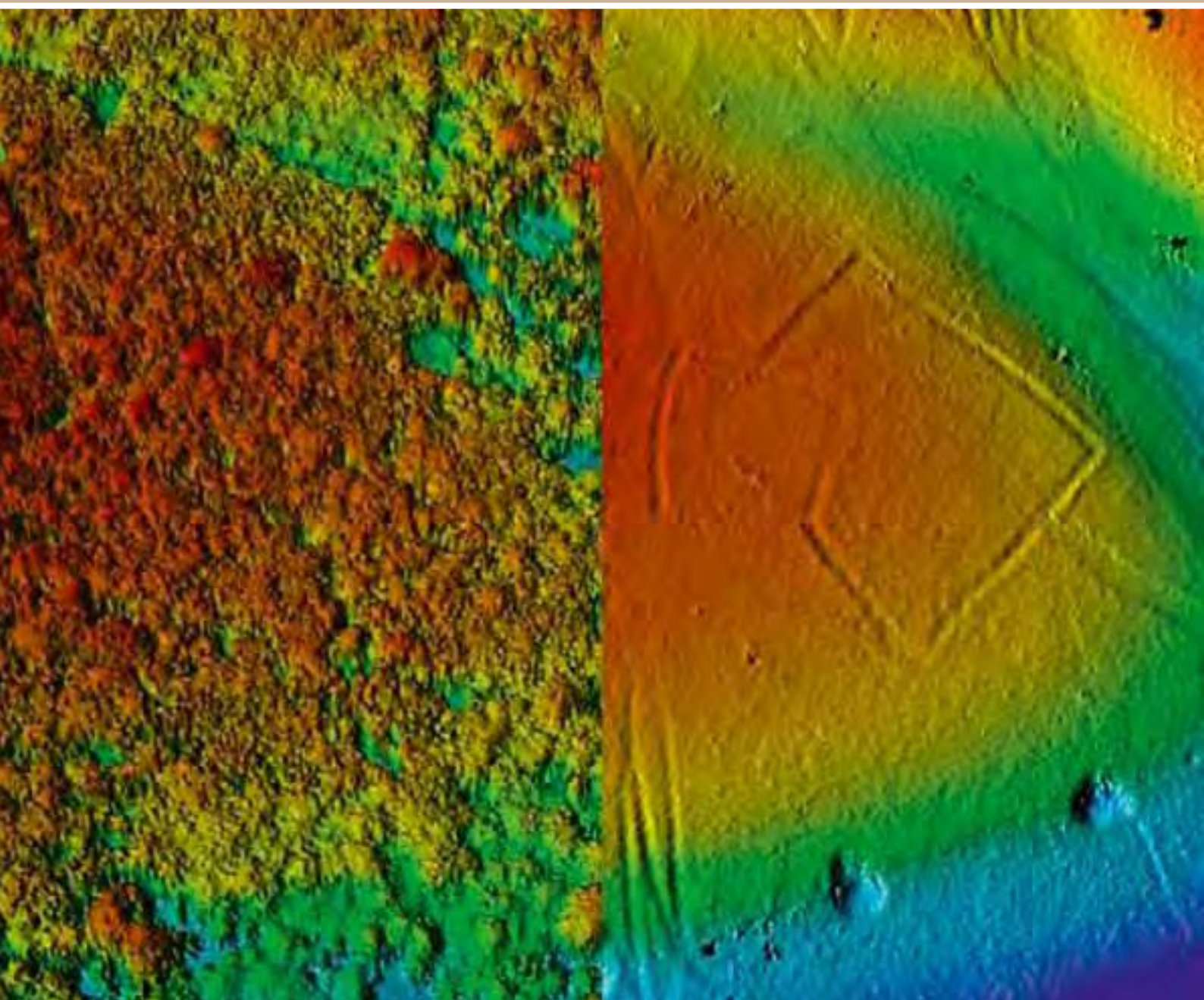


SAVERNAKE FOREST A REPORT FOR THE NATIONAL MAPPING PROGRAMME

Simon Crutchley, Fiona Small and Mark Bowden



SAVERNAKE FOREST A REPORT FOR THE NATIONAL MAPPING PROGRAMME

Simon Crutchley, Fiona Small & Mark Bowden

© English Heritage

ISSN 1749-8775

The Research Department Report Series, incorporates reports from all the specialist teams within the English Heritage Research Department: Archaeological Science; Archaeological Archives; Historic Interiors Research and Conservation; Archaeological Projects; Aerial Survey and Investigation; Archaeological Survey and Investigation; Architectural Investigation; Imaging, Graphics and Survey; and the Survey of London. It replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series, and the Architectural Investigation Report Series.

Many of these are interim reports which make available the results of specialist investigations in advance of full publication. They are not usually subject to external refereeing, and their conclusions may sometimes have to be modified in the light of information not available at the time of the investigation. Where no final project report is available, readers are advised to consult the author before citing these reports in any publication. Opinions expressed in Research Department Reports are those of the author(s) and are not necessarily those of English Heritage.

Requests for further hard copies, after the initial print run, can be made by emailing:

Res.reports@english-heritage.org.uk.

or by writing to English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD
Please note that a charge will be made to cover printing and postage.

SUMMARY

This National Mapping Programme (NMP) survey was carried out with a dual purpose; part of the reason for the survey was to investigate an area of low monument density in an otherwise archaeologically rich landscape; the other aim of the survey was to carry out a structured analysis of the relative benefits of lidar and conventional photography in a largely wooded landscape.

The project succeeded in both its aims; it added 324 new sites to the national record, more than doubling the number for the project area. It also produced detailed systematic results showing that neither lidar data nor standard aerial photographs on their own were able to give a full picture of activity within the forest area. Working with staff from Archaeological Survey & Investigation detailed ground survey was carried out on a chosen site that analysed the metrical and interpretative accuracy of the mapping carried out from the lidar data.

Sites from the Neolithic to the Second World War were recorded, but it is not the aim of this report to attempt a synthesis of all available data, nor to provide an overall analysis of the archaeology of the project area either in terms of period or any given theme; instead it is intended to concentrate on the methodological elements of the project and to select only certain highlights of those archaeological remains recorded from the various periods.

CONTRIBUTORS

The interpretation, transcription and recording were carried out by Simon Crutchley and Fiona Small. The detailed field survey of the enclosures at Church Walk was carried out by Mark Bowden and Dave Field. The report on this survey and the comparison with the lidar data was written by Mark Bowden.

ACKNOWLEDGEMENTS

Thanks to Luke Griffin, Archive Support Team, English Heritage, for supplying the bulk of the photographs; Dave Field for carrying out, along with Mark Bowden, the detailed survey of the Church Walk site to validate and compare the lidar data.

Special thanks are due to the Forestry Commission who commissioned and paid for the initial lidar data and allowed access to this for interpretation. Specifically thanks are due to Peter Crow (Historic Environment Project Leader, Forest Research) who provided lidar derived imagery and helped through discussions on processing techniques etc; also to Ben Lennon (Planning and Conservation Manager - Forest of Dean, Forestry Commission) who was very helpful with interpretation of woodland features on the ground and provided access to the forest for field visits and detailed survey.

I am also grateful to the assistance given by Graham Bathe who provided a great deal of information about sites gathered from his extensive documentary research.

This project was carried out in collaboration with the Cambridge University's Unit for Landscape Modelling (ULM); their contribution was two fold being in part the loan of material from the Cambridge University Collection of Air Photographs and in part the original capture of lidar data for the survey area.

Ordnance Survey maps were acquired under license number 100019088 © Crown copyright. All rights reserved. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Historic Ordnance Survey maps are © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2007). Licence numbers 00394 and TP0024.

ARCHIVE LOCATION

The National Monuments Record Centre
Kemble Drive
Swindon
SN2 2GZ

DATE OF SURVEY

October 2007 – July 2008

CONTACT DETAILS

Aerial Survey & Investigation
English Heritage
Kemble Drive
Swindon
SN2 2GZ

AerialSurvey@english-heritage.org.uk

CONTENTS

Figures.....	iii
Introduction	1
Background.....	1
Project Area.....	1
Brief History of Savernake Forest.....	2
Geology, topography and modern land use.....	3
Previous archaeological work.....	4
Methodology and sources.....	5
Summary of NMP results.....	8
Period analysis.....	10
Neolithic and Bronze Age.....	10
Late prehistoric.....	13
Iron Age	13
Roman.....	24
Medieval.....	29
Post Medieval.....	37
World War II	38
Lidar analysis.....	45
The lidar data.....	45
Field validation - Detailed ground survey of enclosures on Church Walk.....	51
Conclusions.....	58
Bibliography.....	59
Glossary.....	62

Appendix 1 - Sphere of interest.....	63
Appendix 2 – Methodology.....	64
Appendix 3 – NMP conventions	66

Figures

Figure 1 - Project location.....	1
Figure 2 - Project area with contours and extent of woodland.....	2
Figure 3 - Landscape view of project area showing extent of tree cover.....	4
Figure 4 - Plan of Crofton causewayed enclosure and surrounding features.....	11
Figure 5 - Distribution of Bronze Age and Iron Age sites across the Savernake area.....	15
Figure 6 - Plans of all enclosures mapped from aerial photographs and lidar imagery.....	16
Figure 7 - PCA generated colour image of Chisbury hillfort using multiple light sources. ..	17
Figure 8 - Transcription of the earthwork and cropmark traces of the possible Late Iron Age oppidum enclosure and later Roman building on Forest Hill.	18
Figure 9 - A large enclosure possibly a late Iron Age temple enclosure identified from lidar imagery in a heavily wooded area within Savernake Forest.....	20
Figure 10 - A possible Romano-Celtic temple complex visible as a soil mark mapped from aerial photographs as part of the Lambourn Downs NMP project.	21
Figure 11 - Field systems on the southern edge Tottenham Park recorded from both aerial photographs and lidar imagery.	24
Figure 12 - Roman villa complex on Postern Hill with the traces of a possible incomplete enclosure or road visible to the south.	26
Figure 13 - Traces of a rectilinear enclosure, possibly the remains of the medieval/post medieval Great Lodge aligned on the course of Great Lodge Drive.....	30
Figure 14 - The Great Inclosure and surrounding features at the heart of Savernake Forest bisected by the course of the Roman road	34
Figure 15 - Extract of an aerial photograph showing the cropmark of a square foundation adjacent to the former Roman road which may represent the foundations of the Duke of Somerset's failed mansion.....	36
Figure 16 - The possible remains of the Duke of Somerset's house in relation to the Great Conduit in Bedwyn Brail.	37
Figure 17 - Dispersed ammunition storage along Column Ride within Tottenham Park in March 1944.....	41
Figure 18 - Extract of mapping showing clusters of munitions stores and earthen banks along the main rides and drives within Savernake in relation to the 'Y' Site gas storage area.	43
Figure 19 – A probable late prehistoric enclosure and field boundaries of medieval date in Savernake Forest seen on lidar derived imagery.....	48
Figure 20 – The same probable late prehistoric enclosure and field boundaries seen on an aerial photograph.....	48
Figure 21 - A late Iron Age enclosure in Savernake Forest on lidar derived imagery.....	49
Figure 22 – Part of the southern side of the enclosure as recorded on the Ordnance Survey map.	50
Figure 23 – The same enclosure with large sections of the north and eastern edges visible on 1969 OS photograph.....	50
Figure 24 - Field survey of the Church Walk enclosures and associated features.....	53
Figure 25 - Lidar derived image of Church Walk enclosures and associated features.....	54

INTRODUCTION

Background

The Savernake Forest NMP project came about due to the Forestry Commission (FC) carrying out a lidar survey of their holdings in Savernake Forest as part of planning for a Management Plan. The processed lidar data had revealed a large number of previously unknown features within the boundary of the Forest, but these had not been fully mapped and interpreted.

Savernake Forest occupies approximately 4500 acres and lies about one mile (2km) southeast of the historic town of Marlborough (Fig 1). It is designated as both a Site of Special Scientific Interest (SSSI) in its own right and is also part of the North Wessex Downs Area of Outstanding Beauty (AONB). The North Wessex Downs was designated in 1972 and is the largest AONB in South East England and the third largest AONB nationally.

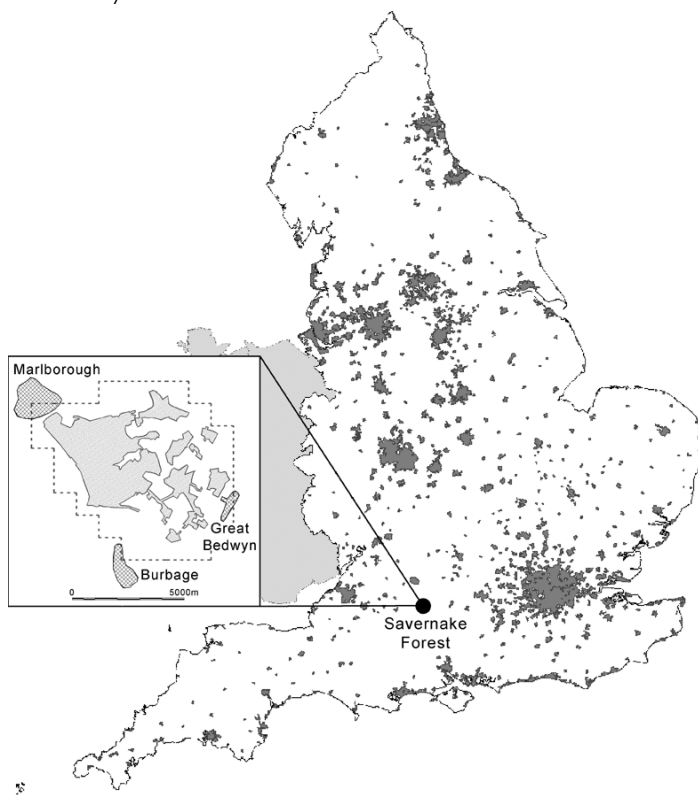


Figure 1 - Project location

Project Area

The project area centred on the bulk of the current woodland that makes up Savernake Forest just off the scarp of the North Wessex Downs, south of the small market town of Marlborough in north Wiltshire. (Fig 2) The survey area is c54 sq km, based on any full km squares covered by a significant amount of the lidar survey commissioned by the Forestry Commission together with a small contextual area where considered appropriate. This includes all the woodland together with significant areas of arable. Although the Roman small town of *Cunetio* at Mildenhall would ordinarily fall within the project area and might be seen as a logical inclusion in any investigation of this area it was excluded from the

survey. Because the aim of the current project was to investigate the wooded area of Savernake and its immediate vicinity where there was a low monument density and because there were large numbers of good quality photographs that would reveal information about the town, it was decided to exclude Mildenhall from the survey area so as not to lend a bias to the project.

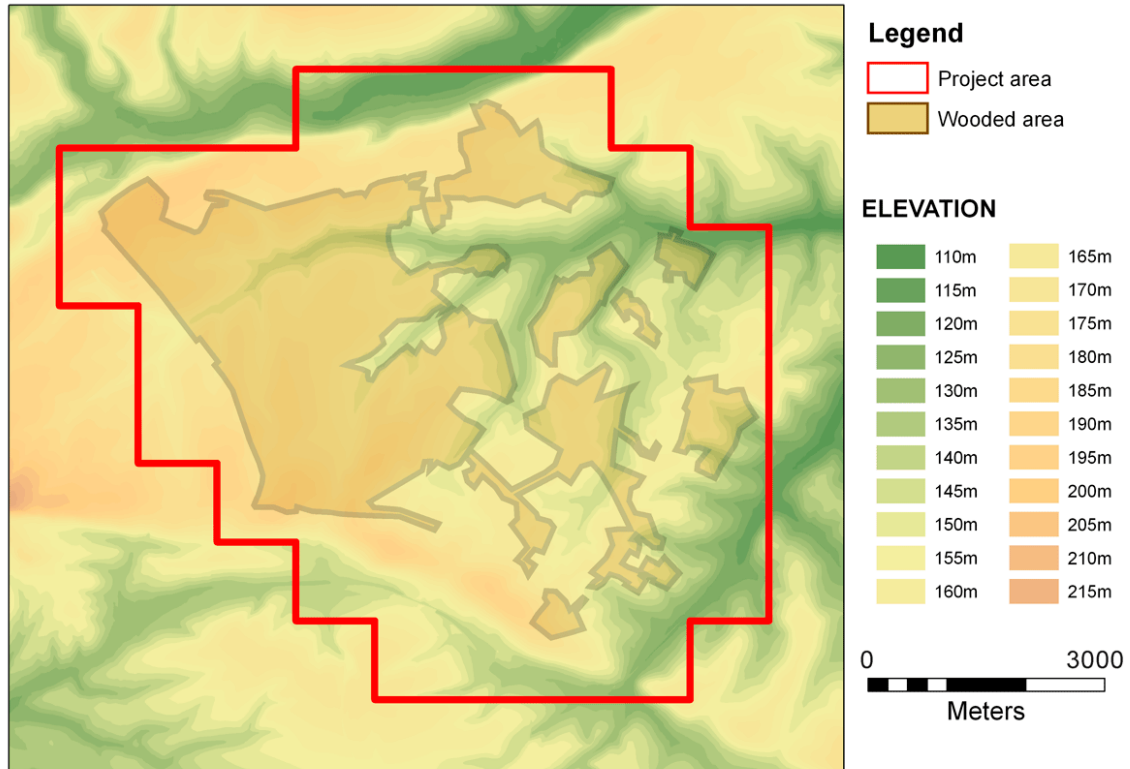


Figure 2 - Project area with contours and extent of woodland

Brief History of Savernake Forest

Savernake Forest is one of the oldest woodlands in England and believed to be well over 1000 years old. The first reference to “the wood which is called Safernoc” occurs in a charter referring to a grant of lands at Oare by King Athelstan to Wilton Abbey in 993 AD (Dugdale 1693). It was established as a royal hunting forest by the time of the Domesday survey and tythes were taken by Salisbury cathedral in the 12th century by grant of the crown. In 1275 the Bishop of Salisbury who had a chase for wolves and hares at Studecomb was complained of for encroaching on Savernake to the damage of the king! In 1280 the limits of the forest were much more extensive than now running from West Overton to Denford beyond Hungerford. By the perambulation recorded in 1301, however, 80% of lands were disafforested, but two of the wooded parcels that remained correspond to what is now Savernake. From 1415 to 1447 it was held “in fee” by Humphrey, Duke of Gloucester, son of Henry IV.

Whilst the forest had been managed by wardens on behalf of the crown for centuries it finally passed into private ownership on the death of Catherine Parr in 1548 under a grant of 1547 when it reverted to Edward Seymour, Duke of Somerset, its former warden. It

was then passed down through the generations until in 1676 it passed by marriage to the Bruce family and so to the present owner, the Marquis of Ailesbury, whose mansion, the present Tottenham House, was begun in 1781 by the first Earl of Ailesbury.

Whilst there are several thousand ancient oaks and ancient beeches, as well as over a hundred ancient chestnut trees in the present forest, it must be remembered that a medieval forest was a legal designation rather than a description and did not necessarily imply an abundance of trees. Given the importance of hunting in forests it is likely that in the medieval period it would have been made up of sporadic copses and coverts for game. It was also likely to have been largely unenclosed until it passed into private hands in the 16th century at which point its deer were not protected by royal forest law and so a park pale was built (completed c 1600), some of which still survives.

In the early 18th century there was a vigorous planting regime followed by extensive landscaping under the First Earl of Ailesbury, Thomas Bruce. After marrying Susanna Hoare (1761), the daughter of Henry Hoare (who had laid out the gardens at Stourhead) the Earl took the advice of his father-in-law and engaged the great 18th century landscaper 'Capability' Brown. One of Brown's major features is The Grand Avenue, which was laid out in the late 1790s and at over five kilometres (three miles) long is the longest avenue in Britain. At its centre Eight Walks radiate out into the surrounding forest. At the beginning of July 1940 the area was requisitioned by the War Office which quickly set to work turning the forest into an ammunition dump that eventually became one of the largest of its type. It saw occupation by the Royal Army Ordnance Corps and the American Army both of whom used it for storage, including large numbers of conventional and chemical weapons (Day 2007). Savernake Forest is now private property owned by the Earl of Cardigan who since 1938 has leased it to the Forestry Commission who manage the Estate.

Geology, topography and modern land use

The forest lies on the Savernake Plateau, a high plateau of rolling downland dissected by small valleys, founded on Upper Chalk overlain with deposits of Clay with Flints. To the east of the area the Chalk is overlain by London Clay, the Reading Beds, Bagshot Beds and Plateau Gravel. It is these drift deposits that create the heavier soils supporting the highly wooded character of this area. The underlying chalk creates a karst landscape with a number of swallet holes both within the confines of the forest and in surrounding arable fields. These features can easily be confused with features of archaeological origin and special care had to be taken when dealing with them (see below). The Forest sits within a wider woodland farmland mosaic that includes some more open arable areas and is knitted together by hedgerows with many hedgerow trees.

Today the Forest consists of extensive tracts of semi-natural ancient woodland, wood pasture with majestic veteran trees, and 18th and 19th century beech plantations, as well as more modern coniferous plantations (Fig 3). The southern end of the project area is dominated by the historic parkland and designed landscape features with Tottenham Park containing permanent pasture, parkland trees, avenues and rides. Reflecting its origins as a Royal hunting forest, settlement is limited to a concentration of villages in the valley of the River Dun including Great Bedwyn and Little Bedwyn.



Figure 3 - Landscape view of project area showing extent of tree cover (NMR 21339/19_10-AUG-2001 © English Heritage. NMR)

Previous archaeological work

The majority of previous archaeological investigation in the vicinity of Savernake has been concentrated on and around the Roman small town of *Cunetio* at Mildenhall just east of Marlborough. As noted above, the town was excluded from the survey area so as not to bias the project and elsewhere in the project area there has been relatively little previous activity.

Colt-Hoare covered the area of Savernake during his recording of the presumed course of the Wansdyke, but lost track of it in the woodland (see below). There has also been the usual smattering of antiquarian interest in certain of the barrows within the project area and the enclosure near Braydon Oak (UID 224741) was partially excavated by boys of the Marlborough College Natural History Society in 1934. Evidence of the Savernake Ware Roman pottery industry was first discovered through excavations carried out in the late 19th century and followed up by further work in the wooded area in 1957-1961 and 2005.

An air photo survey of the cropmark remains of the Neolithic causewayed enclosure at Crofton was undertaken in 2001 as part of an English Heritage survey. The plan and discussion of the site were included in the subsequent publication: *The Creation of Monuments - Neolithic Causewayed Enclosures in the British Isles* (Oswald et al 2001, 71). The survey at Crofton was only focused on the causewayed enclosure so did not

include any analysis of adjacent Bronze Age features which were also visible as cropmarks.

Grahame Bathe has been undertaking research in the forest using documentary sources and more recently lidar derived imagery supplied by the Forestry Commission.

