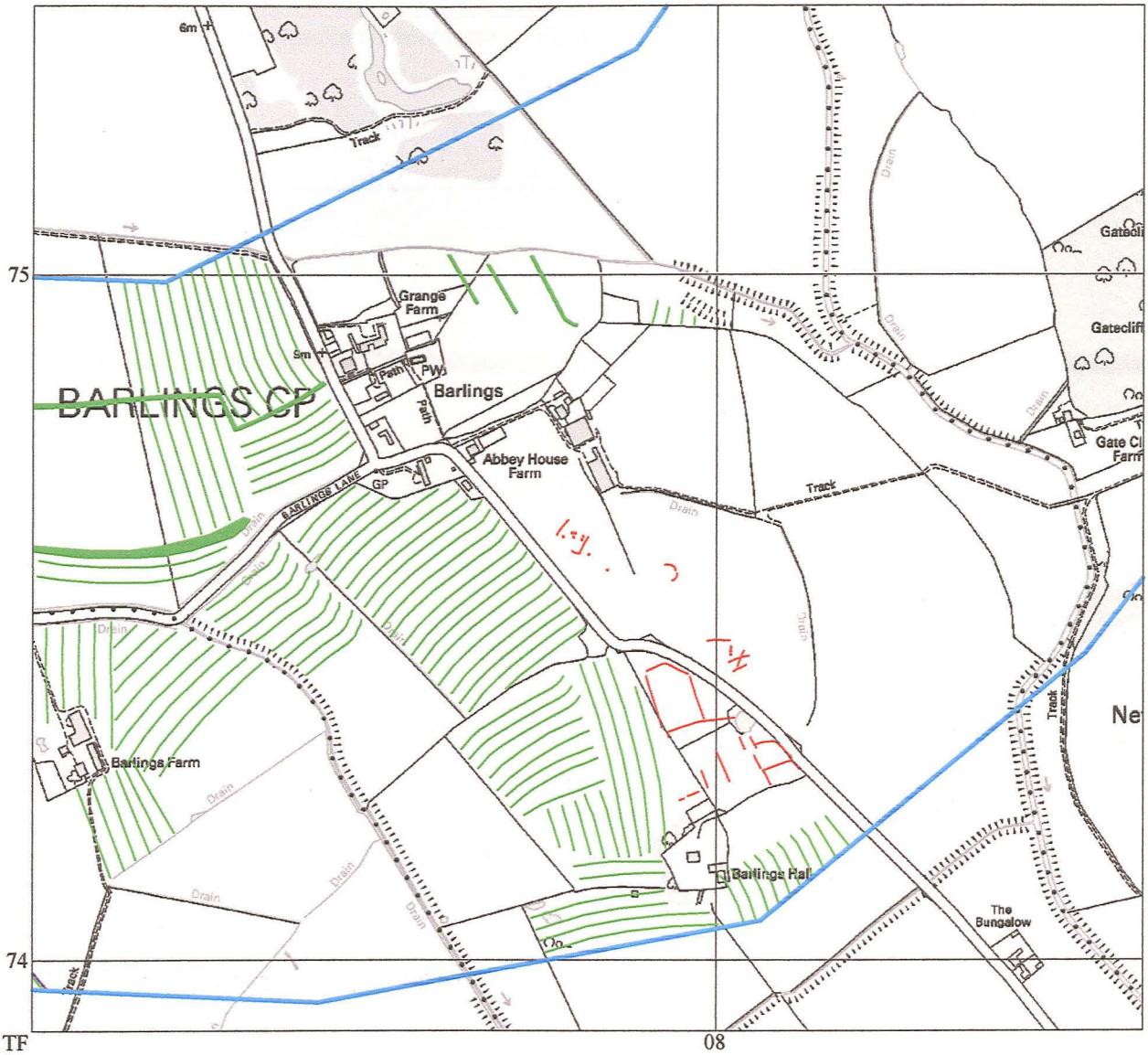
Original photo interpretation and mapping at 1:10000 level
based on photographs at CUCAP and NMRC.
Background maps from Ordnance Survey 1:10000 sheets

Air Photo Services Cambridge
February 2005
Drawing: 0504Reep.dwg

Reepham to Wragby pipeline, Lincolnshire:

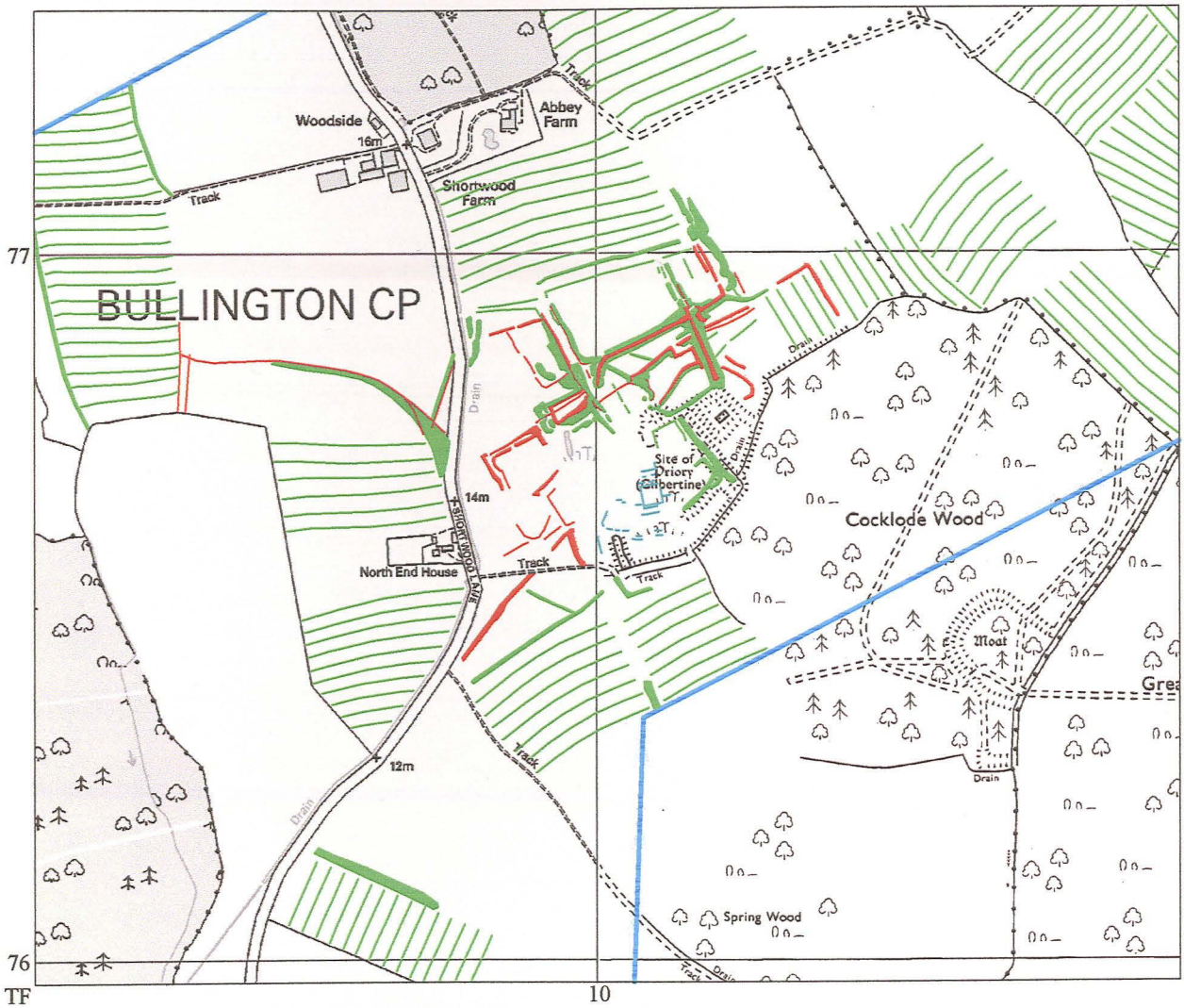
Figure 1. All features identified on aerial photographs

Reepham to Wragby pipeline, Lincolnshire: Figure 2. Barlings area



Selected area at 1:10000. Key as Figure 1.

Reepham to Wragby pipeline, Lincolnshire: Figure 3. Bullington Priory and environs



Selected area at 1:10000. Key as Figure 1.