Methodology and sources

The survey was based on the interpretation of lidar data and aerial photographs supported by relevant documentary sources and archives. Over 1500 aerial photographs were consulted together with lidar imagery in various forms; mapping and interpretation was carried out to NMP standards (Bewley 2001) by English Heritage investigators (Simon Crutchley and Fiona Small); detailed field survey was carried out by English Heritage investigators (Mark Bowden and Dave Field). This project forms part of English Heritage's on-going National Mapping Programme and involved the interpretation, transcription and recording of all archaeological features (from the Neolithic to the end of the Second World War seen on aerial photographs and lidar derived imagery).

See appendices for a detailed description of the methodology and mapping conventions.

The aerial photographs

The photographs consulted consisted of both vertical cover (868 prints from the NMR) and specialist obliques (715 prints from the NMR). The survey area has comprehensive cover by the RAF dating from the mid-1940s, through the 1950s and early 1960s.

The vertical photographs were not taken to record archaeological features and as a result the date and time of the photography does not necessarily coincide with the best conditions to identify such features. This is particularly true in a wooded environment where large numbers of sorties reveal nothing within the wooded areas other than the top of the tree canopy and occasional features within clearings. However, some sorties were very beneficial revealing not only the extensive remains of World War Two activities, but also traces of much earlier features. Specifically there are a series of sorties flown by the United States Army Air Force (USAAF) in early 1944 which have the fortuitous combination of being flown during a period when the forest was still being used extensively as an ammunition storage area and at a time early in the year before the trees had developed full foliage. This means it is possible to see through the forest canopy to the floor below. After the 1960s there is coverage provided by the Ordnance Survey photographs and a number of sorties flown by the commercial air survey company Fairey Surveys.

In addition to the non-archaeological vertical aerial photographs a number of specialist oblique photographs taken of archaeological, and occasionally architectural sites were also consulted. These specialist photographs covered an even broader date range than the verticals with the three earliest images dating from September 1918. In many cases, although classified as oblique photographs, these were actually vertical images. The photos from 1918 are general shots that do not record any features not seen elsewhere, but give a good impression of the landscape, particularly the woodland in the central area of the forest which appears less densely planted in some areas. The 1920s photographs by contrast show a number of features not visible on any other cover. These include the

earthwork at Furze Coppice (UID 224756) that is not visible on any other aerial photographs and is very indistinct even on the lidar derived imagery, presumably because of heavy undergrowth. Also visible only on the photographs from June 1929 are the traces of a ditched field system (UID 147150) south of the hillfort at Forest Hill (UID 224753).

There are more photos dating to the 1930s, again with a combination of vertical and oblique imagery; then there is a gap during the war years and they resume in the early 1950s, continuing through the 60s, 70s, 80s and 90s up with the most recent flights dating from September 2005. These specialist photographs concentrated mainly on the cropmarks visible in the arable fields around the fringes of the woodland, but also included several stretches along the scarp edge where there were earthwork remains.

In addition to the photographs held by the NMR, the Cambridge University Unit for Landscape Modelling collection of air photographs was also consulted. These photographs were loaned to the project on a map by map basis by special arrangement with Cambridge University (see Appendix 00). A small number of photographs held by the Wiltshire County Council Archaeology Service were also consulted at the Wiltshire and Swindon History Centre. Both sources yielded small numbers of additional features that were not visible on any of the photographs held by the NMR.

The lidar data

Lidar stands for Light Detection and Ranging and consists of a scanning laser beam being emitted from a plane, striking a surface and being reflected back to the sensor. Using a combination of known variables it is possible to calculate the precise location of each spot hit by the laser to within 10-15cm in x, y, and z (Crutchley 2008). The Forestry Commission commissioned Cambridge University's Unit for Landscape Modelling (ULM) to carry out a survey of Savernake Forest as part of planning for a Management Plan. With the agreement of ULM they then provided the data to English Heritage to use as an additional source for the NMP survey. The data was provided as first return, last return and as a filtered digital terrain model (DTM) (see glossary). The first and last returns are precisely what they sound like; when the laser is fired from the plane it travels towards the ground and if it strikes anything in passing part of that beam is reflected back to the sensor and forms the first return; the rest of the beam continues towards the ground and may strike other features that produce further returns until an element of the beam finally strikes the ground, or a solid surface that allows no further progression. This returns to the sensor as the last return. In practice in open land the first and last returns are often identical; in woodland, however, the first return generally represents the top of the tree canopy whilst the last return represents some of the ground surface, but with the inclusion of the main trunks of the trees and areas of dense undergrowth. The last set of data (the filtered DTM) uses complex algorithms to remove all traces of vegetation or other features above the natural ground surface to recreate a "bare earth" model. The flight was carried out on 6th April 2007 and the data processed over the following months.

Other sources

The survey was carried out with help from the Wiltshire County Council Archaeology Service, who provided copies of their HER information for comparison and analysis. These were consulted together with the monument records held on the NMR AMIE database for concordance with existing records and to aid identification of the sites mapped from

the aerial photographs.

Maps from many sources were used. Control was derived from the OS 1:2500 current edition Landline maps in digital form. The current OS 1:10,000 maps were used as a base against which features mapped in AutoCAD were plotted, and the OS 6" first edition maps were also consulted for information on removed buildings and field boundaries.

Published research covering subjects relevant to the archaeological understanding of the region's sites was consulted throughout the survey.

Summary of NMP results

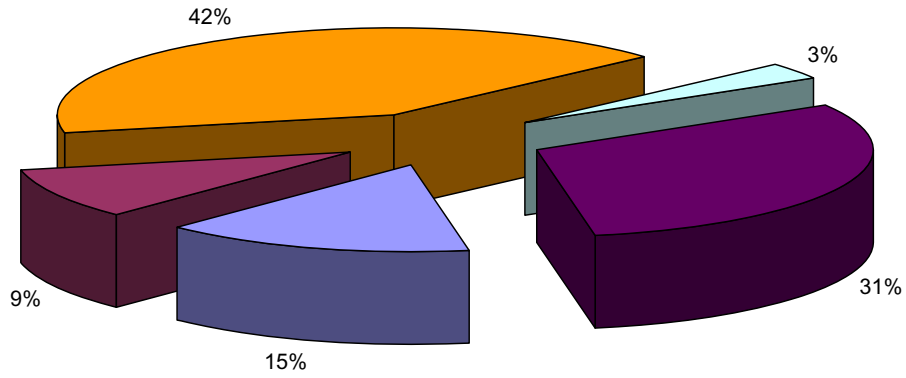
As noted above, in heritage terms, the area of Savernake Forest forms a relative blank spot within this part of north Wiltshire. Prior to the survey there were less than 200 (actually 193) monuments recorded within the project area on AMIE the English Heritage national database of Monuments, Archives and Events and just over 250 (255) on the Wiltshire Historic Environment Record (HER). There was an unusually low level of concordance between the two databases with only somewhere between 53 and 69 AMIE records also recorded by the HER; the reason for the ambiguity in the figures is that in several cases more than one HER record is referenced by an AMIE record, or vice versa.

Of those records on AMIE 35 were records of buildings or similar structures (eg the monumental column in Tottenham Park); 40 merely recorded find spots often relating to objects found in the nineteenth century or earlier with a very imprecise location and 36 were military remains from WWII recorded as part of the Defence of Britain project, concentrating along the stop line of the Kennet and Avon Canal. This left fewer than 100 records relating to earthwork remains in an area of 54 square kilometres; less than one set of remains per two square kilometres. Of the 250 HER records, after removal of buildings, findspots etc as with the AMIE records, there were slightly more monument records, c175 in total.

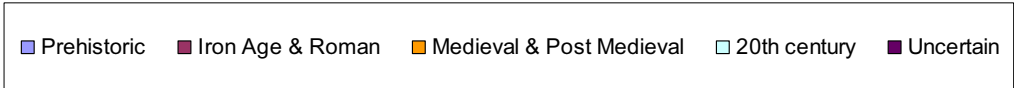
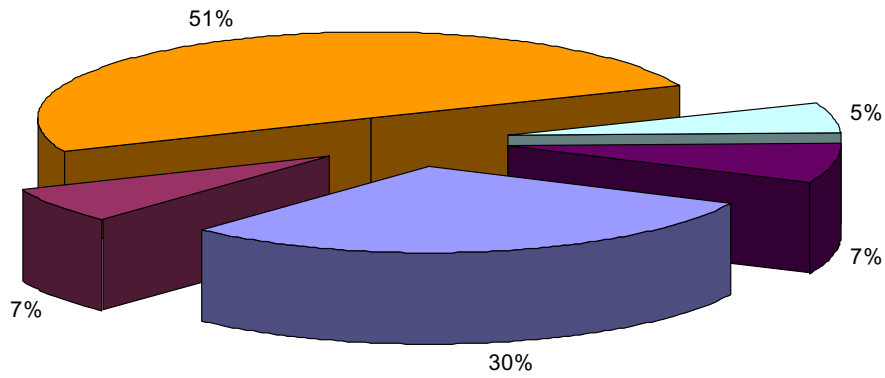
The survey added 315 new records to AMIE, more than doubling the previously recorded number of sites. Within the AMIE database it is possible to assign a feature to multiple periods such as Iron Age and Roman where there is doubt about the precise date of a feature, which is common with features for which the only evidence is that from aerial photographs (or lidar derived imagery). Thus whilst there are only 315 new records, because of double indexing there are 481 period records of which 247 have only a single period assigned (51%). Whilst multiple indexing does allow a degree of leeway when recording features, there are always a high percentage of sites for which no definite date can be given as they could originate anywhere between the Neolithic and Post Medieval eras. In such cases they are not recorded as being of every possible date, but rather as "Uncertain". Of the total records 30% are Uncertain a total that rises to nearly 45% when considering those records with only a single date assigned.

Period	Number of records	Percentage of records	Unique period	Percentage of records
Early Prehistoric	19	3.9%	14	5.7%
Iron Age/Roman	45	9.8%	10	4%
Prehistoric	52	10.8%	30	12.1%
Med & Post Med	200	41.6%	74	30%
Post 20th century	15	3.1%	8	3.2%
Uncertain	148	30.8%	111	44.9%
Total	481		247	

Savernake sites by period



Savernake sites by unique period



PERIOD ANALYSIS

Neolithic and Bronze Age

Of the 481 individual sites recorded during the course of this survey, only one Neolithic site was recorded, and 14 attributed were to the Bronze Age. Four further sites were double indexed with Bronze Age as one of the possible dating suggestions.

The single Neolithic site was the causewayed enclosure at Crofton (UID 867544) (Oswald et al 2001). Now entirely plough-levelled it is only visible as a cropmark on aerial photographs. It is nearly circular in plan and takes no account of the topography and may have surrounded the confluence of the River Dunn and a smaller tributary now obscured by the course of the Kennet and Avon Canal (Oswald et al 2001). The enclosure is formed by a single interrupted circuit of irregular elongated segments of ditch, and at approximately 600m in diameter Crofton is one of the largest known causewayed enclosures. The scale of the site means that it is not possible to record the entire enclosure on a single aerial photograph, and the variation of agricultural practice within each field through which the enclosure ditches pass results in variable cropmark conditions affecting the visibility of the site. Excavation and field walking in and around the enclosure undertaken in 1984 produced flint finds from the primary ditch fill confirming a Neolithic date for the enclosure. Surface finds included Bronze Age and Romano-British potsherds and a large collection of worked flints consistent with known Bronze Age and Roman occupation of the area (Lobb 1995).

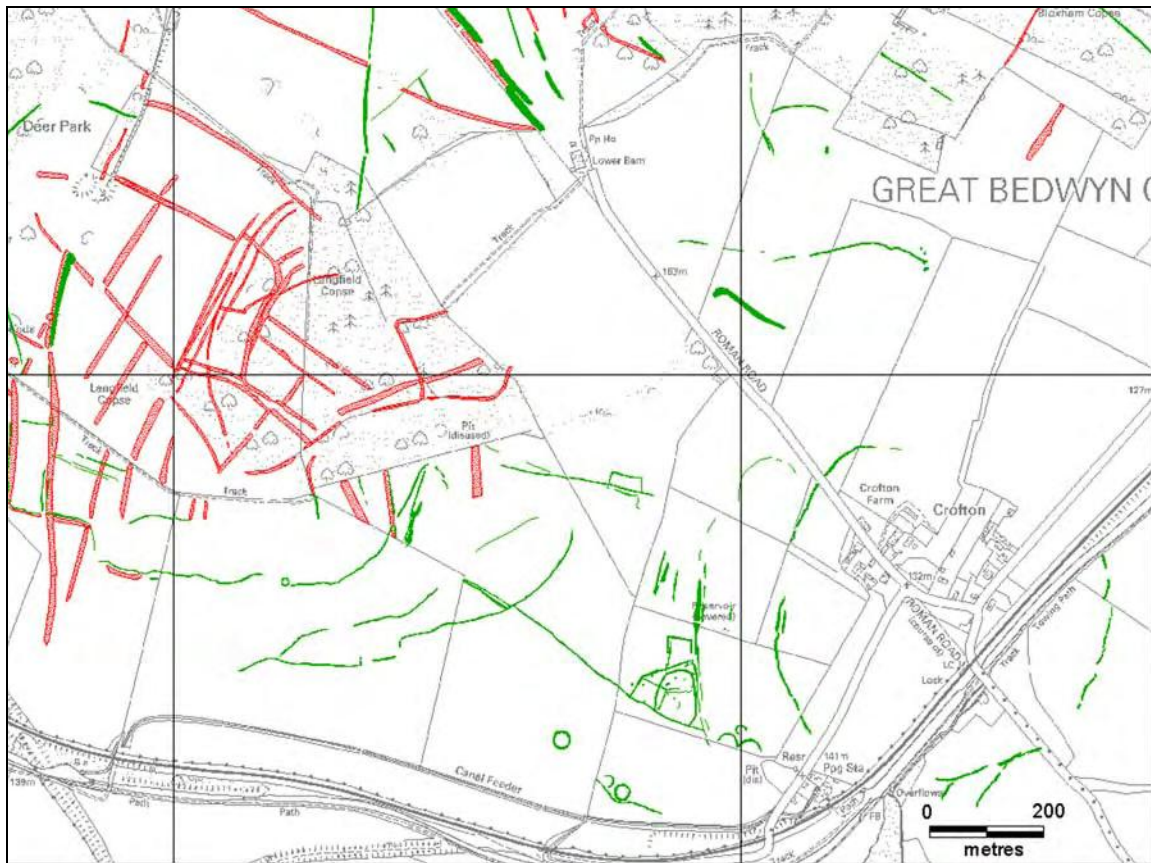


Figure 4 - Plan of Crofton causewayed enclosure and surrounding features. This map is reproduced from the OS map by English Heritage with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. All rights reserved. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number 100019088. 2009

The present village of Crofton lies in the centre of the enclosure, and the course of the Roman road from Cunetio passes NW-SE through the middle of the enclosure, met at 90° by the staggered course of a minor road from Great Bedwyn to Burbage aligned NE-SW (Figure 4). This arrangement is reminiscent of the Neolithic henge at Avebury with the current village of Avebury and the meeting of four roads within the ancient earthwork. Crofton lies just beyond the limits of the lidar coverage, but it is unlikely that the levelled remains of the causewayed enclosure would have any surviving raised elements detectable through lidar survey. This is true of cropmarks to the north of the enclosure which coincided with the lidar coverage but could not be detected.

Immediately to the west of Crofton the aerial photographs revealed the cropmarks of a probable later prehistoric farmstead with at least two phases of development represented by a curvilinear enclosure and a group of superimposed asymmetrical rectilinear enclosures. Associated with the settlement are clusters of pits, boundary ditches, and a trackway. The trackway appears as re-cut ditches aligned north-south along the eastern side of the settlement. This continues northwards mirroring the gentle curve of the western side of the causewayed enclosure approximately 140m to the east. The cropmark traces of sinuous boundary ditches extending to the west of the settlement are probably part of a field system. One of these ditches deviates around the a small ring ditch (also visible as a cropmark), probably a Bronze Age round barrow, indicating the

boundaries and at least one phase of the settlement post date the barrow and are either Bronze Age or later in date. The cropmarks of six further ring ditches, also presumed to be Bronze Age round barrows, were seen in close proximity to the settlement and the causewayed enclosure. One group of three lay immediately to the south-east of the settlement, between 86m and 100m from the causewayed enclosure, the second group to the south-west of the settlement with a linear ditch skirting around the easternmost barrow.

The occurrence of Bronze Age round barrows in close proximity with causewayed enclosures has been noted elsewhere. This may simply be due to reuse of a desirable or prominent location, but other examples are thought to be located on the sites of what were already, to peoples of the Bronze Age, long deserted 'ancient monuments', the original function long since forgotten. There is no suggestion of continuity of use of these sites from the Neolithic to the Bronze Age; rather it is seen as a renewal of ritual activity at these sites after a lengthy period of abandonment and inactivity (Oswald et al 2001).

Round barrows were the only Bronze Age sites recorded in this survey. Of the seventeen identified, nine were new records to the AMIE database, five visible as extant earthworks with existing records, and twelve were seen as cropmarks. The newly recorded sites were all cropmark ring ditches. One possible barrow (UID 1469002) was identified adjacent to a large earthwork bowl barrow (UID 224730) standing in open, grazed parkland immediately east of the Grand Avenue, within Bagden Lawn. Photographs taken in 1944 and 2001 show a cropmark of a sub-circular depression surrounded by a broad ditched which apparently respects the extant barrow. However, it is possible that the cropmark has undergone a reversal (common on chalk geology), and that the feature is in fact a levelled mound surrounded by a circular bank.

Though sparse and few in number, the potential barrows appear either to be situated in prominent locations on the northern and southern edges of the Savernake massif or at the head of dry valleys of former rivers which arose in the plateau and drained eastwards. The location of these barrows suggests that these valleys and surrounding areas would almost certainly have been bare of trees in the Bronze Age, barrows typically being sited at points chosen for their prominence and visibility.

In addition to the dispersed barrows found within the plateau, two larger groups of barrows were also noted. One group of six with a smaller outlier occurred adjacent to the Crofton Neolithic causewayed enclosure and a probable later prehistoric settlement which has been described above. The second group was recorded in the north-eastern corner of the survey area on the northern side of the major dry valley which now carries the A4 trunk road. To the west of the main group were two pairs of small ring ditches visible only as cropmarks despite lying within the area covered by the lidar imagery. The main group to the east form an east-west linear arrangement of four barrows which are so tightly placed that the ditches of three of the barrows touch. All were defined by a single ring ditch with cropmark hints of the ploughed out central mound, though all appear to be completely levelled. The eastern-most and largest of the four barrows has a rectilinear enclosure attached to its ditch presumably post-dating the barrow. It is not entirely clear what the relationship between the barrows and this rectilinear enclosure is. Around 1.3km south-west of Savernake a similar arrangement of closely spaced Bronze Age barrows and rectilinear enclosures (identified as an Iron Age/Roman settlement) has

been recorded between Wilsford and Charlton in the Pewsey Vale (Carpenter, pers comm.).

The presence of a number of large prehistoric sites such as the probable Neolithic causewayed enclosure at Crofton, the nearby settlement and the spread of Bronze Age round barrows illustrates the presence of a number of important social and religious foci in the region from the Neolithic period onwards.

Late prehistoric

A considerable number of potentially later prehistoric sites including enclosures, linear boundaries and field systems have been recorded throughout Savernake Forest and the immediate area. Only a handful of the enclosures have been investigated and dated through excavation, the remainder have been tentatively dated to the later prehistoric or Iron Age/Roman periods based on morphology alone. Within the wooded areas of Savernake, many sites could be seen as earthworks. The majority of the enclosures were encountered rectilinear in form, most without any internal or external associated structures. In contrast, all the sites identified outside the forest had been plough-levelled and only visible as cropmarks. These included rectilinear enclosures and a small number of curvilinear ditched enclosures similar in form to several sites encountered in the Pewsey Vale to the west which have dated to the Iron Age or Roman periods (Carpenter, pers com.).

Iron Age

Present day Wiltshire extends across the area which would have formed parts of the adjoining territories of three Iron Age tribes – the Dobunni to the north, the Belgae to the south and south-west and the Atrebates to the east. By the late Iron Age a market economy was well established within this region with evidence of a flourishing trade with the Gallo-Belgic regions of continental Europe and the Mediterranean, illustrated by an influx of exotic goods and wine into southern Britain. Further continental influences were brought by incursions of the Belgae peoples in the late Iron Age who are believed to have settled to the south of this region around the south coast. The two major Iron Age centres known in immediate area are Chisbury hillfort and the possible late Iron Age oppidum at Forest Hill. In addition to these centres Savernake Forest is also known to have been an important centre for pottery production in the Roman period, exploiting the readily available clay deposits overlying the chalk. This industry almost certainly had its origins in, at the very least, the late Iron Age, and it is possible that some of the enclosures identified within the area were linked in some way to the pottery industry.

Probable Iron Age enclosures within and around Savernake Forest

Within Savernake Forest the combined sources of aerial photographs and lidar derived imagery have recorded a number of enclosures, many surviving as earthworks, probably the remains of small settlements or farmsteads of Iron Age or Roman date. A number had previously been identified, but this survey has discovered a significant number of new sites. The lidar imagery was a key source for sites within the woodland, though most were also

visible to varying extents on corresponding aerial photographs despite the woodland cover. Aerial photographs remained the major source beyond the edge of the woodland areas where plough damage had levelled earthworks to the point where lidar could no longer detect them. The high level of earthwork survival within the forest could imply that for the most part there has been little or no agricultural disturbance, specifically ploughing, within the region of Savernake Forest, perhaps from the Roman period.

The enclosures form two morphological groupings. The first group are typically sub-rectangular and defined by a ditch, some with traces of an inner bank. The second group are more curvilinear in form, and as with the rectilinear enclosures, some have traces of internal banks. Some do appear to have associated linear boundaries occurring as ditches, banks or a combination of both, but there are no traces of associated field systems. The absence of field systems is discussed below.

These enclosures have variously been recorded by different authorities as Uncertain, Later Prehistoric or Prehistoric/Roman in origin. Because only one site (NMR Amie database: UID 224741) has been excavated all enclosures described have been classified based on their morphology and relationship to other features. The general consensus is that these are probably examples of small enclosed later Prehistoric or Roman settlements or farmsteads, most probably dating from the late Iron Age into the Roman period. Some may also have had ritual/religious or perhaps even industrial functions. As mentioned elsewhere in this report, the clay deposits found in the Savernake region have been exploited variously for pottery and then brick manufacturing from at least the late Iron Age through to the 20th century. The forest is dotted with numerous pits and depressions, many being naturally occurring 'swallets', but a considerable number are the result of centuries of clay extraction. The pottery production was such in the Roman period that it reached industrial proportions, but this industry is believed to have its origins in the Iron Age. It could be argued that a number of the later prehistoric/Roman enclosures were linked to the ceramics production sites, perhaps providing an explanation for the absence of fields around the settlements. It is likely that manufacturing processes were undertaken in close proximity to the clay pits, and a permanent settlement and working area would have been necessary. Charcoal needed to fire the kilns could be derived locally from adjacent coppiced woods, and perhaps a small vegetable plot and a couple of animals would have provided basic subsistence needs. The trafficking of the finished ceramic wares out of the area would have facilitated regular links with the markets and ensure a flow of necessary supplies.

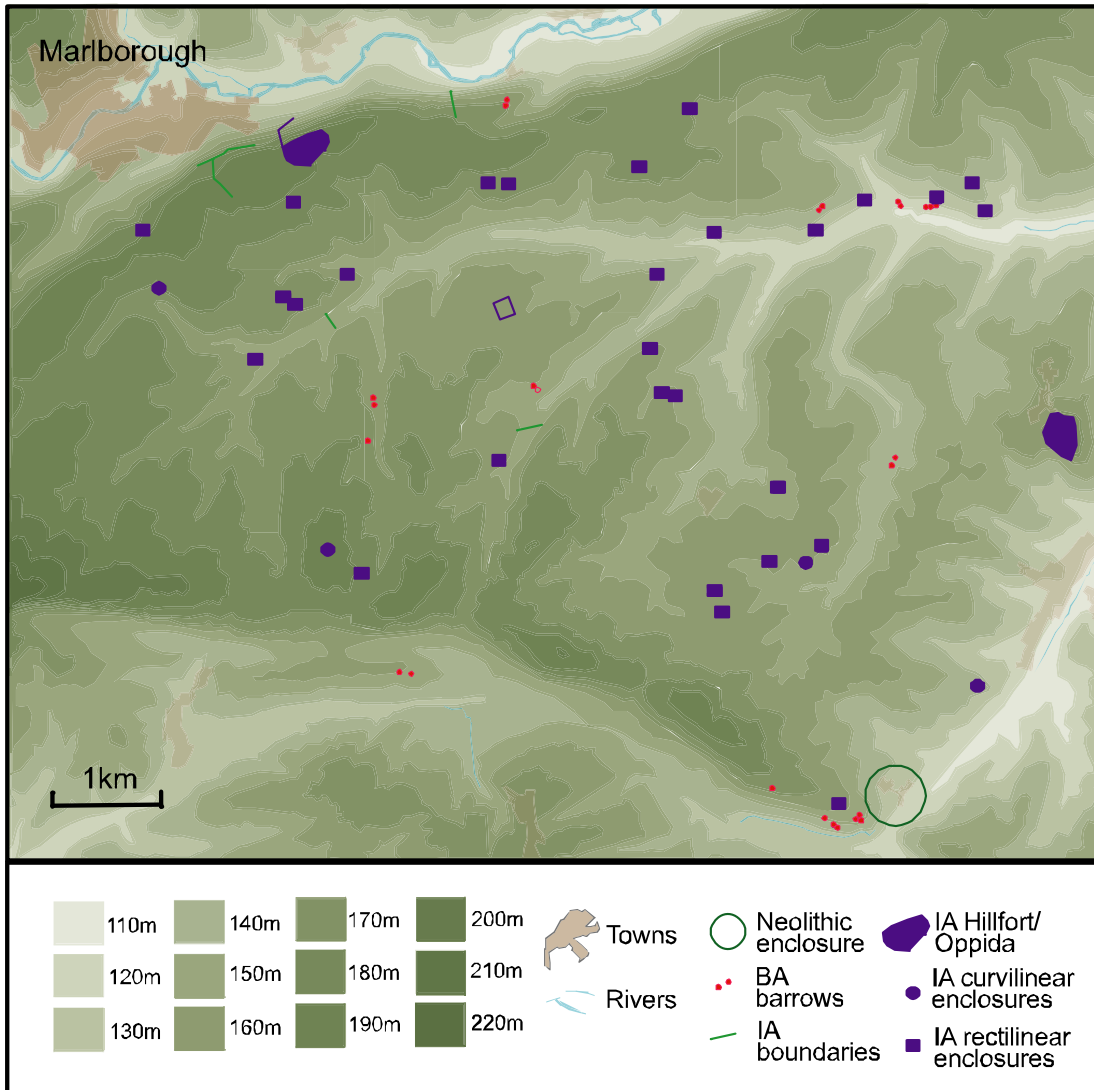


Figure 5 - Distribution of Bronze Age and Iron Age sites across the Savernake area. Background map and contour data derived from Ordnance Survey 1:25,000 sheets. © Crown Copyright. All rights reserved. English Heritage 100019088, 2009

NB. It has been suggested (Field pers comm.) that the numerous natural depressions (swallets) which occur throughout Savernake Forest could have acted as religious foci within the prehistoric era. Elsewhere in southern England ritual deposition of material and in some cases burials have been found placed in natural holes and shafts. Some examples have yielded deposits from multiple prehistoric periods. It is possible that some of the enclosures encountered in Savernake are linked to ritual activity and perhaps explain the absence of agricultural activity within Savernake.

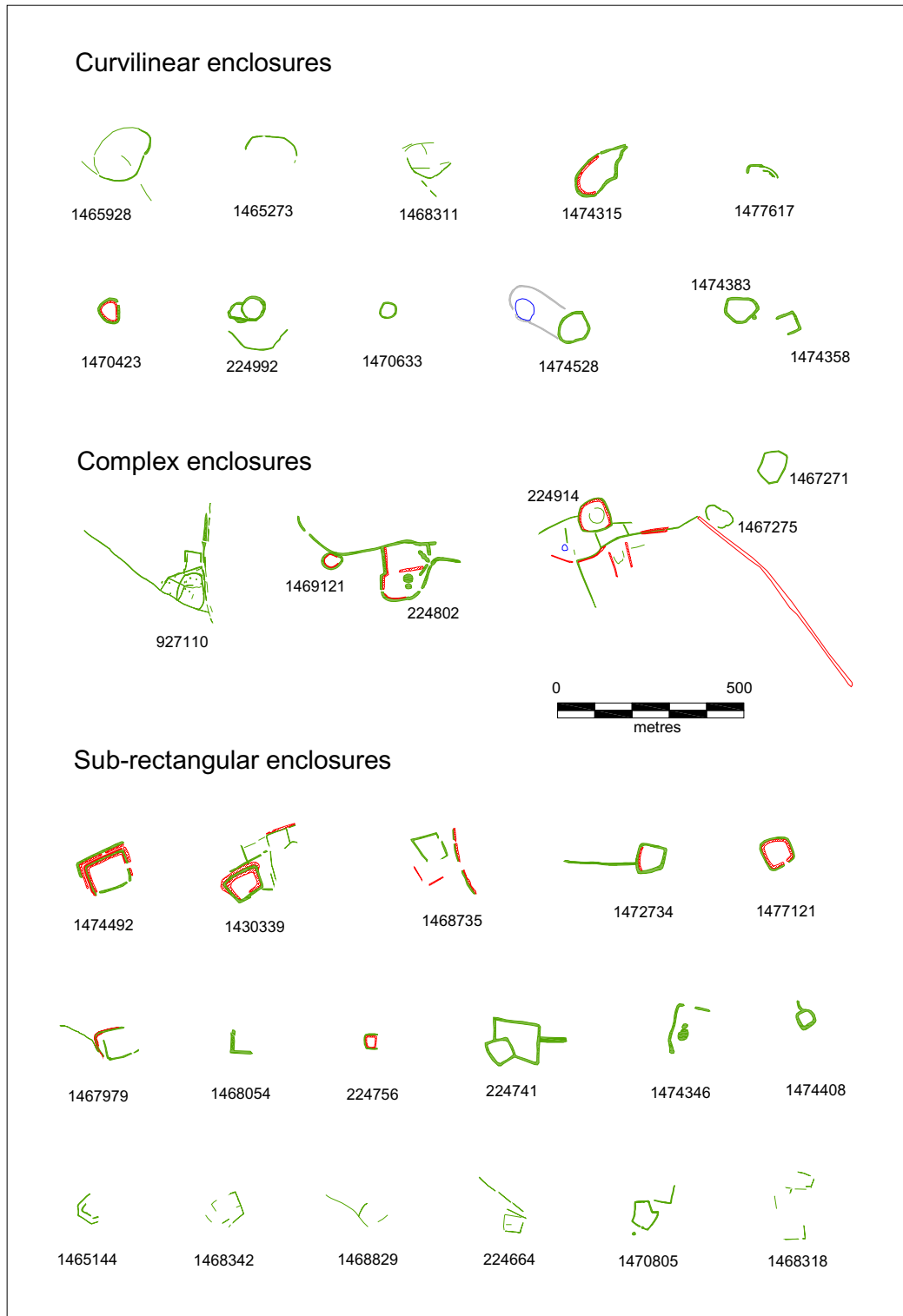


Figure 6 - Plans of all enclosures mapped from aerial photographs and lidar imagery. Site references are the unique NMR Amie number of each enclosure.

Chisbury Camp

The earthwork remains of Chisbury Camp, a large multivallate hillfort lie on the eastern edge of the survey area. Chisbury Camp was surveyed using both aerial photographs and

lidar images, but neither added any significant additional information to the existing plans of the site. The fort occupies a high point north of great Bedwyn, overlooking the valley of the River Dun to the south-east. It is oval in plan and covers approximately 5.7ha (Hogg 1979), and though the ramparts are generally well preserved, it is not clear which of the four current entrances were original. The northern and southern entrances are utilised by the modern road (RCHME 1973). To the north-east is a smaller entrance adjacent to Chisbury Manor, and there is another small break in the ramparts to the west. Aerial photographs from the 1930s of the interior of the hillfort show a raised linear bank, possibly a boundary or trackway aligned E-W apparently leading to this gap. The largest break cuts through the eastern ramparts and is possibly an original entrance to the fort,. This is now overlain by the farm buildings and St Martin's church and used by a track. The Andrews and Dury map of the area published in 1773 depicts a hollow way leading to this gap, possibly providing access to the church (Andrews and Dury 1773).

The interior of the hillfort has been altered considerably through centuries of occupation and re-use evident from the discovery of Iron Age structures and Roman pottery (Pugh and Crittall (eds) 1957), (Passmore 1903-42), and the presence of the 18th century Chisbury Manor farm and the late 13th century Church of St Martin. More recent disturbance has been caused by, an episode of gravel digging in 1900 and the addition of a covered reservoir in 20th century.

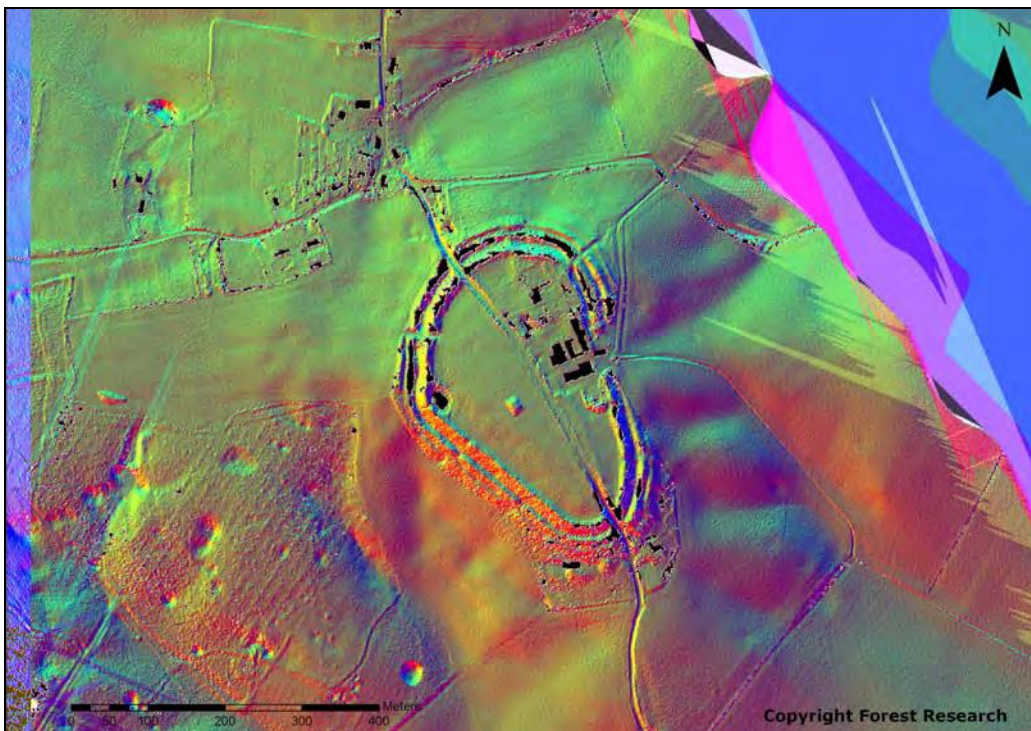


Figure 7 - PCA (Principal Component Analysis) generated colour image of Chisbury hillfort utilising multiple light sources. LIDAR SU2666 DTM 06-APR-2006 © Peter Crow – Forest Research; source Cambridge Unit for Landscape Modelling.

Aerial photographs taken between 1933 and 1939 record the interior of the fort prior to the excavation of the reservoir (visible as a raised square earthwork within the fort (Figure 7)). These show two perpendicular banks, probably field boundaries in the south-east

quadrant immediately to the south of the church. It is not clear to which phase of occupation these banks relate. Immediately outside the fort only a few disjointed fragments of linear banks, probably part of an Iron Age or Roman field system, were seen to the east and north-east of the hillfort.

In the late Iron Age, Chisbury was located within the realm of the Atrebatian peoples at a time when the first truly urban centres were being established in southern Britain. Known as oppida, some are enclosed sites, whilst others appear unenclosed. These sites have yielded high concentrations of late Iron Age coinage, some with evidence of coinage minting, as well as luxury imports from continental Europe, particularly from Roman Gaul. In this region of southern Britain some existing hillforts were maintained and some fortified enclosures appear to have been re-modelled in bivallate form at the very end of the Iron Age, possibly functioning as a large local centre similar to oppida. Chisbury may well have been such a site (Cunliffe 2005).

Forest Hill a possible Late Iron Age Oppidum

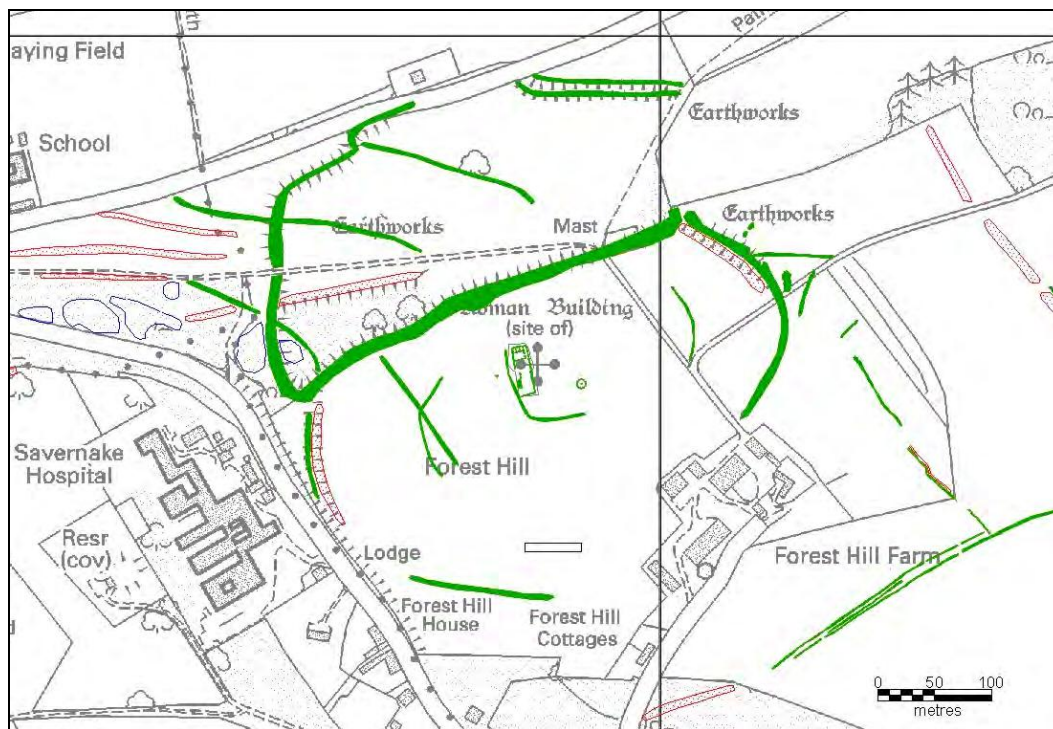


Figure 8 - Transcription of the earthwork and cropmark traces of the possible Late Iron Age oppidum enclosure and later Roman building (visible as a cropmark) on Forest Hill. This map is reproduced from the OS map by English Heritage with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. All rights reserved. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number 100019088. 2009

Forest Hill is situated on the north facing scarp overlooking the River Kennet, to the south of present-day Marlborough. This site is thought to be an example of a Late Iron Age oppidum, possibly the regional capital prior to the Roman conquest (Corney 1989). Now largely plough-levelled and visible partly as a cropmark on aerial photographs, the site appears as a large sub-circular univallate enclosure encompassing approximately 11 ha (Figure 8). The main surviving entrance is to the east, but there may also have been a

western entrance, now presumed destroyed by the cutting of the A4 road. Further earthworks extend northwards down the scarp towards the river, as does the course of one of the roads to the later Roman settlement of Cunetio which forms a diagonal cutting in the hillside. This route may well have Iron Age origins.

Within the vicinity of Forest Hill there have been a number of significant finds including a rare La Tene III burial with a bronze bound wooden bucket found in 1807 at Marlborough. A large number of late Iron Age coins have been unearthed over the years, including a substantial hoard of coins found in the 19th century in the vicinity of Postern Hill (Corney 1989). This concentration of late Iron Age finds indicates the presence of a significant centre in the vicinity, Forest Hill being the most likely candidate (Corney 1989).

The presence of a number of Claudian military finds within the enclosure suggests that the site continued to be occupied after the Roman conquest, initially as a short lived military site (Annable, 1976). Identification of the earlier course of the Roman road approaching from Venta Belgarum (Winchester) appearing to lead to the eastern entrance of the oppida lends weight to this argument (Corney 2001). Continued occupation of the site is evident through cropmark traces of a substantial Roman villa sited within the enclosure. This pattern of re-use of former Iron Age defended sites has been seen elsewhere in southern England, for example at Tidbury Ring, Hampshire and The Ditches at South Cerney, Gloucestershire (Corney, 2001).

Possible Late Iron Age Temple Complex Identified From Lidar Imagery

A large enclosure thought to be the remains of a possible late Iron Age temple enclosure has been identified solely from lidar imagery in a heavily overgrown area within Savernake Forest. The lidar imagery revealed the earthworks of a large incomplete rectilinear enclosure (c.140m x at least 110m) defined by two ditches and two banks located immediately to the east of the Roman road from Cunetio to Winchester (Venta Belgarum). The site was obscured by dense undergrowth making it virtually invisible from the ground. Field visits were made to the site in late autumn 2007 and again in late January 2008 when the vegetation had died back sufficiently for the earthworks to be discerned. Unfortunately, where the course of the Roman road meets the south-western corner of the enclosure the vegetation and disturbance due to domestic garden waste from an adjacent house made it impossible to determine the exact relationship between the two features, but the lidar imagery suggests that the Roman road post-dates the enclosure. Both the relationship with the Roman road and scale of the site suggest that this is unlikely to be one of the four or five medieval hunting lodges known to have existed in Savernake Forest. Lodges were typically built within an earthwork enclosure topped by a palisade, but were generally half the size of the enclosure in question.

The enclosure is itself reminiscent of a class of late Iron Age (pre-Roman) ritual or religious site known in continental Europe as *viereckshanze*, which are characterised by square or sub-rectilinear enclosures with a single entrance and enclosing less than 1 ha in size. A number of these temple complexes have been identified across southern Britain, a few of which have been excavated (Corney 1989). These sites are typified by an absence of domestic materials or structures and an abundance of pottery and apparently ritual or funerary deposits such as animal and human remains in pits and/or the enclosure ditches. The interior space of several of these enclosures contained a central building or shrine (or

cella), (eg. Heathrow, Middlesex and Lancing Down, Sussex (Cunliffe 2005)), and another example appeared to have a metallised interior (Blagdon Wood, Berkshire (Corney 1989)). The most impressive example is that of a site at Fison Way, Thetford in Norfolk which is thought possibly to be a late Iron Age (pre-Roman) sanctuary. Excavation reveals that this was initially the site of a series of Iron Age hill-top enclosures which appear to have been replaced in the early 1st century AD by a large rectilinear enclosure with a concentric inner enclosure and traces of a large circular building. The third and final phase of the site saw this replaced by 5 circular buildings and the space between the two enclosures filled with eight concentric sets of trenches which have been interpreted as possible bedding trenches for trees or bushes (Cunliffe 2005).

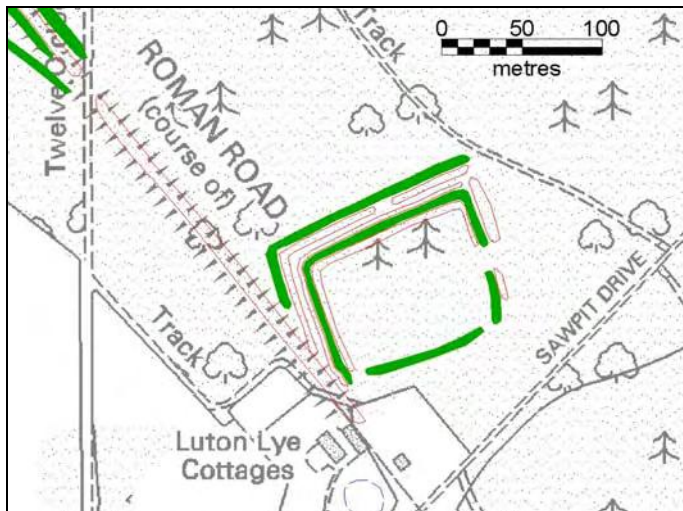


Figure 9 - A large enclosure possibly a late Iron Age temple enclosure identified from lidar imagery in a heavily wooded area within Savemake Forest. © Crown Copyright. All rights reserved. This map is reproduced from the OS map by English Heritage with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. All rights reserved. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number 100019088. 2009.

The enclosure in Savemake Forest though slightly larger, is similar in form to two possible Romano-Celtic temple complexes located on the Lambourn Downs. One of these sites discovered by English Heritage in 1998 appeared as a double-ditched rectangular enclosure with opposing entrances measuring approximately 75m x 68m. This had a third inner enclosure and traces of a probable building (Small 2002).

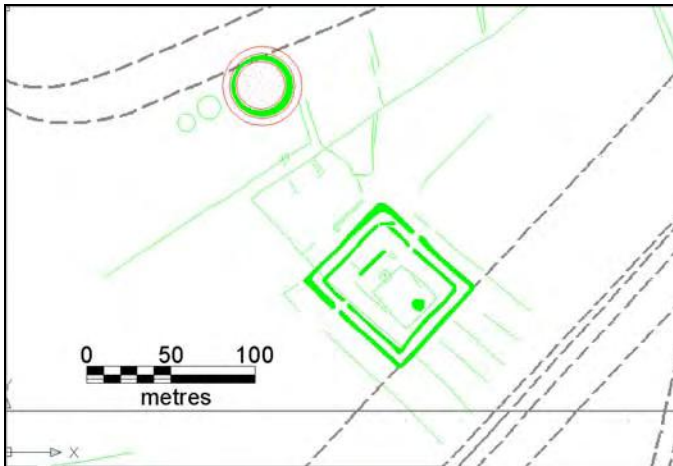


Figure 10 - A possible Romano-Celtic temple complex visible as a soil mark mapped from aerial photographs as part of the Lambourn Downs NMP project. © Crown Copyright. All rights reserved. This map is reproduced from the OS map by English Heritage with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. All rights reserved. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number 100019088. 2009.

Many Romano-Celtic temple sites in Britain when excavated show evidence of continuity of ritual use with traces of Iron Age ritual sites beneath or adjacent to Roman sites (Cunliffe 2005). There is strong evidence from both ritual sites and villas across Britain that the Romans neither attempted to discourage nor suppressed the worship of the indigenous Celtic deities, nor enforce Roman Classical religions on the native population. A degree of blending of the two is known to have occurred over time with individual Classical and native gods equated with one another ((Robinson 2001) *in WAHM 2001*). It is possible that these ritual/temple sites not only saw a continuity of function, but also a continuity of basic beliefs and worship following the Roman conquest. However, the Savernake enclosure does not show surface evidence of any such continuity, in fact the apparent slighting of one corner of the enclosure by the Roman military road suggests rather a discontinuity. Similarly, the possible temple site at Postern Hill (described below) is also cut by a later, probably Roman track from the adjacent villa.

Possible polygonal temple enclosure near Postern Hill

Immediately to the east of the villa site at Postern Hill, aerial photographs have revealed traces of an incomplete polygonal (probably hexagonal) double-ditched enclosure with inner and outer circuits measuring approximately 70m and 49m. This site has been suggested as a possible Iron Age or early Roman shrine or temple site (Corney 1989 and Robinson 2005). However, the site is known only from the cropmark evidence and has not been investigated further. The cropmark traces of the metalled road or track from the 2nd – 4th century AD Roman villa appear to pass through and presumably post-date the enclosure (Figure 12).

Cross-valley dykes/boundaries within Savernake

Within Savernake Forest only a few linear earthworks of potential later prehistoric date have been identified, and all have been discovered through earlier field work. Most have been interpreted as boundaries, but two linear earthworks have been identified as

probable cross-valley dykes. Savernake Forest extends across a raised chalk massif cut by a network of dry valleys and capped with a deposit of clay with flints. The two dykes are located at the upper ends of two of these dry valleys. Both are relatively short structures which appear to cut across the base of the chalky valleys, but cease at the point where they encounter the clay with flints (Ramsey and Bathe 2008). The north-western dyke is an isolated structure approximately 135m in length which straddles the dry valley known as Great Lodge Bottom. It appears as a broad ditch with a bank to the west with a break at its midpoint in the valley bottom, probably a later interruption through which the present day track passes. The dyke is aligned NW-SE, perpendicular to the valley, which at this point runs SW-NE (Ramsey and Bathe 2008).

The second dyke crosses the dry valley known as Shovel Bottom. Its structure is more complex than that seen in Great Lodge Bottom, comprising a linear ditch flanked by banks along its western half. The dyke is aligned east-west, crossing the valley at an oblique angle. At the western end, where the dyke meets the chalk with flints layer, there is a change in direction to the north-west. This is the point at which the boundary has been incorporated into the circuit of the later Great Inclosure, a banked boundary which enclosed a large area of Savernake during the Tudor period (Ramsey and Bathe 2008). This dyke also has an interruption in the valley bottom, but again it is not clear whether this break is part of the original construction or a later breaching of the earthwork (Ramsey and Bathe 2008). No further dykes have been identified from the photographs, lidar or from field work within the forest.

Later Prehistoric Field Systems

The largest area of probable prehistoric fields recorded during the NMP survey was seen to the south of the forest (Figure 11). This appears to have been largely plough-levelled, though small sections of bank have survived at field edges or been fossilized as modern field boundaries. Approximately one third of the field system elements could only be seen as soilmarks on aerial photographs, one third was only visible on the lidar imagery as very slight earthworks, and the remaining third was derived from a combination of both photographs and lidar.

Though fragmented, this field system can be seen to comprise sections of straight field bank forming rectilinear fields within a broadly coaxial field system. However, towards the northern edge there appears to have been re-use consisting of a combination of sub-division and amalgamation of the older field units into a number of parallel strips which extend southwards from the rear of several house plots of Durley village. Adjacent to these strips is a single field of medieval ridge and furrow within which the alignment and curvature of the rig mirrors that of the strips suggesting they too are medieval in origin. Within the ploughed-out core of this field system were traces of later medieval ridge and furrow seen overlying at least one of the earlier field banks.

The northern extents of the coaxial fields could not be traced any further northwards into Savernake Forest or Tottenham Park on either the conventional aerial photographs or the lidar imagery. A small area of fields and lynchets also survive as earthworks on the northern scarp of Postern Hill, and other fragments were recorded to the north-west of Chisbury hillfort.

The evidence for any other prehistoric cultivation has been sparse. In particular, within the confines of Savernake Forest itself, it was expected that remnants of field systems would be found surviving as earthworks comparable with the plough-levelled remains seen beyond the woodland extents. In actual fact, all three areas of field systems described above survive outside the forest. A few sections of boundary banks and ditches have been identified within Savernake Forest which may be fragments of field boundaries or lynchets, but none have been dated nor appeared to form any identifiable system of fields or enclosures. In particular, the traces of possible boundaries or lynchets were noted at three locations in the forest: a) Immediately south of Bradon Oak SU215670 a group of banks interpret as possible fields (HOBUID 1474584), b) possible field banks in New Road Bottom at SU 215662 (HOBUID 1474586), and c) possible lynchets around Pig Sty Track south of Eight Walks at SU 227664 (HOBUID 1475768).

This pattern of fragmented boundary banks is very similar to that encountered in the central and southern regions of the Lambourn and Berkshire Downs to the east of Savernake. The soils here are also predominantly heavy clay with flints, possibly a factor affecting the patterns of landuse, the survival and the visibility of these linears (Small 2002). However, in contrast, the Avebury World Heritage Site NMP project mapped and recorded extensive field systems in areas with a similar geological makeup. In the case of Savernake it is not clear whether the cultivation was piecemeal in forest clearings, or that factors such as the soil conditions and forest management have led to destruction and/or poor detection of these features.

The presence of, in some cases, well preserved earthwork enclosures suggests that the conditions are indeed favourable for the survival of other presumably contemporary features, but field systems remain strangely absent. This would suggest that there was little or no cultivation, or later landscaping and planting has removed most earthworks. Excavations within Tottenham Park undertaken by Wessex Archaeology in 2005 encountered numerous poorly preserved features such as ditches and pits from all periods from the Neolithic to the present day and concluded that their poor survival could be due to emparkment and landscaping (Wessex Archaeology 2005). Some of these features were detected on the lidar imagery and many were seen as faint parch marks and low earthworks on aerial photographs despite the levelling and landscaping processes.

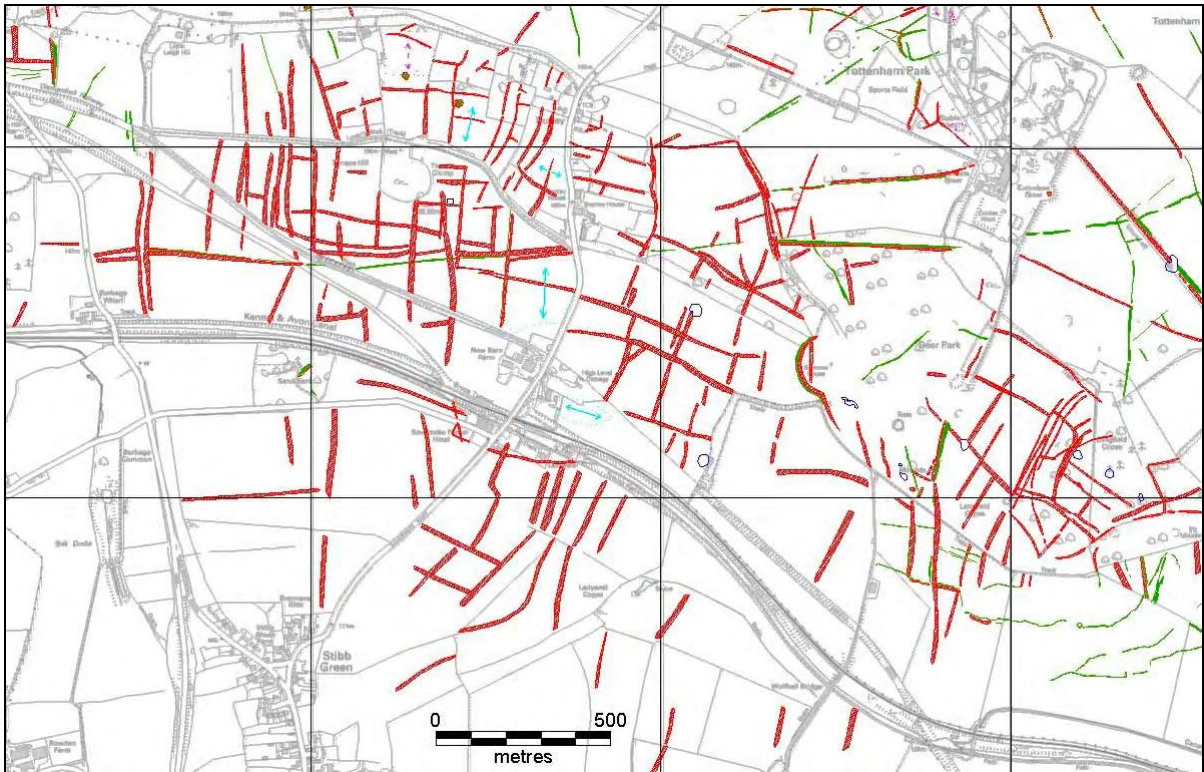


Figure 11 - Field systems on the southern edge Tottenham Park recorded from both aerial photographs and lidar imagery. © Crown Copyright. All rights reserved.. This map is reproduced from the OS map by English Heritage with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. All rights reserved. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number 100019088. 2009.

Roman

As already mentioned, during the late Iron Age this region encompassed parts of the three adjacent tribal areas of the Dobunni, the Belgae and the Atrebates. Their regional capitals developed into the Roman towns of Corinium Dobunorum (Cirencester), Venta Belgarum (Winchester) and Calleva Atrebatum (Silchester) (Walters 2001). However, within the region encompassed by modern day Wiltshire no Roman towns of civitas status have been found, though a number of nucleated settlements have been identified across the region (Corney 1989). These sites appear to have developed from late Iron Age settlements and occupy a landscape known to have been intensively farmed and valued for its cereal production during the Roman period (Corney 1989).

Villa Estates

The agricultural production of the region and its role in feeding the Roman army is believed to have played a significant part in the siting of Roman Cunetio at this strategic point on the River Kennet. Once thought to be a quiet back-water, Wiltshire has now been found to have the highest concentration of Roman villas in Britain, with a number representing the largest and most elaborate examples (Waters 2001), one of which was found at Castle Copse, Great Bedwyn immediately to the east of this survey area.

These villas are now believed to have had multiple functions within an estate of varying

size. They not only functioned as dwellings and farms, but depending on their location, practiced mixed farming and in some cases acted as the centres for industrial activities such as ceramics production, iron working, wool processing, quarrying and mining. Within northern Wiltshire villas have been found to be located in positions exploiting both land suitable for arable crop farming and the open downland for stock rearing (Walters 2001).

The sites of two Roman villas lie within the Savernake survey area. Lying approximately 1.7km apart, both are situated on the northern edge of Savernake Forest overlooking the Kennet Valley. Both sites are plough levelled and can only be seen as cropmarks. One is situated in the centre of the univallate defended enclosure thought to be a late Iron Age oppidum on Forest Hill. Immediately following the Roman invasion the site is believed to have been occupied prior to the establishment of the Roman town of Cunetio in the valley below (Corney 2001). This villa was first located by Colt Hoare in the early 19th century whilst digging what he described as 'undoubted remains of Roman settlement with a portion of its square circumvallation with its usual rounded corners'. He found an array of Roman remains and described the site as 'Upper Cunetio' (Colt Hoare 1821). Further investigation of the site in 1956 by K. Annable yielded Roman floor and flue tiles from the topsoil, and evidence of masonry walls. In 1969 the Ordnance Survey investigated the site, noting scattered Roman building debris including roof and flue tiles, and crude tesserae covering an area approximately 50m x 60m. They concluded the site was that of a large Roman building, probably, though not necessarily a villa. Aerial photographs of the site show the cropmark traces of a large rectangular building with a number of small rooms, but the lidar imagery revealed no sign of upstanding remains. Also visible as a cropmark was a large ditch approximately 2m across seen curving around the southern and western sides of the building, possibly the original 'circumvallation' described by Colt Hoare. Other cropmark features included two large pits, one surrounded by a ring approximately 7.5m across some which might be interpreted as a contemporary well.

The second villa is located to the south-west on Postern Hill and was first seen as a parch mark during the drought of 1975. Aerial photographs revealed an L-shaped winged villa and traces of ancillary buildings enclosed within a roughly square walled compound approximately 84m x 88m. Subsequent fieldwork yielded tiles, tesserae and 2nd – 4th century AD pottery from the surface of the field (Wiltshire County Council SMR).

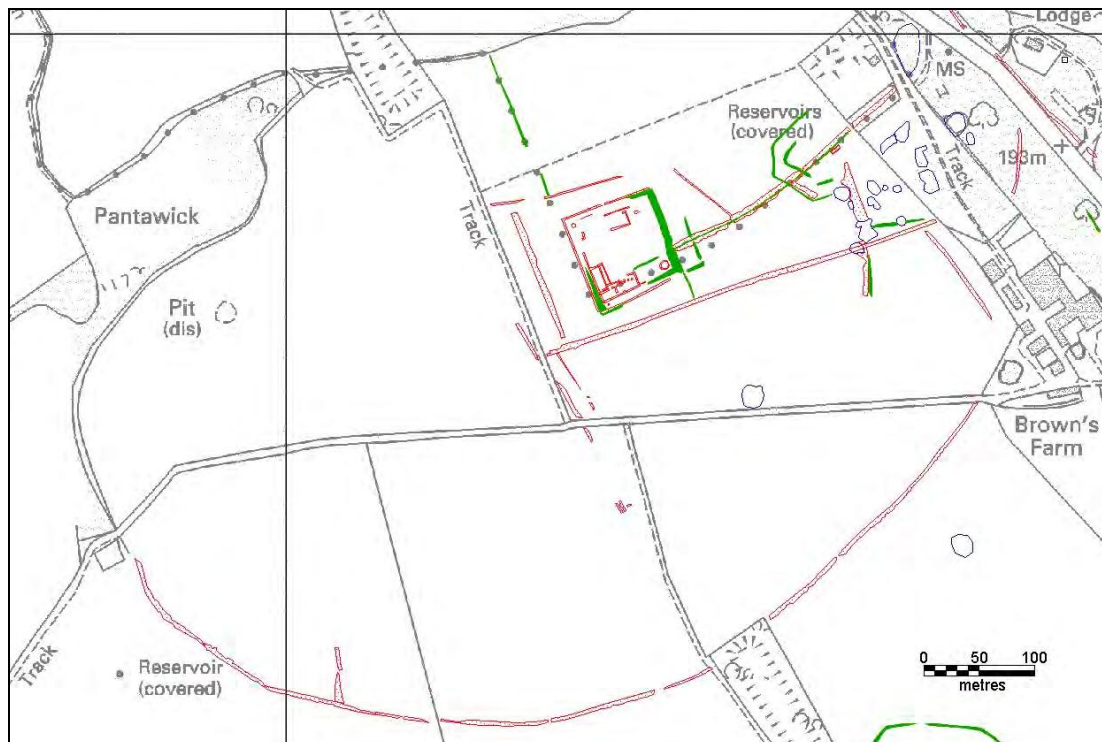


Figure 12 - Roman villa complex on Postern Hill with the traces of a possible incomplete enclosure or road visible to the south. © Crown Copyright. All rights reserved. This map is reproduced from the OS map by English Heritage with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. All rights reserved. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number 100019088. 2009.

Within eastern wing of the main villa building, the cropmark traces of two sets of paired pillar bases could be seen at either end of a large sub-divided room. Also noted in the south-eastern corner of the compound, adjacent to the entrance, were traces of a circular walled structure 7-8m in diameter possibly a building, perhaps a well house.

An apparently metalled road approximately 250m in length enters the site from the north-east, presumably branching off a larger road. This can be traced almost to the edge of the current A346 which follows the course of one of the many earlier routes from Marlborough. The line of the parish boundary between Marlborough and Savemake follows the course of the road to the villa, abruptly changing course through 90° to follow the rear boundary of the villa complex northwards. This strongly indicates that the Roman remains were still substantial enough to be utilised as boundaries when the parishes were laid out in the 11th century.

The main villa compound is surrounded by traces of further walled boundaries. The eastern ends of both the southern linear boundary and the roadway into the villa survive as slight earthworks detected by the lidar survey. Unfortunately, the lidar survey stops short of the villa so aerial photographs were the only source available for the majority of the site. The aerial photographs also revealed a curving (possibly metalled) feature extending from the corner of Brown's Farm, circling around the south of the villa, interrupted by the entrance to a now disused railway tunnel. It is not clear if this feature represents a boundary or road. An undated aerial photograph taken in the in the 1930s

(SUI967/11 (CCCI1758)) shows the eastern half of this feature marked by a field boundary, and the remainder visible as a cropmark. A map dating from 1820 shows the course of this feature marked by a curving field boundary which stands out in stark contrast amongst the surrounding rectilinear fields. The alignment and shape of the parcels of the earlier ridge and furrow are also affected. This feature may be a grubbed out hedge line, but the odd alignment indicates the presence of an earlier boundary or feature which may relate to the Roman villa. It terminates at the edge of a field, but if projected would meet the course of a current field boundary and track seen to descend the slope towards the Kennet river.

Prior to the Second World War, the fields occupied by the villa were used as a private airfield known as Marlborough Landing Ground. This strongly indicates that there were little or no surviving earthwork remains of the villa by the early 20th century.

Cunetio

Though lying immediately outside this survey area, the Roman town of Cunetio, the principle centre in this region, must be considered when discussing the Roman remains in the area as a whole. The settlement covered at least 18ha, but has been entirely levelled and the details of the site have been derived from aerial photographs and a few small excavations (Corney 2001). The town lies at the point where at least six main Roman roads converge to cross the River Kennet, and it is possible that Cunetio derives its name from that of the river. Corney 2001 suggests that the initial post-conquest phase of Cunetio could have been a military fort controlling this crossing, but no trace of such a site has yet been found. Aerial photographs reveal a town with grid of streets with several substantial buildings and at least two successive defensive phases.

Cropmark traces of a number of metalled roads can be seen extending out of the earlier unfortified settlement. One runs westwards along the Kennet valley, another route extends eastwards, curving north-east to a possible river crossing at Sheep Drove Bend. A third route branches out of the settlement to the south-east where it links with a major route which strikes diagonally up the scarp in a still prominent cutting. South of the town three roads appear to converge just outside Folly Copse, perhaps forming a single route to the south.

Savernake Ware

From the 1st to 3rd centuries AD Cunetio appears to have functioned as the principle market centre for the local pottery industry centred to the south within Savernake Forest (Hodder 1974, Swan 1975 and Timby 2001). This distinctive coarse-ware pottery known today as Savernake Ware was traded for the most part locally within Wiltshire (Hodder 1974, Timby 2001). The existence of this local pottery industry was first suggested in the 1920s (Watson 1921), and confirmed by K. Annable and colleagues in 1957-8 when two Roman kilns were excavated close to Bitham Pond near Column Ride in Savernake Forest (Annable 1962). More recently, kiln sites have been identified within Tottenham Park by Wessex Archaeology during a programme of test excavation (Wessex Archaeology 2005).

The pottery is classified as a coarse-ware, mostly large hand made jars (the principle

export), bowls decorated with burnished chevrons and wavy lines, and a range of finer wheel-thrown flagons, jars, bowls platters and beakers (Timby 2001). These forms were being produced from the mid to late 1st century AD, but the pottery forms, especially those from the kilns around Oare, were believed to be developed from a mixture of indigenous types and copies of Gallo-Belgic forms brought in by Belgic potters (Swan 1975). However, Jane Timby has subsequently suggested that these forms were a continuation of the Iron Age indigenous traditions rather than copies of continental wares (Timby 2001). Julius Caesar reported the settlement of Gallo Belgic groups in the 1st century BC. This has traditionally been thought to have occurred in the eastern counties of England. Barry Cunliffe has recently suggested that the region centred on Venta Belgarum – ‘market of the Belgae’ (Winchester) is most likely to be the area settled by Belgic peoples (Cunliffe 2005). The proximity of Venta Belgarum to Savernake Forest would explain any possible Belgic influence detected in the styles of Savernake ware.

Many of the kiln sites are believed to have pre-Roman conquest origins, and it is unlikely that the market would have developed so widely and rapidly without being already being established in the late Iron Age. Potters may well have adapted and expanded the production for the new Roman market. They would have been catering for both the indigenous population and the military market which was centred on Cunetio from the second half of the 1st century AD onwards. Production continued until well into the 2nd century (Timby 2001).

As suggested earlier, a number of the large villas within this region could represent large estates performing a number of functions, not necessarily purely agricultural (Walters 2001). It is possible that in this area some functioned as centres for ceramics production. The large villa located near to Postern Hill on the north-western edge of Savernake Forest is situated in an area dotted with clay extraction pits. Immediately to the east of the villa are the traces of extraction believed to have been dug for brick production in the 1800's, and a brick yard is recorded beside the road on a map of 1820, marked as a brick kiln on a subsequent map of 1845. Within the woods to the east of the road numerous pits have been noted both on aerial photographs and the lidar imagery. Though none have been investigated or dated, it is probable that this source of clay has a longer history of exploitation, and it is possible the Roman villa had connections with the nearby pottery industry.

A considerable hoard of late Iron Age coins (including one Roman coin of Tiberius (AD 14-37)) is purported to have been recovered during clay digging for a brickfield at the top of Salisbury Hill sometime between 1850 and 1880. Unfortunately both the date and find spot is vague (somewhere in the vicinity of Brown's Farm) and the coins were allegedly dispersed amongst Marlborough College boys so the tale cannot be corroborated (Soames 1880-1).

The success of an industry such as the Savernake potteries, producing bulky and fragile items would have relied on a local market and a good trading and transport network. At least two Roman roads pass through Savernake Forest. One (Margary 43) linked Cunetio to Venta Belgarum (Winchester), c.46.5km to the south-east. This route followed a straight south-easterly course through Savernake Forest, Tottenham Park, passing through the village of Crofton, crossing the Kennet valley before rising up onto the chalk again and continuing on to Winchester. The second road (Margary 44) branches off the Venta

Belgarum road approximately 1 km south of Cunetio and follows a straight course to Sorviodunum (Old Sarum) c.38 km to the south. Parts of the agger of both roads survive as considerable earthworks within Savernake, though the dense undergrowth in the wooded areas obscures much of the route. Outside the confines of the woodland survival is poor. Within Tottenham Park, where there has been considerable landscaping over the centuries, the course of the road to Venta Belgarum could be seen as a slight fragmented earthwork on historical photographs and a poor parch mark on photographs taken in the 1970s. Part of the agger could also still be seen as a slight earthwork on the lidar imagery, though little of the road structure was detected during a programme of sample excavations undertaken by Wessex Archaeology (Wessex Archaeology 2005). South-east of Tottenham Park the road is fossilized as the lane through the village of Crofton, continuing as an unmetalled lane over Doddsdown and Wilton Hill.

In the northern part of Savernake, between Cunetio and the junction of the two Roman roads, the course of the road had been plough-levelled and presumed to continue in a northerly direction to the core of the Roman town. No trace could be detected from the lidar imagery, but the aerial photographs revealed traces of the road (fragments of the parallel side ditches and a hint of the agger) extending north-west as a direct continuation of the road from Venta Belgarum, not leading straight into the heart of Cunetio to the north. Mark Corney (Corney 2001) suggests that this supports the idea that the site of the probable late Iron Age oppida on Forest Hill was initially used as the early post-conquest Roman base prior to the establishment of Cunetio in the valley below.

The Roman roads through Savernake would have been vital for distribution of Savernake ceramic wares through Cunetio, the main market centre for the area at the time. It is likely that these roads were constructed to replace established routes. The presence of a possible late Iron Age temple enclosure adjacent to the course of the Cunetio to Venta Belgarum (Winchester) road within Savernake Forest lends weight to the suggestion of an Iron Age route, at the very least coinciding with the Roman road at this point, assuming this was a roadside structure.

Medieval

Savernake Forest was an established royal hunting forest by the time of the Domesday survey, and in common with other royal forests was managed primarily for hunting of game, particularly deer by the King. Hunting rights and rights to gather tithes were granted by the king to various noblemen or the church, and the forest was used, abused and trespassed upon by commoners living around the periphery. Commoners and borderers (commoners living adjacent to the forest edge) exercised their rights to graze animals, collect firewood, brushwood and bracken. Though managed by wardens and bailiffs on behalf of the Crown they frequently poached, encroached and took wood, leading to overall 'harm' to the King's forest. By the perambulation recorded in 1301 around 80% of lands were recorded as disafforested, with two wooded parcels remaining which correspond to the present-day Savernake Forest. From 1415 to 1447 it was held 'in fee' by Humphrey, Duke of Gloucester, son of Henry IV. It passed into private ownership on the death of Catherine Parr in 1548 under a grant of 1547 when it reverted to a former warden Edward Seymour, Duke of Somerset.

The Great lodge

Prior to the emparkment of Savernake Forest and the creation of the deer park known as Savernake Great Park in 1570s, there were originally five hunting lodges (Bathe pers comm.). Vaguely marked on early maps, their exact locations have been lost. The possible site of only one, the Great Lodge, is thought to have been identified from aerial photographs on the western edge of the current limits of the Forest, west of the Marlborough-Salisbury road. Visible only as a cropmark, the site appears as a sub-rectangular enclosure (approximately 75m x 76m) defined by a bank with traces of an outer ditch. There are records of slight earthworks of a 'quadrangular work' noted in the vicinity by locals, but no suggestion made to explain the remains. Situated immediately to the north-east of Great Lodge Farm and exactly opposite the western end of Great Lodge Drive, it is a distinct possibility that this site represents the remains of the former Great Lodge. Great Lodge Drive is one of the eight drives known as Eight Walks laid out on the guidance of Capability Brown in the 17th century. The alignment of the drives appear to have been skewed slightly off the true compass points to align the E-W drive on the proposed site of the Great Lodge. An early map constructed by the Earl of Cardigan from a 16th or 17th century (itself a copy of a medieval map) held in the Savernake archive (Cardigan 1946) depicts the forest as almost double the current size with a large area of Savernake deer park extending to the west. This places the lodge more centrally in the forest. This historic map also indicates that the Great Lodge lay to the east of the Marlborough-Salisbury road, and not to the west as it appears today. However, the map also shows this earlier road taking a more westerly course through Wootton Rivers, which would indeed take the road past the lodge on the other side, adding weight to this theory.

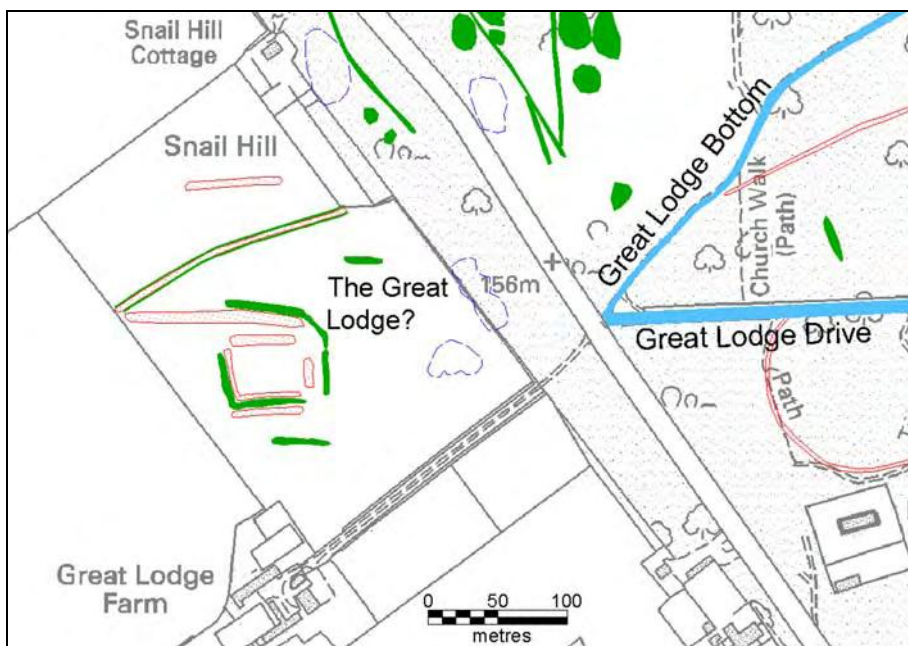


Figure 13 - Traces of a rectilinear enclosure, possibly the remains of the medieval/post medieval Great Lodge aligned on the course of Great Lodge Drive. © Crown Copyright. All rights reserved. This map is reproduced from the OS map by English Heritage with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office, © Crown Copyright. All rights reserved. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Licence Number 100019088. 2009.

Routes and roads through the medieval and post medieval Forest

Savernake Forest is littered with the traces of numerous hollow ways, many of which are almost certainly the remains of former routes through the forest. Where these ditches are seen to be concentrated it is more certain that they represent major routes which have become braided as new firmer routes are sought when another becomes impassable. This can be seen on slopes such as at Postern Hill where the earthwork remains of numerous alternative tracks up the steep slope could be seen in the fields on either side of the current Marlborough to Salisbury road. The course of the roads south of Marlborough and east towards London have changed through localised diversions as described above, for improvement of the route, or through re-routing of the road by the owners of the land. It is hard to date many of the minor track fragments, but the map constructed by the Earl of Cardigan has made it possible to identify some early tracks and roads (Cardigan 1946). His map also shows that the woodland was generally less dense than it is today, tending to be made up of more discrete woods and copses interspersed with open ground.

Within the northern parts of the forest the course of the former Marlborough to Bedwyn road is visible as a profusion of braided tracks which can be traced from close to the top of the Grand Avenue gates, splitting into two routes which skirt the north-eastern and south-western sides of a former woodland known as Bolesoak (Bathe pers comm.). The tracks converged again at a point on the course of the Roman road north of Eight Walks, following the Roman road to the point where it is crossed by the boundary of the Great Inclosure, then diverging to the ESE towards Great Bedwyn. This road was closed after 1795 (Bathe pers comm.). Where the Bedwyn road diverts around Bolesoak wood, the former course of the London road can be seen as multiple tracks branching off to the east, extending over 1 km along the southern side of the present road.

On the western side of Savernake the present day Marlborough-Salisbury road forms the current western boundary of the forest, following a south-easterly course via Leigh Hill to Burbage. However, it is likely that this was not the original route. Cardigan's map (Cardigan 1946) suggests that the road originally followed a course from Postern Hill south of Marlborough to Woton (Wootton Rivers). Today, the main road through Wootton Rivers can be seen to continue northwards out of the village where it becomes a track before disappearing in the vicinity of the parish boundary between Savernake and Wootton Rivers.

To the east of the Marlborough – Salisbury, road two further roads within the forest were noted on Cardigan's map. These extended from a pond called Walles Mere thought to be Thornhill Pond which still exists. The westerly route, 'Braden Way' extended SSW to Leighill (Leigh Hill), and the possible traces of the southern end of this track were seen on both the lidar and aerial photographs passing through the woods of Leigh Hill to the cutting of the now dismantled railway line. The second route, known as the Colerode Way extended south-east from the pond (Walles Mere), passing to the east of the hamlet of Durley in the direction of Tottenham Park. It terminated at the 'Great Ditch', an apparent green way curving south-westwards through Stock Common (Cardigan 1946). Traces of track fragments were seen extending through the woods along this approximate course which represent the former route. The Great Ditch may well be the

ditch referred to as the Magnum Fossatum in perambulations of the forest dating from 1300 and 1330 (Bathe pers comm.). The remains of a large ditch and bank which corresponds to this description could be seen on both lidar and aerial photographs to extend for over 1km across the northern section of Tottenham Park, crossing the course of the Roman road and the Grand Avenue immediately to the north of Tottenham House. A second linear ditch was also seen extending for nearly 4km from a point immediately north of Burbage Wharf. This linear could be seen passing through the traces of the earlier prehistoric field systems south of Durley village, skirting along the edge of Tottenham Deer Park, passing close to south of Tottenham House and through the Park to the edge of Birds Hole Wood. This too may equate to the course of the Great Ditch.

Great Inclosure

Within the north-eastern core of Savernake Forest there is a large roughly oval area enclosed by a low earthwork bank. It occupies a plateau between 160m and 170m OD with the south-eastern end cut NE-SW by a dry valley known as Shovel Bottom. The enclosure's NW-SE axis corresponds almost exactly with the course of the Roman road which can still be seen as a substantial earthwork in this part of the forest. Within the enclosure is the area known as Luttons Lye and the centre of the 'Eight Walks', the planned rides laid out in consultation with Lancelot Capability Brown (Ramsey and Bathe 2008). Much of the enclosed area is made up of several regions of open, grazed, parkland dotted with single mature trees, surrounded by young plantations of oak, beech and sycamore. Beyond the enclosure boundary the forest tends to be more self-sown with hawthorn and occasional large specimen trees (Ramsey and Bathe 2008).

The enclosure measures approximately 1220m x 1910m and is defined by a low bank ranging between 1.5m and 3.5m in width with traces in the northern and north-eastern sections of an outer ditch. Parts of this boundary were visible on aerial photographs, but with the exception of the south-eastern end, virtually all of the enclosure could be seen on the lidar imagery. Known as the Great Inclosure, it is recorded on early maps as an '*ancient enclosure (park or enclosure)*', but the exact date and function has been long forgotten (Ramsey and Bathe 2008). It appears as a partially fenced and hedged enclosure on the first dated map of Savernake of 1786, by which time all the rides and walks we see today had been laid out. The northern perimeter shares its course with the boundary of the parishes of Savernake and Mildenhall, and the north-eastern section marks the boundary between Savernake and Little Bedwyn, the three parishes meeting at a point on the enclosure bank at the Amity Oak (Ramsey and Bathe 2008). Towards its south-eastern corner the enclosure bank gently deviates to the south-west of the parish boundary for around 240m before petering out at the edge of the open area known as Bagden Lawn. It can be traced again for c.240m NE-SW to the south-east of Bagden Lawn close to an ancient oak called The Duke's Vaunt, before petering out again. The boundary is picked up just west of the course of the Roman road extending westwards to the dry valley known as Shovel Bottom. Here, a short section of the enclosure boundary at its southern-most point appears to have a very different form from the rest of the circuit where it crosses Shovel bottom. The boundary is thought to have incorporated what has been interpreted as a prehistoric cross valley dyke (Ramsey and Bathe 2008). The boundary changes direction and continues north-west skirting the open area of woodland pasture known as Woolslade and then the open pasture to the west of Eight Walks. From this most westerly point the boundary follows the line of a natural ridge

around the northern edge of Lutton Lye and the Eight Walks to complete the circuit.

As to the mystery of the origin of the enclosure, no mention is made in the records of a deer park being established here. Most of the surrounding parks were established in the medieval and post medieval periods. Chisbury Park's licence was granted in 1261 (Close Roll, 1259, 355), Savernake Great Park in 1575 (WSRO 9-22,204) and Wolfhall or Sudden Park (the family home of the Duke of Somerset (Bathe 2006)) by 1536 (WSRO 9-1-30) (Ramsey and Bathe 2008).

The presence of the bank with an external ditch strongly indicates that the enclosure was intended to keep animals and people out rather than in, the opposite of the park pale. The exclusion of beasts might have been done to allow sapling trees to mature without being damaged by grazing deer. The excessive over-exploitation of the country's forests has been recorded at various times in history. Apart from the plundering of the forests by wild animals (particularly young tree shoots and buds), severe damage could be done by grazing and the removal of wood, causing a severe shortfall in the numbers of mature trees, specifically oak for ship building to maintain the nation's navy. To this end, in 1544 Henry VIII passed a statute for the preservation of woods. The archives from the Savernake Estate suggest the Great Inclosure was under construction during the Tudor period, and documents from the Earl of Hereford (the son of Edward Seymour, the Duke of Somerset) track proposals initiated in 1594 to enclose a portion of the forest to exclude the deer enabling replenishment of the depleted woodlands. The enclosure boundary was to be a ditch, hedged with 'quick plants' (probably hawthorn and blackthorn) (Ramsey and Bathe 2008). The local commoners and borderers (occupants of adjacent lands) objected at an assembly at the Great Lodge to the enclosure which would exclude them from large area of the forest within which they could normally exercise their rights to pasture, browse, and to collect fire wood, heath, fern and thatching material. The matter appeared to remain unresolved when in 1598 the Earl of Hereford sought further confirmation that he has the authority to proceed with the enclosure. Though obviously completed, no further mention is made of enclosure in subsequent court records of the catalogue of trespasses and thefts from the forest, and the 1611 census of Savernake recorded deer within the forest (Ramsey and Bathe 2008).

When, in 1767 Capability Brown was consulted during the course of landscaping of the park, the Great Inclosure was included in these improvements; the interior was set as open parkland, and the forest outside designated as thick woodland (Ramsey and Bathe 2008).

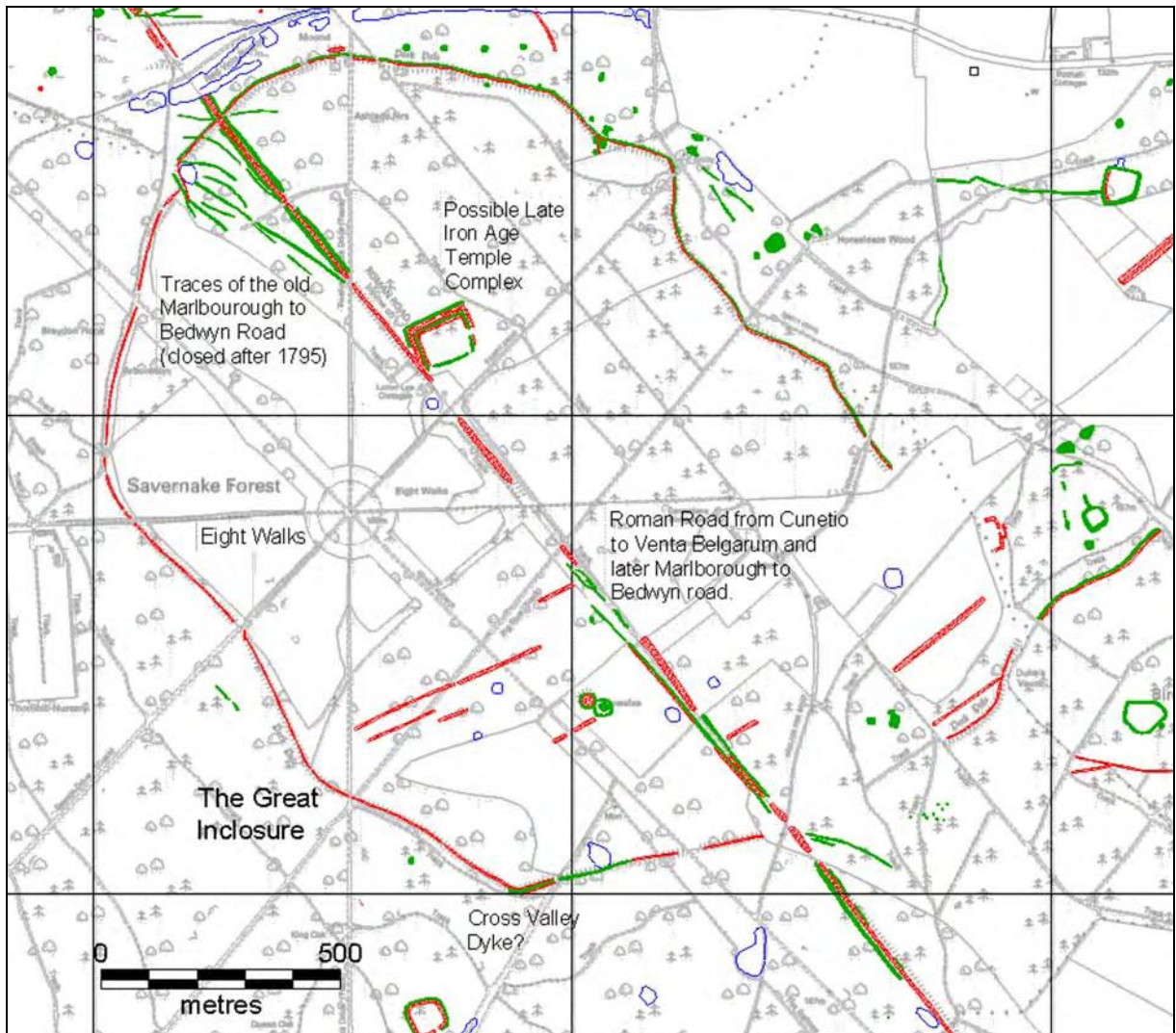


Figure 14 - The Great Inclosure and surrounding features at the heart of Savernake Forest bisected by the course of the Roman road. © Crown Copyright. All rights reserved. OS background map: English Heritage 100019088. 2009.

Possible medieval or later Boundary pits within Savernake Forest

Savernake Forest is littered with numerous pits and hollows, some as mentioned above are natural solution holes, though most probably result from centuries of exploitation of clay deposits. Particularly in the northern region of Savernake the aerial survey identified a number of alignments of large pits which have been suggested (Lennon and Bathe pers comm.) to have some relationship with former medieval or later boundaries, possibly acting as markers for the boundaries within the forest. One alignment of seven large pits closely follows the outer north-eastern edge of the Tudor Great Inclosure, which at this point is also the course of the boundary between the parishes of Savernake and Mildenhall. The pit alignment terminates close to the point this boundary meets the parish boundary between Mildenhall and Little Bedwyn. A second similar alignment was seen extending south-west from the point where the Roman road from Cunetio to Sorviodunum (Old Sarum) is crossed by the parish boundary between Mildenhall and Savernake parish, terminating at the possible Iron Age cross-dyke across Great Lodge

Bottom. This line is the course of the former division between the former parishes of North Savernake (within Selkey Hundred) and South Savernake with Brimslade and Cadley (within Kinwardstone Hundred), first formed out of the extra-parochial Forest in 1857 (Crowley 1999).

The Lost Tudor House of the Duke of Somerset

In 1548 Edward Seymour, the Duke of Somerset, started work on a grand new house close to his family home at Wolfhall. Edward was the brother of Jane Seymour, who died giving birth to Edward VI. Henry VIII willed that after his own death a Council of Regency of 16 chosen men would serve in the young prince's stead until he was old enough to rule, but Edward Seymour, one of the elected council, took advantage of his position as uncle to the prince. He acquired supreme power as Lord Protector acting as king in all but name. Whilst in power, he and the council appropriated wealth and favourable positions for themselves, and Edward became Duke of Somerset.

In the 1540s he embarked on the construction of a number of opulent mansions including the conversion of Syon House in Middlesex and commenced building of Somerset House in London. His last great scheme was to construct a country seat for himself at the Brails near to his childhood home in Wiltshire. The construction work is documented in the Longleat/Thynne Papers held at Longleat House, unearthed by the Reverend Canon J E Jackson in the 19th century. Letters and documents tracked this grand project which included a house and a park stretching from Bedwyn to Wilton, The planned park would have enclosed common land around Wilton and Great Bedwyn and severely impacted on the access and grazing rights of the local farmers. The documents state that 280 men were engaged and work commenced in 1548. Quarries were opened, bricks were made in nearby Dodsdown, and a conduit 1600ft long and 15ft deep was dug to supply water to the house. The foundations were laid and building commenced, but the house was never completed. Work ceased while the project was still in its early stages when building tensions in the Royal court caused by Edward's ambition for power led his peers to plot his downfall. Edward was arrested on the charge of felony and executed in January 1552 (Crowley 1999).

No plans survive, and the actual location of the house was never named in any of the documents, though contemporary letters mention nearby place names. Over time the site of the house was forgotten, though there have been a number of suggested sites (Bathe 2006). Jackson failed to locate the house, but found what he believed to be the conduit in Bedwyn Brail, deducing that the house must be to the south. The Great Conduit, as it is known today, is a massive partially water-filled ditch aligned NNE-SSW located between c.162m and 169m OD within the woods of Bedwyn Brail fed by at least two springs.

On the crest of a prominent hill south-east of Crofton village the cropmark traces of what appears to be square enclosure, approximately 53m square, have been seen on aerial photographs (Figure 15). The site is defined by a broad ditch with protrusions at the northern and western corners (possibly the foundations of corner towers), and has an apparently raised and compacted interior approximately 30m square (possibly a courtyard). Immediately to the south-east of the main site are the cropmark traces of three parallel broad ditches which could be the remains of terraces. The nearest is immediately adjacent to the main square foundation. Faint cropmarks of a curving feature

were also seen immediately to the south-west of the house on the opposite side of the road which may be a continuation of one of these ditches.



Figure 15 - Extract of an aerial photograph showing the cropmark of a square foundation adjacent to the former Roman road which may represent the foundations of the Duke of Somerset's failed mansion. NMR SU 5284/84 20-OCT-1998 NMR © English Heritage (NMR).

Subsequent consultation with Graham Bathe who has been investigating the location of a lost house of the Duke of Somerset, confirmed this site as one of three likely candidate locations, the others being situated within Bedwyn Brail (Bathe 2006). Recent excavations at the site of the Great Conduit undertaken by Graham Bathe uncovered a brick built conduit at the base of the ditch constructed from apparently Tudor bricks (Bathe pers comm. 2007).

Topographic analysis of the site indicates that the possible house foundations (just above the 170m contour) lie slightly above the height of the Great Conduit. Unless the source was channelled from the highest point on the hill it could not siphon water up to the level house itself. If this is the site of the house and the conduit that described in the records, it is entirely possible that conduit was designed to supply water to fountains and ponds in the gardens surrounding the house. This ambitious project and it is more than likely that The Duke of Somerset had a grand garden and park planned for his sumptuous country residence, undoubtedly intended to be a rural showpiece designed to impress (Figure 16).

A brief visit made by the project team to the proposed house site during 2008 identified considerable disturbance of the ground visible within the field which had been recently ploughed. Also noticeable were the considerable quantities of broken brick, tile, and fragments of pottery and slag within the plough soil in the vicinity of the cropmark. Whilst it was not entirely clear from the available evidence what period these remains belonged

to, this is undoubtedly the former site of a substantial brick building of some form set on a prominent hilltop affording fantastic views, and certainly warrants further investigation.

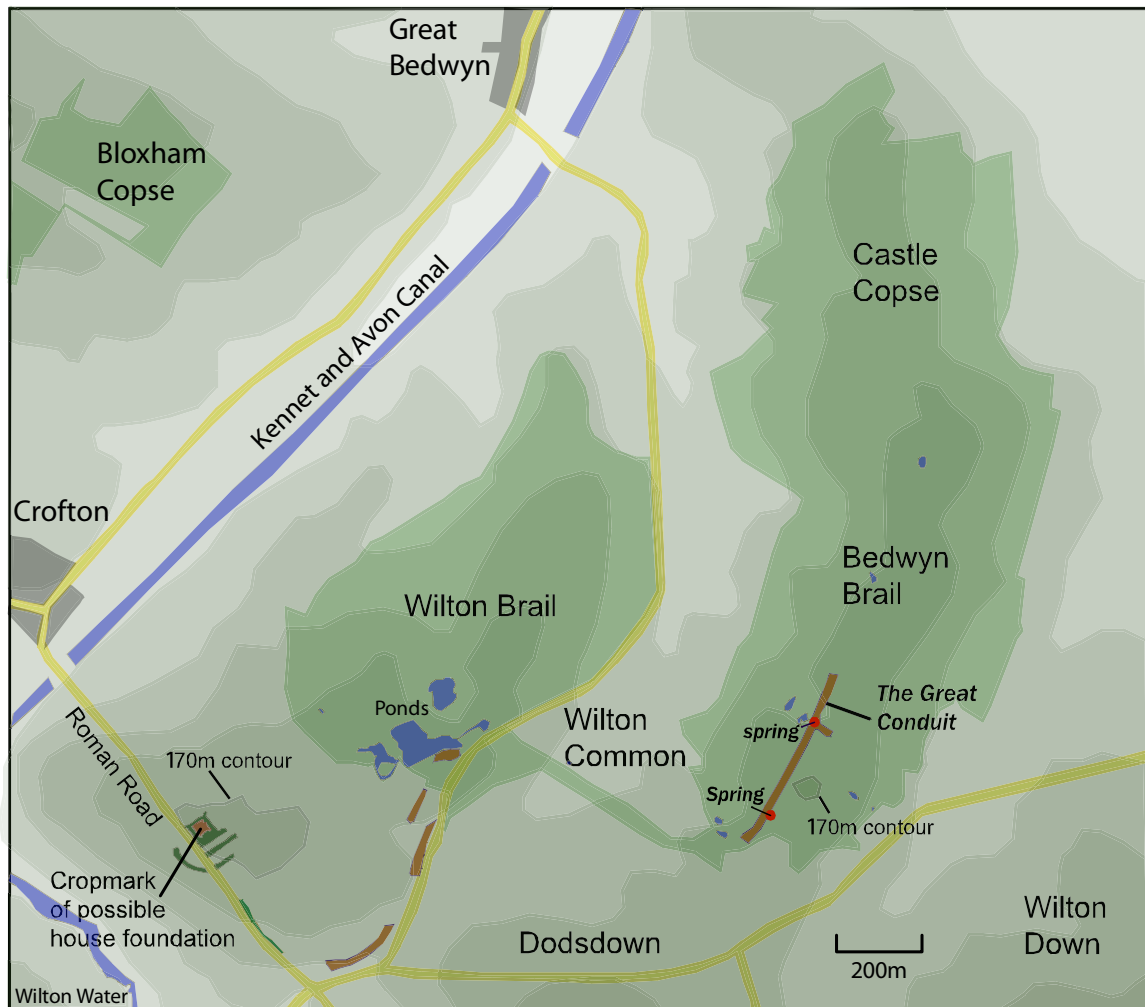


Figure 16 - The possible remains of the Duke of Somerset's house in relation to the Great Conduit in Bedwyn Brail. Background map and contour data derived from Ordnance Survey 1:25,000 sheets. © Crown Copyright. All rights reserved. English Heritage 100019088. 2009.

Post Medieval

In the late 16th century the western half of the area originally covered by Savernake Forest (beyond the Marlborough road) was impaled as Savernake Great Park, cleared of woodland for red and fallow deer. In the 17th century this was converted to agricultural use and a number of farms established. Brown's Farm near Postern Hill dates from 1618 (Crowley 1999).

In contrast, the surviving wooded areas of Savernake Forest to the east of the Marlborough road saw increased tree cover over time. Though privately owned from the 16th century, it was not impaled and the villagers on the periphery still had grazing rights within the forest. In the late 18th century coppices were amalgamated and areas of open heath planted with oak and Spanish chestnut. Replanting for commercial purposes

occurred between 1894 and 1911, and the woodland was leased and managed by the Forestry Commission from 1939. Since then there have been programmes of replanting and management of the woodlands both with deciduous and some (20% of the forest in 1995) coniferous trees (Crowley 1999).

In 1723 the 3rd Earl of Aylesbury redesigned the parkland of Tottenham House under guidance from Capability Brown (Day 2007). This included the planning of the two straight rides – Column Ride extending WNW from the house to the Marlborough-Andover road, and Grand Avenue aligned NW following close to the course of the Roman road. Where the avenue met at the London road, two great gate piers were erected. Between 1764 and 1786 this redesigning shaped the woodland around Tottenham House establishing parkland clearings, paths, drives and the nodal point called the Eight Ways – the meeting point of eight rides corresponding to the points of the compass (Crowley 1999). These rides are in actual fact slightly skewed from the true compass points to align Great Lodge Drive on the two former lodges to the east and west.

World War II

The onset of the Second World War set in motion events which were to alter the lives of the people of Britain. In particular, quiet rural areas frequently found themselves suddenly exposed to fundamental changes with the establishment of the numerous military installations. Marlborough and surrounding villages and the woods of Savernake Forest were all to play their part in the nationwide war effort. At nearby Ramsbury an airfield was established, which for most of the war was manned by American forces of the USAAF, and Savernake Forest was designated as a military ammunition dump, again serviced by American soldiers for much of its life. The arrival of the huge numbers of American servicemen in this sleepy English backwater must have had a massive impact on the lives and outlooks of the local population. Surprisingly, despite the intensity of the wartime activity in the area, very few traces survive in the landscape today.

Marlborough Landing Ground

Prior to the war a small private airfield known as Marlborough Landing Ground had been established to the south of Marlborough just west of the A346 close to Postern Hill in fields adjacent to Brown's Farm. From 1936 the airfield was being used regularly by Chilton Aircraft Ltd and by the RAF Central Flying School (CFS) based at RAF Upavon for forced-landing tuition. All private flying ceased with the outbreak of World War II, but the CFS continued to use the site until 1942 when operations moved to Overton Heath (Day 2007). No trace of the airfield could be seen on wartime photographs, presumably because the grass landing strip was never consolidated. The site of the airfield encompasses that of the 2nd-4th century AD villa and possible late prehistoric temple enclosure described in the Villa Estates section above and it would seem that no extant trace of the villa or the metalled road leading to the site survived to cause obstruction to landing aircraft.

Ramsbury Airfield

The major part of this section is derived from the work of Berryman 2004. Located on a plateau above the River Kennet at the northern edge of the survey area, the

remains of the former World War II airfield were recorded from aerial photographs taken after the war. It was constructed between May 1941 and August 1942 in response for the need for more airfields with training and operational facilities for the bomber squadrons, becoming a satellite to the airfield at Membury 6.5km to the north-east. The airfield had concrete runways, the main one measuring 6,000 feet (approximately 1830m), 28 pan-type hard standings or dispersals, two T2 hangers, a control tower and support buildings. The accommodation for the airfield personnel was in the woods to the east of the site.

In 1942 the site was allocated to the USAAF as one of several bases for their preparations for operations in mainland Europe. The first American forces, the 64th Troop Carrier Group (TCG), arrived in August 1942 equipped with Douglas C-47 (Dakota) planes to ferry supplies from the entry ports of Liverpool and Bristol to other USAAF bases around the country. In November 1942 the TCG were dispatched to Algeria for Operation Torch, the invasion of North Africa.

Ramsbury was then transferred to the No.70 Group, RAF Training Command. No.15 (Pilot) Advanced Flying Unit ((P)AFU) arrived at the airfield in December 1942 to provide advanced training for pilots trained elsewhere under the Empire Training Scheme (EATS). They were moved out of Ramsbury in September 1943 to accommodate the US forces again, becoming USAAF Station No.469 in November 1943. For the remainder of the war Ramsbury was used as a training and operational base for 434th, 435th and 437th TCGs of US 9th Air Force in their roles in the Allied operations building up to and following D-Day. The Base was used as a launching point for troop and supply deployment and returning casualties from D-Day (6th June 1944), D-Day +1 (7th June 1944) and Operation Market Garden (17th September 1944). The US forces finally departed in June 1945, returning Ramsbury briefly to the RAF for use as a satellite training airfield for Welford and then Upavon before being closed at the end of March 1946, and returned to agricultural use. Some accommodation buildings were taken over by the Wiltshire Agricultural Committee as a hostel for the Women's Land Army until it was finally disbanded in 1950. Other buildings were briefly used immediately post-war to house refugees from Poland and the Ukraine in a camp for Displaced Persons set up by Wiltshire County Council until permanent homes could be found.

By the mid 1960s most of the concrete runways had been removed and surviving buildings incorporated into Darrell's Farm built on the junction of the two shorter runways. All that remains is few runway fragments, the Station Operations Centre, a few original storage buildings and part of the southern perimeter road used as a farm track.

The majority of the airfield elements were recorded from RAF vertical photographs taken immediately after the war, before the run-ways were taken up. Later photographs reveal a number of potentially ambiguous cropmarks where the concrete hard standings once stood to the south of the main runway. Because of its location on the edge of the survey area, only the southern edge of the airfield was mapped. The features recorded included the end of the main runway, the perimeter road with numerous of the pan-type and D-shaped dispersals, dispersed buildings and one, possibly two heavy AA anti-aircraft gun emplacements situated close to the south-western end of the main runway.

Savernake Forest and its Role in World War Two

(The major source drawn upon for this section is that of Day 2007, *Savernake at War*)
In common with many stately homes and parks, Savernake Forest and Tottenham House and some adjacent farms and civilian sites were requisitioned within weeks of the outbreak of World War Two for a range of military purposes.

The Royal Army Medical Corp (RAMC) took over Tottenham House on 5th October 1939; on 17th October soldiers moved into barns of Warren Farm to the north of Tottenham House, and in January 1940 Wolfhall was occupied and yet more soldiers accommodated at Warren Farm.

In July 1940 control of the ammunition service was taken over by Whitehall, one function being to maintain ammunition supplies. Pre-war munitions depots rapidly became unable to accommodate the accelerated output from the munitions factories, and new depot sites were sought. Open air sites such as woodland, road verges and field edges were preferred because they required considerably less effort to establish than purpose built depots. The new depots were required to be within easy reach of two railway stations. Savernake had the specified rail access, and being predominantly broad leaved woodland provided excellent cover to conceal and dampen potential explosions (Day 2007). Savernake's nearby stations - High Level station and Marlborough station were prepared to process up to 60 railway wagons a day, and on 14th July 1940 a total of 556 men from three separate corps were dispatched to Savernake to prepare the forest for its new role as 22 Ammunition Sub-Depot (22ASD). The capacity of a dump was based on the strict guidelines dictating the size and distances between ammunition stacks which depended on the type of explosive or chemical. Stacks were spaced to limit the damage and the possibility of chain explosions (of which there were several) and limit loss from a direct hit during an air raid. The forest rides, paths and tracks, including the Eight Rides, provided easy access for the vehicles ferrying the ammunition arriving by rail. Many tracks were consolidated to withstand heavy traffic in all weather conditions. The men were accommodated in a camp made up of a mixture of old railway coaches and huts in the northern part of the forest at Iron Gates, the entrance to the Grand Avenue. This was supplemented initially with a tented encampment on Marlborough Common before billets were found in the stables at Tottenham House. Additional huts were built in Tottenham Park later in the war (Day 2007).

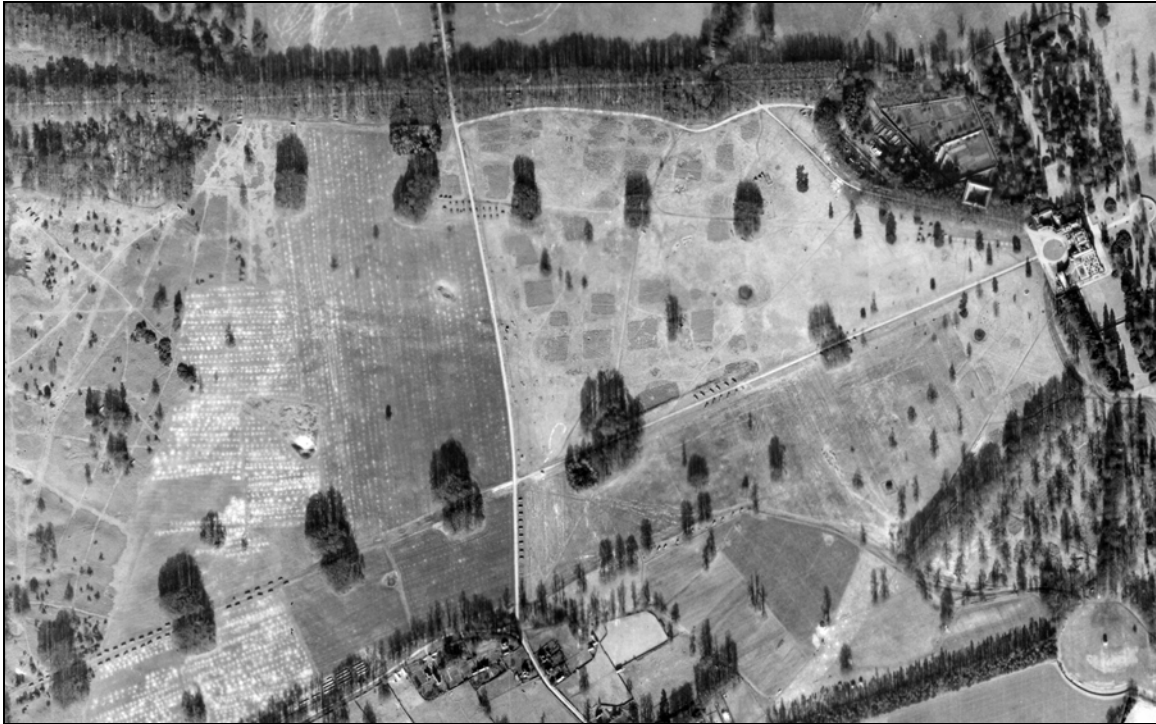


Figure 17 - Dispersed ammunition storage along Column Ride within Tottenham Park in March 1944. *NMR US/7PH/GP/LOC209 5017 08-MAR-1944 English Heritage (NMR) USAAF Collection.*

Both the RAF and USAAF vertical aerial photographs taken between 1942 and 1946 revealed the extent of this storage operation. Following preparation in the summer of 1940 the ammunition storage operations started swiftly and were concentrated in the north-western half of Savernake Forest. However, the earliest available photographs date from March 1942 showing the southern half of Tottenham Park when operations had been extended to encompass Tottenham Park and the woods to the east and north-east with areas of storage visible along the Grand Avenue and in Bedwyn Common. Also visible were a small number of well hidden accommodation huts in trees to the north of the kitchen garden, slit trenches and several gun emplacements around the grounds of the house. USAAF photographs from March 1944 clearly illustrate the escalation of storage activity with munitions stores extending eastwards to Froxfield and up to the railway line and Kennet and Avon canal. Storage shelters were visible throughout Savernake Forest, Tottenham Park and the adjacent woods of Cobham Frith, Knowle Cowleaze, Bedwyn Common and along London Ride. Thousands of covered ammunition shelters could be seen in discrete clusters and lines along rides, paths and tracks. The arrangements of stacks could be seen to alter slightly over time as the stored ammunition was processed and replaced.

On the aerial photographs the ammunition stacks had the appearance of Nissen-style huts, but were in fact mostly semi-temporary structures made up of curved sheets of corrugated iron covering the stacks of shells or crated ammunition. The main forms of shell storage were the Standard 'Elephant' huts made up of 21 (arranged 3 x 7) sheets of curve corrugated iron. Ammunition stacks were raised on bricks for ventilation with net or waterproof covers at the open ends of the arc. Smaller 'non-standard I.G. Shelters' constructed from 2 x 5 sheets of corrugated steel were also used. More portable items of

ammunition such as 12 bore and revolver rounds, and pyrotechnics for the shells were stored in more secure Nissen-type ammunition stores. These were constructed from corrugated steel plates, had a concrete floor, brick ends with doors protected by an outer brick traverse, and covered in earth to aid concealment (Day 2007). Thirteen of these brick-built stores were seen on aerial photographs at intervals along the length of the Grand Avenue, appearing as an elongated mound between 11m and 14m in length, and approximately 6.5m across. These were surrounded on three sides by a substantial banked enclosure (between 24m and 26m in length) open on the road-ward side. A single isolated Nissen shelter was also seen mid-way along Charcoal Burners' Road. A number of these shelters can still be seen overgrown with vegetation and in varying states of ruin within the woodland along the Grand Avenue.

Chemical weapons such as gas were stored in a separate area away from the explosive ammunition stores. The main site was outside Savernake Forest in the woods of Cobham Frith. Known as 'G' Site, this was kept secret and secured with a 24 hour road block. The chemical weapons were stored in trenches with sandbag walls and corrugated iron roofs. A second site, 'Y' Site, was located within Savernake between Sawpit Drive and Charcoal Burners' Road (Day 2007). The chemical stores at 'G' Site in Cobham Frith were visible on the aerial photographs taken by the USAAF in September 1943 and March 1944. These stores could be seen to take two different forms. Those on the eastern side of the road through the woods were relatively small and could clearly be seen to be placed in excavated pits spaced between 8m and 10m apart in two parallel rows. Two further areas of stores of more conventional covered shelters were only seen later in 1944 spaced along two woodland tracks to the east. The location of 'G' Site could not specifically be differentiated from the clusters of storage piles within Savernake Forest.

The lidar derived imagery revealed a number of irregular linear banks enclosing areas of flat ground on either side of Sawpit Drive, Column Ride and Twelve o'clock Drive forming a triangular block in the core of the forest. The enclosed areas averaged between 80-90m by 50-55m in size and were evenly spaced on either side of the track. When their location was combined with that of the storage areas visible on the WWII photography a strong correlation between clusters of storage arcs and these earthworks could be seen. Examination on the ground revealed that the banks had no associated ditch and had the appearance of having been piled up, possibly the result of bulldozing an area to clear it. In 'Savernake at War', Day 2007 mentions levelling ground in preparation for storage in the woods, so it is possible that these earthworks are the remains of levelling. However, these features do not appear on the wartime photographs which clearly show the actual storage shelters. Perhaps these structures post date the storage, possibly representing clearance of the storage sites after the removal of the ammunition. These earthworks were recorded in a triangular arrangement of rides roughly corresponding to the area (described by Day 2007) occupied by the chemical weapons 'Y' Site, and may represent clearance of the soil where the toxic weapons had been stored (Figure 18).

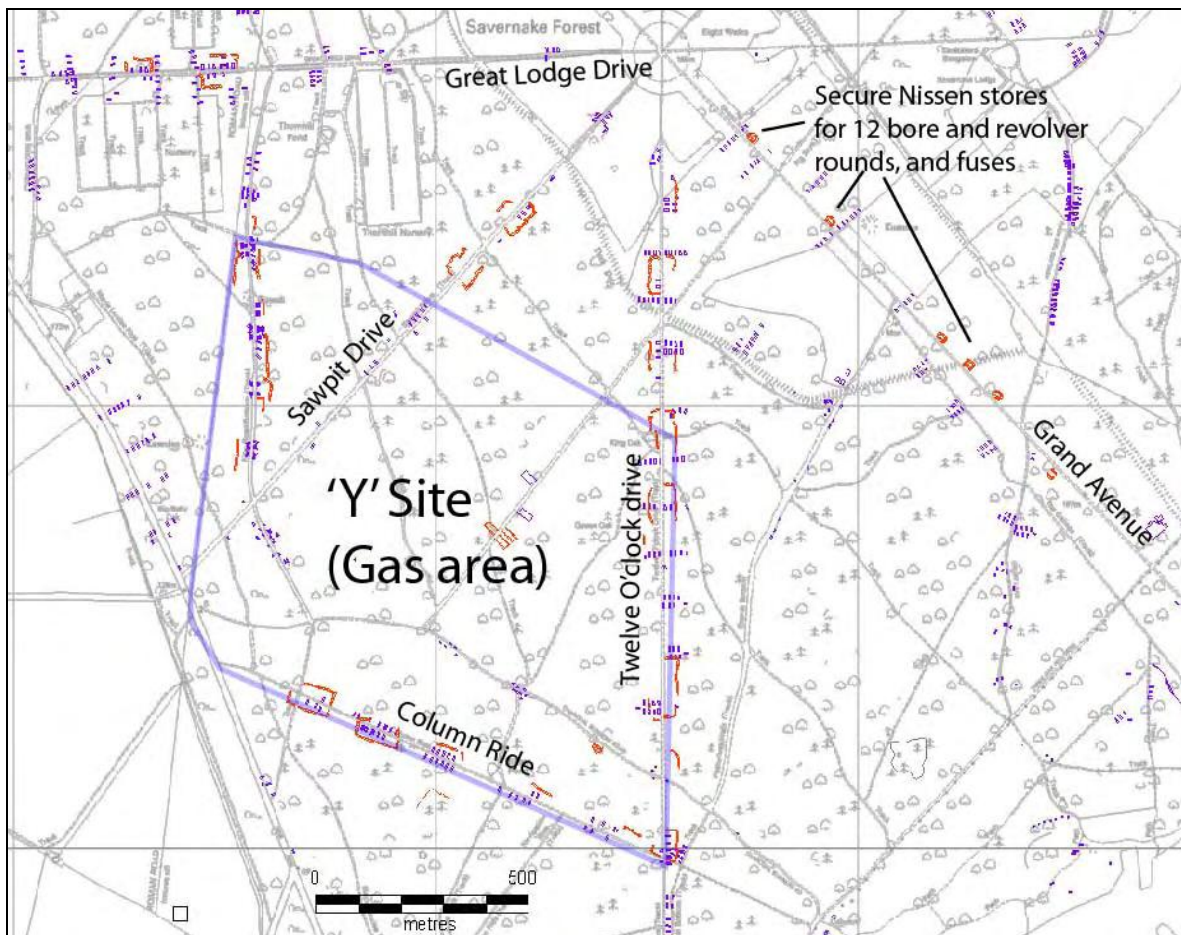


Figure 18 - Extract of mapping showing clusters of munitions stores (purple) and earthen banks (red) along the main rides and drives within Savernake in relation to the 'Y' Site gas storage area. These were recorded from wartime photographs taken in 1944 and 1946. OS background map: © Crown Copyright. All rights reserved. English Heritage 100019088. 2009.

Until the summer of 1943, all military supplies, equipment and the ammunition stores were transported by rail to Marlborough (Savernake Low Level) Station or to Savernake High Level Station on the M&SWJR to the south of the forest. From there everything was transported by lorry into the forest. This was inconvenient to say the least and Marlborough goods yard was becoming inadequate for handling the increasing volume of ammunition destined for Savernake. A dedicated spur (North Savernake Mileage Sidings) off the existing M&SWJR was opened in August 1943 enabling rapid transit of ammunition onto waiting trucks to be transported the short distance into the adjacent forest (Day 2007). To the west of the forest the line of the main and later branch lines were visible on aerial photographs from the 1940s, but all lines have long since been removed. There were several incidents involving the ammunition stores, but the worst by far occurred after the war on 2nd January 1946 when Savernake was being cleared of both allied and captured enemy ammunition stores. Destined to be dumped at sea, a consignment of ammunition was being prepared at the Mileage Sidings by drilling holes in the crates to hasten sinking. Whether this was the cause is not certain, but there were two massive explosions involving the outgoing train and an inbound train bearing ammunition from South Wales, resulting in the deaths of eight soldiers and the serious injuries to several others. The Mileage Sidings were seriously damaged and two craters were caused by the

blasts (Day 2007). By July 1946 the sidings can be seen on aerial photographs to be back in order with the tracks replaced. In November 1946 loaded trains can be seen in the sidings and storage shelters are still abundant in the forest. Savernake remained in use until the end of 1949 when the forest was declared free of ammunition and demilitarised. Today all that remains of the military occupation of Savernake Forest are the brick walls and concrete floors of the Nissen huts which lined the Grand Avenue and scattered remnants such as gun emplacements, pill boxes, water tanks and buildings and the remains of the railway sidings.

LIDAR ANALYSIS

The lidar data

One of the main reasons behind the Savernake project was an opportunity to test the latest methodology for using the lidar data within a mapping project. The latest versions of AutoDesk Map (2007 onwards) include the facility to view raster surfaces with interactive hill shading defined by a user-controlled light source together with height exaggeration. Placing these facilities within the CAD environment means that, it is now possible to combine the mapping elements of CAD with the 3D facilities that allow the enhancement of lidar data, which are so crucial in its interpretation. It was hoped that using fully interactive lidar data would produce a more accurate and detailed plotting of features than had previously been possible using flat 2D imagery. One aim of the project, therefore, was to carry out a systematic analysis of the value of using fully interactive lidar data in a wooded area.

Lidar has previously been used for recording archaeological features in woodland in the UK (Hoyle 2005) and in Europe (Doneus et al 2008, Sittler 2004), but in general the ground truthing has consisted in confirming the presence or absence of features on the ground. One aim of this aspect of the Savernake project was not only to confirm presence or absence, but also to carry out detailed metrical comparison between the results recorded from the lidar derived imagery and from survey on the ground. This comparison compared not only the geometric accuracy of the plotting from the lidar derived imagery (ie were the features being recorded in the correct position), but also their interpretational accuracy; the aim was to carry out a detailed survey of a given feature and then compare this interpretation with that obtained from the lidar derived imagery. These elements of the project were carried out by staff from the English Heritage Archaeological Survey & Investigation team and the results are reported below.

A degree of analysis was also carried out to assess the overall impact of the lidar data. One element of this was a comparison between the different lidar data sets; the first return data was only useful in open land without tree cover. Whilst the last return data was an acceptable source for interpretation in some wooded areas, the presence of the remainder of tree trunks etc made this much less useful than the filtered DTM. This included a brief analysis of those areas where the lidar data was less useful such as regions where areas the data for the forest floor was incomplete or degraded due to lack of penetration through the forest canopy. Comparison with the Forestry Commission records for the forest showed that with a couple of exceptions the worst areas of pixilation, and hence lack of penetration, were found over Corsican Pine, Douglas Fir and Norway Spruce, all coniferous species; in most cases these areas also lay over examples of these species planted within the last 20 - 25 years. This is a something that Peter Crow at the Forestry Commission has done more detailed research into; his analysis of the effects of different species and undergrowth on the viability of lidar has shown that these types of trees, especially when in their pre-thinned state are very restrictive of lidar penetration and the examples in Savernake seemed to fully support his findings.

Comparison of lidar data v conventional aerial photographs

Another aim of the methodological aspects of the project was to assess the relative value

of using lidar versus conventional aerial photography. To this end, rather than using the lidar derived imagery as just another source to be examined simultaneously with the conventional aerial photographs, each map sheet was mapped using aerial photographs and lidar derived imagery independently of one another. Because mapping was carried out by the same team members it is impossible to be certain that knowledge of sites recorded via one medium did not influence the search for features using the other, but as far as possible mapping was carried out separately without reference to other sources. For each map sheet all features were recorded using standard NMP methodology, but with the duplication of layers according to source (i.e. BANK and LIDAR_BANK etc). This meant that it was possible to compare not only the number and type of features recorded, but also their relative locational accuracy. Because the lidar derived imagery is based on data with residual accuracy of 10 – 15cm it has been assumed that the mapping based on this is always more accurate than that from rectified aerial photographs. The detailed survey comparison described below confirmed this.

It had also been assumed that for those areas of actual woodland within the Forest there would be very little visible on the conventional aerial photographs. In fact in the only other project that has looked at a largely wooded landscape, the Forest of Dean NMP (Small & Stoertz 2006), this had not been entirely true as a large number of features were recorded from within the core area of the forest. However, these were almost exclusively large features related to industrial activity such as extractive pits and spoilheaps and since such activity was not expected to be found within the bounds of Savernake it was believed there would be little recorded within the woodland; this was particularly thought to be the case with regard to the prehistoric settlement enclosures that were assumed to exist within the woodland, given their distribution in the arable land around the forest in the general vicinity. In the Forest of Dean only a single probable prehistoric enclosure had been found during the NMP survey, whereas many more were recorded from the lidar data. This did not turn out entirely to be the case in Savernake. As well as the massive number of features related to the wartime use of the Forest as a wartime ammunition storage area (see above) a surprisingly large number of features of varied dates were visible on conventional photographs through fortuitous flight dates in winter when the trees were largely without leaves and ground cover was low.

It is difficult to calculate the precise number of monuments recorded by each source because the final records do not record every source on which a given feature was present, but rather the key source that best illustrates the feature. It is possible to calculate the number of individual features recorded (as opposed to monument records) based on the two separate mapping processes and of the 5803 features recorded from the various sources 1765 were recorded from lidar data, as opposed to 4038 from conventional photography. These figures however are heavily skewed by the military remains as 2180 features were recorded from the 1944 USAAF photographs, the vast majority of which were single military ammunition storage shelters. If, taking into account the above problems, the actual monuments recorded are analysed based on the recorded source then of the 350 monuments 166 (47.5%) were recorded from lidar, 131 (37.5%) from traditional aerial photographs and 53 (15%) from both. As has been noted above this figure cannot be considered an absolute representation of the source for any given monument, but should preserve the general impression of sources, which suggests that for the Savernake project aerial photographs and lidar were equally valuable sources. It is true that the majority of features recorded from conventional aerial photographs within

the wooded areas were military, and that Savernake is unusual in having such a wealth of post medieval archaeology of interest, but this does not alter the fact that more features were recorded within the woodland than were expected. Furthermore there were a significant number of features visible only as cropmarks. Lidar is sometimes able to record traces of large positive earthwork features such as field boundaries even after decades of degradation through ploughing because residual traces of the feature exist. This is not the case with smaller features and those that consisted largely of ditches; where there is no physical trace of the feature on the ground and all that remains are subsurface deposits that affect the growth of the crops planted above them then there is no height difference for lidar to record. Work has been carried out elsewhere (Challis et al 2006) to examine the effectiveness of analysing the intensity values to predict buried deposits based on their moisture content, but this has so far proved to be inconclusive. No examination of this aspect of the lidar data was used during the Savernake project.

As noted above, one of the key findings from the survey was the number of earthwork sites that were visible on conventional aerial photographs when a thorough and systematic analysis of the images was carried out. Two particular sites will serve to demonstrate the usefulness of the conventional photography; a probable late prehistoric settlement enclosure and an Iron Age enclosure that was previously known in part, but had been substantially revised by the use of lidar data.

The first site lies in Hen's Wood near the northern edge of the survey area and consists of an area of probable medieval fields and a late prehistoric enclosure. A number of the presumed medieval field boundaries have been fossilised in the landscape and are recorded on the Ordnance Survey base map, but analysis of the lidar data revealed that they were more extensive than presently recorded covering an area of nearly 20Ha (UID 1470424). More importantly, on the eastern edge of the fields and clearly cut by one of the main field banks was a roughly 'D-shaped' enclosure defined by a bank and external ditch (UID 1470423) (Fig 19). This had not been recorded previously and seemed to be a good example of the benefits of using lidar in woodland. Examination of RAF photography from the winter of 1952, however, showed that the enclosure and the presumed medieval fields were both clearly visible and indeed certain elements of the enclosure were easier to see on the photograph (Fig 20).

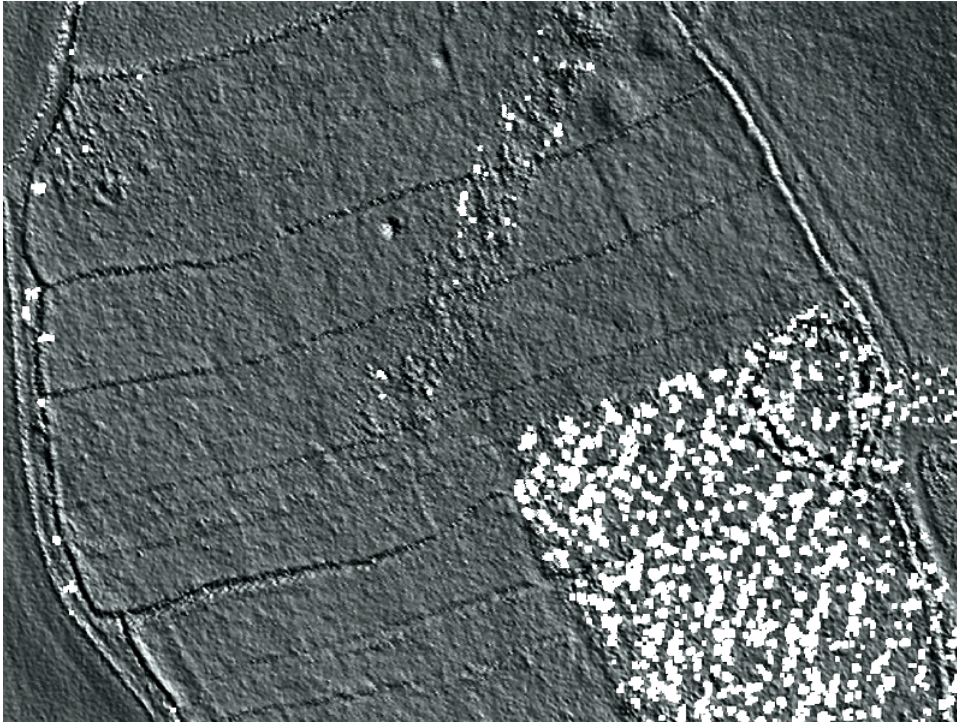


Figure 19 – A probable late prehistoric enclosure and field boundaries of medieval date in Savemake Forest. The previously unrecorded enclosure is visible middle right. Lidar image copyright English Heritage 2008; data copyright Forestry Commission - Source Cambridge University ULM (May 2006).



Figure 20 – The same probable late prehistoric enclosure and field boundaries as seen on the lidar image. Although previously unrecorded the enclosure is arguably clearer on this conventional RAF photograph than on the lidar derived imagery. RAF 540/958 4175 01-DEC-1952 English Heritage (NMR) RAF Photograph.

The second site lies in the heart of the main block of woodland just to the north of

Braydon Oak. Here there is an enclosure part of which is recorded on the current Ordnance Survey base map (Fig 22). The site is not recorded on any of the early county series maps and although it was first recorded following excavations by boys from Marlborough College in 1934 it does not appear on the 1943 maps at either 6" or 1" scale that show only the earthworks related to some quarry pits to the south. The site was initially recorded as a seven sided enclosure during the Marlborough College excavations which recovered large amounts of Iron Age C pottery and further pottery was found later on the surface. The site was survey by the Royal Commission on the Historic Monuments of England (RCHME) in November 1974 and recorded as comprising "three sides of a squarish 'enclosure' each side of about 50.0m formed by a ditch with a slight outer bank." It was recorded that there was "now no trace of a fourth side (on the E) but an equally uniform ditch extends from the SE angle." Although the RCHME recorded this as a three sided enclosure and the boys of Marlborough College as seven sided, the evidence from the lidar showed quite conclusively that the site actually consists of two conjoined enclosures, although their precise relationship is unclear (Fig 21). The interesting fact was that once again examination of a range of aerial photographs ranging in date from 1944 to 1970 revealed that large sections of the north and eastern edges were visible and could have been recorded from the photographs if systematic analysis of all available photographs had been carried out (Fig 23).

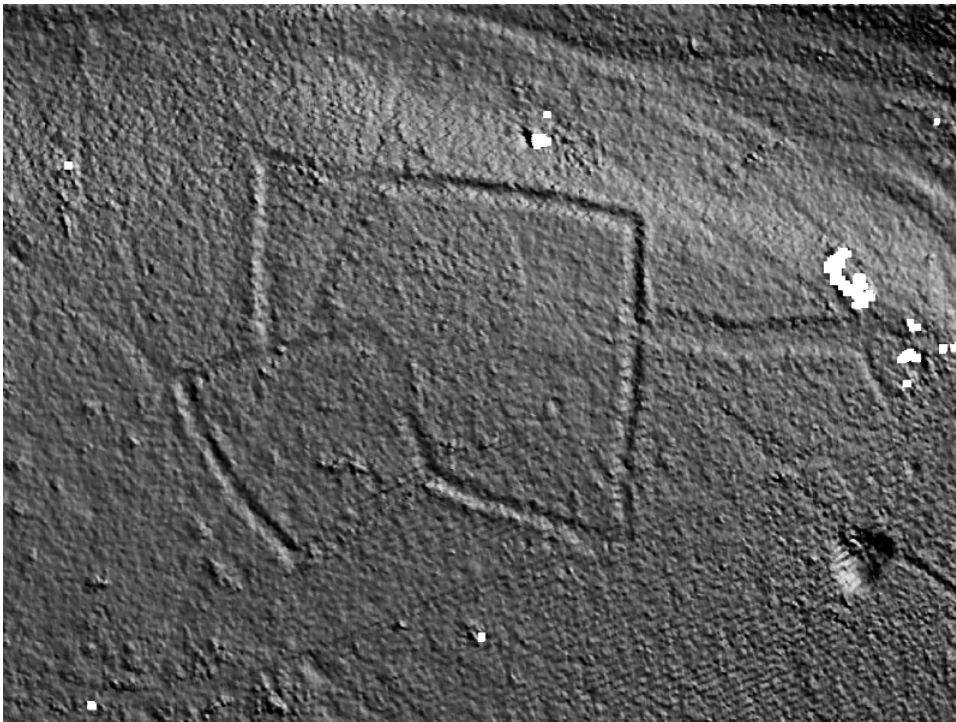


Figure 21 - A late Iron Age enclosure in Savernake Forest. The southern edge of the enclosure had previously been recorded on the ground, but its complexity had not been realised until analysis of the lidar data. Lidar image copyright English Heritage 2008; data copyright Forestry Commission - Source Cambridge University ULM (May 2006)

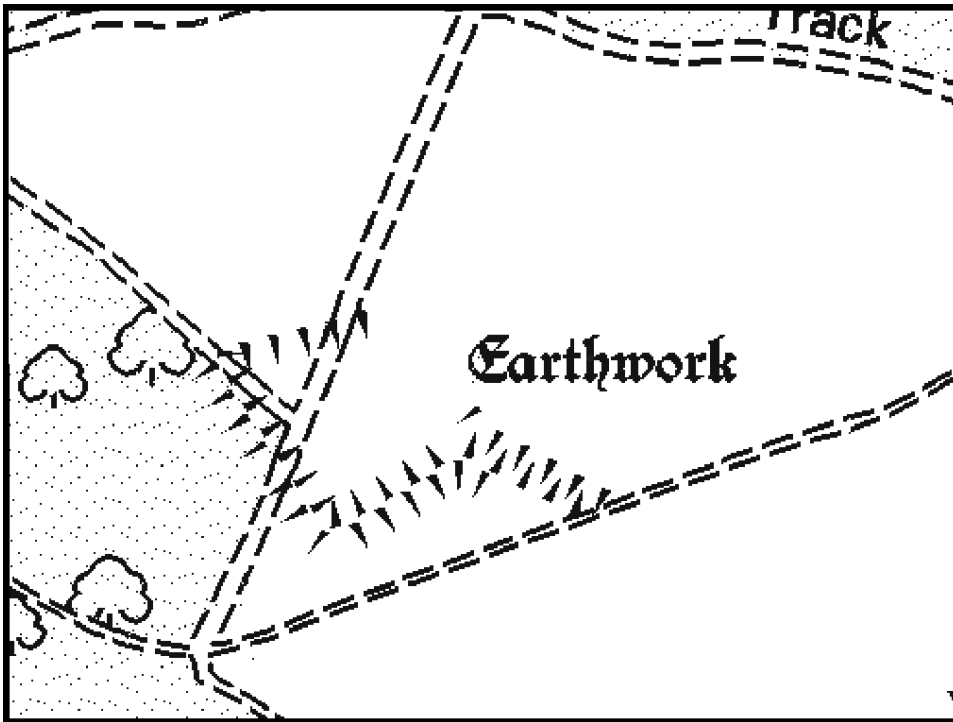


Figure 22 – Part of the southern side of the enclosure is recorded on the Ordnance Survey map. OS background map: English Heritage 100019088. 2009.



Figure 23 - Examination of a range of aerial photographs from 1944 to 1970 revealed that large sections of the north and eastern edges were visible previously such as on this 1969 OS photograph. OS 69014 06 07-MAR-1969 © Crown copyright. Ordnance Survey.

One final set of sites show the benefits of using the combination of lidar data together with conventional aerial photographs. During the interpretation of the lidar data a series of odd banked earthwork enclosures had been found. They were roughly rectangular in shape, but the individual sides that made up the enclosure were quite irregular in their formation, almost as if they were made up of sections of bank that had been joined together (Fig 18). It was only the analysis of the aerial photographic evidence that helped to provide a possible explanation for the sites due to their regular coincidence with the blocks of ammunition storage visible on the aerial photographs; see the section on Savernake Forest and its Role in World War Two, especially page 41 above for a more detailed explanation and interpretation of the features. Without the combination of the lidar data and the conventional aerial photographs it would have been much more difficult to interpret these features and understand their place in the forest.

Field validation - Detailed ground survey of enclosures and associated features on Church Walk

Introduction

One of the enclosure complexes newly revealed by lidar was chosen for large-scale detailed survey in order to test the metrical accuracy and interpretation of the features as mapped from the lidar plot. A group of features on the line of Church Walk (SU 207 672) was identified as being suitable for this purpose because of its relative complexity and intrinsic archaeological interest. The site occupies a level area on a spur with the ground dropping away gently to north, east and south. As well as the interpretative plot produced from the lidar derived imagery, the lidar imagery itself was also examined during the course of the survey to analyse other features that might cause confusion during interpretation and to assess the nature of anomalies on the ground. The image was provided as both a simple hillshaded surface and as a surface with the plotting overlaid. In both cases the model was lit from the north-east at an elevation of 25° with a vertical exaggeration of three times the actual.

Description

The main enclosure (**A** – SU 26 NW 211) is a sub-oval area surrounded by a bank, up to 0.3m high internally, and external ditch, generally 0.5m deep but up to 0.7m at the northern corner, with a slight counterscarp, no more than 0.2-0.3m high, around almost the entire perimeter. There is no clear entrance, though there is an area of shallow ditch and lowering of the banks on the south-eastern side (**a**). The enclosure survives as an earthwork even where it is crossed by Church Walk, though it is much reduced here. There are no discernible internal features, except for those caused by the construction and use of Church Walk (**b**).

Attached to the western side of this is a second, elongated enclosure (**B** – SU 26 NW 213) consisting of a prominent but narrow ditch, up to 0.4m deep, with intermittent remains of an internal bank no more than 0.3m high. Around the western end of the site the internal scarp of the ditch, 0.4m high, is the dominant feature; the outer scarp is very slight. Unfortunately, at the point where the two earthworks join on the south side (**c**) there is no clear indication of a chronological relationship. On the north side there is a gap (**d**) between the first enclosure and the terminal of the ditch of the second enclosure. This terminal is out-turned to conform to the boundary of enclosure (**A**); if this is an original feature, as seems likely, it indicates that enclosure (**B**) cannot be earlier than

enclosure (A). However, though this out-turn is probably the site of an original entrance, it could be due to damage by the construction and use of Church Walk. Along its northern side the enclosure ditch of (B) has been disturbed in two places where holes, up to 0.8m deep, have been dug into it.

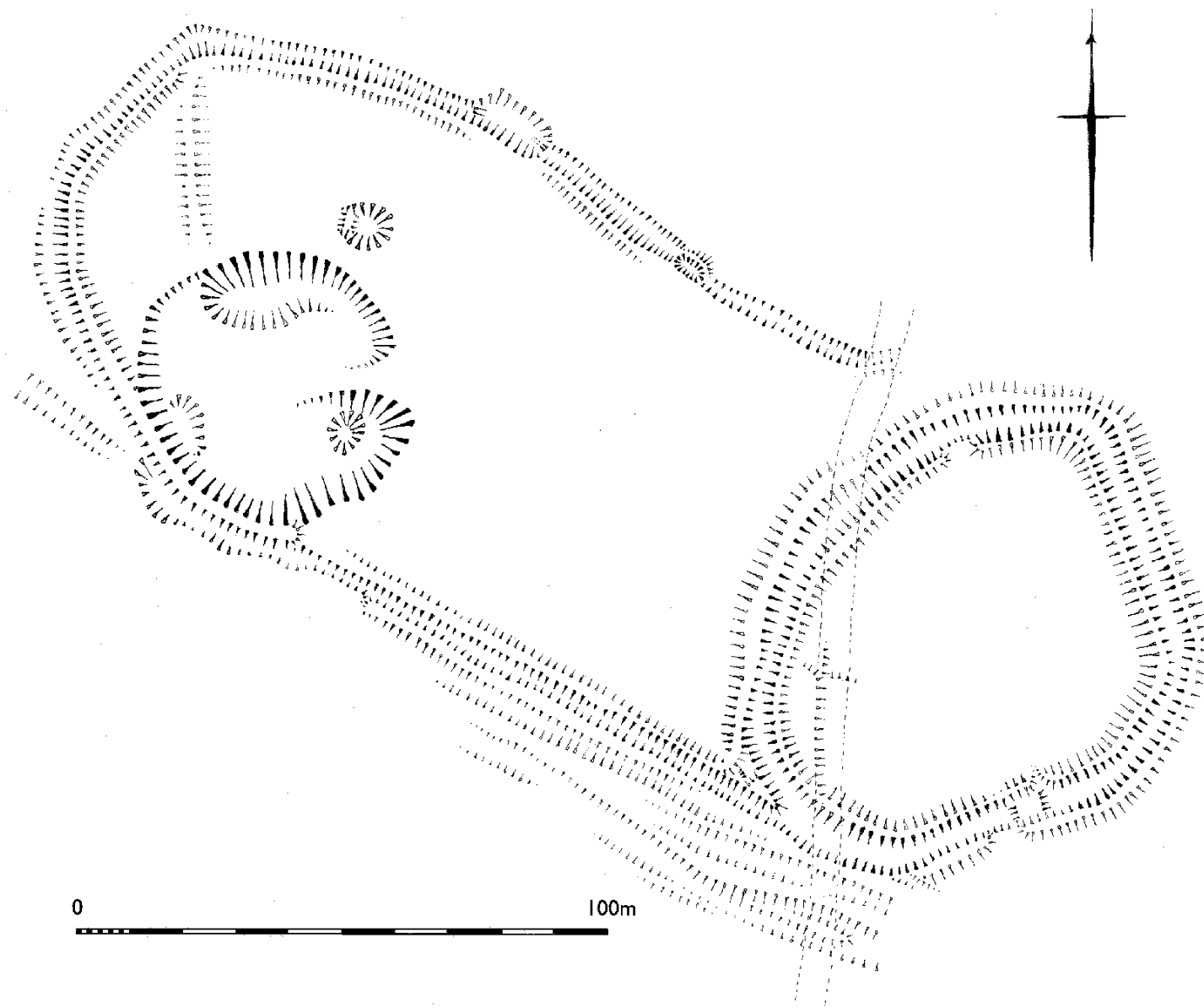


Figure 24 - Field survey of the Church Walk enclosures and associated features. © English Heritage.

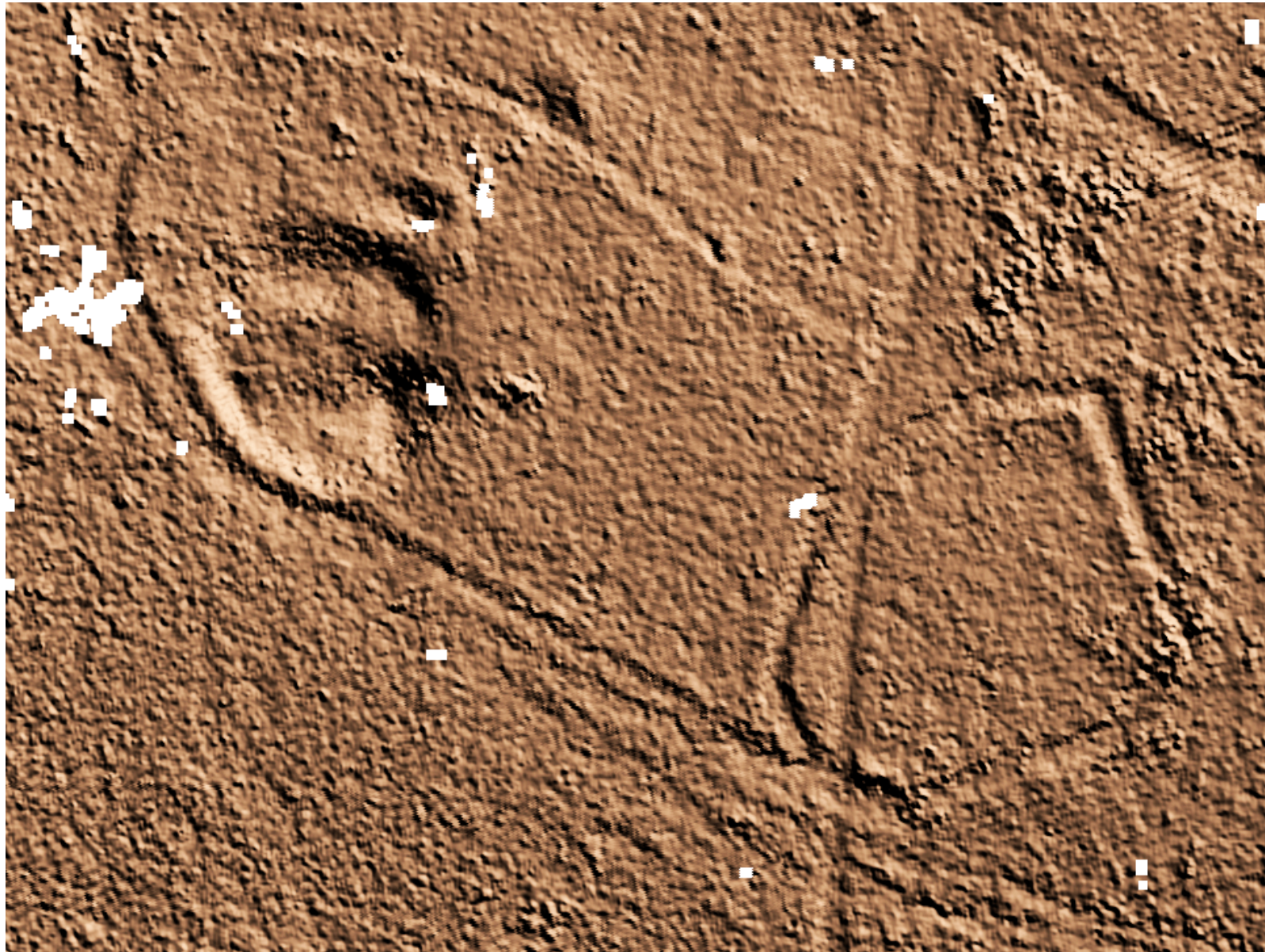


Figure 25 - Lidar derived image of Church Walk enclosures and associated features. Lidar image copyright English Heritage 2008; data copyright Forestry Commission - Source Cambridge University ULM (May 2006)

Within the second enclosure and near its south-western edge is a circular quarry (**e** – SU 26 NW 212). This appears to have a ramped entrance from the east and there are areas of deeper working within it, at least one of which (**e1**) appears to be a secondary intrusion. On some OS maps this is shown as a pond; it was dry at the time of survey. The maximum depth of the quarry is about 2m. There is also a smaller subsidiary quarry pit to the north (**f**), about 0.8m deep. Superficially, the enclosure ditch appears to curve outwards to respect the edge of the quarry, suggesting that it is later; however, closer inspection suggests that the line of the enclosure has been altered by the dumping of quarry waste and perhaps the passage of traffic. Also, the quarry appears to cut the enclosure bank on the west side. A series of linear hollows (**g**) runs outside the south side of the second enclosure and approximately parallel to its ditch. Initially the idea that this might be part of a multiple linear ditch system was entertained but inspection of these features further down slope to the east (not surveyed) shows that they are hollow ways (as noted also by Graham Bathe, pers comm). The ditch of enclosure (**B**) may have been re-used as one of the hollow ways.

Also within the second enclosure and close to its western end is a very low bank (**h**). There is no discernible relationship between this bank and either the enclosure or the quarry.

Interpretation

In the absence of any clear relationships it is impossible to develop a firm relative chronology for the various elements of this site. The two enclosures (**A** and **B**) could be contemporary with one another, the second forming an annexe to the first. Possibly against this is the different form taken by the surrounding earthworks of the two. As noted above, the form of the earthworks on the north side suggests that enclosure (**B**) cannot be earlier than (**A**). Even the relationship with the very regular circular quarry (**e**) is uncertain, though it appears that the quarry is later than the enclosure. The hollow ways (**g**) running along the south side of the complex also have no direct relationship with the enclosures or quarry; all that is clear is that they are not leading to the quarry, the entrance to which is inside the enclosure. The slight bank (**h**) seems to lie entirely within enclosure (**B**) and may therefore be a sub-division of it. All that is certain is that the enclosures are earlier than Church Walk, which cuts across both of them.

Morphologically, enclosure (**A**) could be a late prehistoric settlement, with numerous parallels across the region. The elongated enclosure (**B**) is more difficult to identify as a type. Cartographic evidence suggests that in the 18th century or earlier there was a house here known as Bushell's House. There are no earthworks on site that suggest the presence of a building but that negative evidence is not conclusive. Bushell was a brick maker, so the quarry may have been his clay pit (Graham Bathe, pers comm).

Comparison of lidar and ground survey results

The lidar provides a good, accurate indication of the overall shape and an accurate location for this complex of features. The shapes of the main enclosure ditches and the main quarry match almost exactly on lidar (image and plot) and ground survey. The sharp northern angle of enclosure (**A**) that is such a prominent feature of the lidar is reflected, though perhaps less acutely, in the ground survey; conversely, the north-western corner of

enclosure (B) appears slightly more angular on the ground survey than on the lidar. The course of the hollow ways along the south side also differs slightly, appearing more sinuous and more complex on the ground survey than on the lidar plot, though this probably reflects only the larger working scale of the ground survey. A small hollow (e2) in the south-west edge of the quarry, that was noted during the field investigation but not surveyed, has been added to the plan with some confidence by tracing directly from the lidar image.

The ground survey has provided some additional detail that is not apparent on the lidar and has elucidated the difference in form of the two enclosure earthworks – a bank with external ditch and counterscarp in the case of (A) and a ditch with slight internal bank for (B); the lidar transcription shows only that the ditch of enclosure (A) is broader than that of enclosure (B). Generally the lidar has picked up the ditches clearly but has been less successful in showing positive features; the very slight bank (h), for instance, is not visible on the lidar image. More significantly perhaps, though part of the inner bank of enclosure (A), on the north side, can be seen on the lidar, other parts of it cannot and the counterscarp bank, admittedly slight, is nowhere visible on the lidar. On the other hand, the small quarry pit (f) is visible on the lidar image (perhaps with the benefit of hindsight) but was not plotted. The later damage on the north side of the enclosure (B) ditch is visible on the lidar plot but its detail is not clear.

There are also apparent features on the lidar derived imagery, at (j) and (k) for instance, that were not seen on the ground; these might be explained by the vegetation – a holly bush in the case of (j) and a large fallen tree at or near (k). A dense bank of holly at the extreme west end of the site has resulted in loss of lidar data. The lidar image also has a series of north-south trending 'stripes' across the centre of enclosure (B) and extending to the north; again these were not definitely identified on the ground but ruts caused by forestry vehicles were seen in this general area.

There is a slight discrepancy, which is only to be expected, between the lidar/EDM position of Church Walk and the OS detail; this is exacerbated by any enlargement of the OS map above its original survey scale.

Ground observation might have been expected to reveal further information about the chronological relationships between the various elements but unfortunately in this case, partly because Church Walk passes across the points where the two enclosure earthworks meet, it has not provided any more definite information on this crucial question.

Conclusion

The site:

The Church Walk complex consists of a sub-oval enclosure (A), almost certainly of late prehistoric date, and an elongated enclosure (B), which could be contemporary but which is probably of later, but unknown, date. The latter enclosure has been disturbed by quarrying, notably by what is probably a clay pit belonging to a documented brick maker. A series of undated hollow ways runs along the south side of the enclosures and seems to have partly re-used the ditch of enclosure (B).

The lidar survey and the ground survey:

Comparison of the lidar image and plot with the ground survey plan reveals almost exact agreement over the location, size and shape of the archaeological features; given the 'soft' nature of the earthwork detail involved, the representations could be regarded as 'identical' in terms of accuracy. However, the ground survey shows extra detail that is not visible in the raw lidar data and includes an interpretative element. The lidar plot also includes a degree of interpretation but shows considerably less detail because it was carried out at a smaller scale than the ground survey (1:2500 as against 1:1000).

The quality of the lidar derived image is such that, even when enlarged to 1:1000, it presents a readable and useable representation of the ground surface. It is conceivable that a suitably experienced archaeologist could, with data of this quality, create an accurate large-scale interpretative plan of a site directly from the lidar derived image, without the need to undertake a control survey. However, the archaeologist would have to be aware of several limitations in the data set, especially: false features caused by vegetation response and related factors; lack of definition or absence of very slight features (especially, on the evidence of this study, positive ones); discrepancies between mapped OS detail and lidar positioning of the same detail, exacerbated by any enlargement of the OS base. In this study only one relatively minor feature was supplied in this way: an interesting test would be to try this experiment by surveying a suitable site (with suitably high quality lidar data) entirely by this method, checked by electronic ground survey.

CONCLUSIONS

There are two key conclusions from the Savernake survey. The first is that there is no doubt that the use of lidar data when surveying any area that has a substantial degree of woodland cover is essential, as its ability to penetrate the tree canopy and reveal features on the ground is unrivalled. Whilst it is true that there are some forms of vegetation where it is less successful, specifically densely spaced coniferous woodland, it is also true that under such conditions any form of traditional ground survey, either walkover or more detailed GPS recording, would be equally ineffectual, if not more so. Even in these areas of less responsive vegetation, with careful image manipulation and analysis it is still possible to tease out data that would have been virtually impossible to record by any other means. This is supported by the fact that, as noted above, of the 350 monuments 166 (47.5%) were recorded from lidar, 131 (37.5%) from traditional aerial photographs and 53 (15%) from both; furthermore for the areas of actual woodland this figure rises to closer to 90% recorded from lidar. Apart from the military features dating from WWII and afterwards very few (56) of the sites were recorded from the aerial photographs as opposed to over 200 from the lidar derived imagery. Only a handful of features were recorded solely from aerial photographs. When using the lidar data the combination of 3D viewing of the data with an interactive viewer such as QT and the direct manipulation of the files within AutoDesk was much better than having to use the single illumination imagery. It is unclear whether access to the PCA imagery would have been a major improvement. Whilst it is clearly much better than single illumination imagery, the ability to manipulate the data on the fly in 3D probably allows the same degree of image analysis. It would probably be useful to run a small trial in future to compare the relative benefits of the PCA imagery versus full 3D manipulation in terms of efficiency and resources.

The second conclusion is that whilst lidar is of great benefit in a wooded area it is not a universally applicable survey methodology and will not record all features in the landscape. Specifically if there is no surface indication of any given feature then lidar will be unable to record its presence. Therefore, in any landscape with a combination of wooded and non-wooded areas it is imperative to use a combination of sources, including a structured examination of all readily available aerial photographs, if you wish to gain a full picture of the archaeology.

BIBLIOGRAPHY

- Andrews and Dury 1773. *Map of Wiltshire 1773*. Devises 1952
- Bathe, G 2006 'The Duke of Somerset's Grand Mansion at The Brails, Great Bedwyn; A Review of the Evidence'. *Wiltshire Archaeological and Natural History Magazine*, **99** (2006), 236-245
- Berryman, D 2004. *Wiltshire Airfields in the Second World War*. Countryside Books, Newbury
- Bewley, R.H. 2001 'Understanding England's Historic Landscapes: An Aerial Perspective'. *Landscapes* **2.1**, 74-84
- Burnham, B C and Wachter, J 1990 *The Small Towns of Roman Britain* : Batsford.
- Cardigan, Earl of 1946. 'The Wardens of Savernake'. *Wiltshire Archaeological and Natural History Magazine* **51** (1946) 271-339
- Challis, K, Howard, AJ, Moscrop, D, Gearey, B, Smith, D, Carey, C & Thompson, A 2006 'Using airborne lidar intensity to predict the organic preservation of waterlogged deposits'. in Campana, S. & Forte, M. (eds) *From Space to Place: 2nd International Conference on Remote Sensing in Archaeology*. BAR International Series **1568**, 93-98
- Cooke, N 2003 'Excavation of Roman Features and Deposits on the Outskirts of Cunetio (Mildenhall), Marlborough, in 1997, (contributions by Moira Laidlaw and Jacqueline Mckinley)'. *Wiltshire Archaeological and Natural History Magazine* **96** (2003), 26-32
- Corney, M 2001 'The Romano-British Nucleated Settlement of Wiltshire'. In Ellis P (ed) *Roman Wiltshire and After: Papers in Honour of Ken Annable*. Wiltshire Archaeological and Natural History Society (2001), ???
- Crowley, D A (Ed) 1999 'Kintwardstone Hundred' in *A History of Wiltshire XVI*: Oxford University Press, Oxford 1999
- Crutchley, S 2008 'Using lidar in archaeological contexts: The English Heritage experience and lessons learned.' In Heritage GL, Large, ARG, and Charlton, ME (eds) *Laser Scanning for the Environmental Sciences*. John Wiley and Sons Ltd (2008), 180-200
- Cunliffe, B 1973 '*The Period of Romanization*', in The Victoria County History of Wiltshire, Vol. 1 (ii), 439-67
- Cunliffe, B 2005 *Iron Age Communities in Britain* 4 edn. Oxon: Routledge
- Day, R 2007 *Savernake at War: A wartime history of Savernake Forest 1940-1949*. Whitehorse Press, Newbury.
- Doneus, M, Briese, C, Fera, M & Janner, M 2008 'Archaeological prospection of forested areas using full-waveform airborne laser scanning'. *Journal of Archaeological Science* **35**

(2008) 882 - 893

Hogg, AHA, 1979 'British Hillforts: an index' in *BAR British Series*, Vol. **62**, 209

Hoyle, JP, 2005 *The Forest of Dean, Gloucestershire, Archaeological Survey, English Heritage Project Number 2727, Stage 2: Pilot Field Survey*, Unpublished circulation draft for English Heritage, Gloucestershire County Council Archaeology Service April 2005

Lobb, S 1995 'Excavations at Crofton Causewayed Enclosure'. *Wiltshire Archaeological and Natural History Magazine* **88** (1995), 18-25

Mowl, T 2004 *Historic Gardens of Wiltshire*. Stroud: Tempus

Oswald, A, Dyer, C and Barber, M 2001 *The Creation of Monuments: Neolithic Causewayed Enclosures in the British Isles*. English Heritage

Passmore, A D 1903 'Diary of Wiltshire' Ms 1903-42 (Devizes Museum) 487

Pugh, R B and Crittall, E (eds.) 1952. A history of Wiltshire: volume I, part I in *The Victoria history of the counties of England*, Pages(s) 83, 267

Ramsay, J and Bathe, G, 2008 'The Great Enclosure of Savernake with a note on Cross-Valley Dykes'. *Wiltshire Archaeological and Natural History Magazine*. **101** (2008) 158 - 175

Robinson, P 2001 'Religion in Roman Wiltshire'. In Ellis P (ed) *Roman Wiltshire and After: Papers in Honour of Ken Annable*. Wiltshire Archaeological and Natural History Society (2001) ???

Sittler, B 2004 'Revealing historical landscapes by using airborne laser scanning: A 3-D Model of Ridge and Furrow in Forests near Rastatt (Germany)', in Thies, M, Koch, B, Spiecker, H, Weinacker, H (eds) *Proceedings of Natscan, Laser-Scanners for Forest and Landscape Assessment - Instruments, Processing Methods and Applications. International Archives of Photogrammetry and Remote Sensing XXXVI*, Part 8/W2 (2004), 258 – 261

Small, F 2002 *The Lambourn Downs: A Report for the National Mapping Programme*. Aerial Survey Report Series AER/13/2002.

Small, F & Stoertz, C 2006 *Forest of Dean NMP: National Mapping Programme Report*. English Heritage Research Department Report Series no. 28/2006. ISSN 1749-8775. English Heritage.

Soames, Rev C 1880-1 'Coins found near Marlborough'. *Wiltshire Archaeological and Natural History Magazine* **19** (1881), 87-8

Timby, J 2001 'A Re-appraisal of Savernake Ware'. In Ellis P (ed.) *Roman Wiltshire and After: Papers in Honour of Ken Annable*. Wiltshire Archaeological and Natural History Society (2001) ???

Walters, B and Phillips, B 1982 *Archaeological Excavations in Littlecote Park: interim Report 3*, Swindon.

Walters, B 2001 'A Perspective on the Social Order of Roman Villas in Wiltshire'. In Ellis, P (ed) *Roman Wiltshire and After: Papers in Honour of Ken Annable*. Wiltshire Archaeological and Natural History Society

Wessex Archaeology 2005. Land at Tottenham House, Great Bedwyn, Wiltshire. Archaeological Evaluation Report

Wiltshire Archaeological and Natural History Magazine 2008. Excavations at Bedwyn Brail (interim report). Wiltshire Archaeological and Natural History Magazine, vol. 101, 2008

GLOSSARY

TBC

APPENDIX I - SPHERE OF INTEREST

The standard NMP sphere of interest was followed according to the NMP Manual with two exceptions.

Military archaeology

It is generally within the scope of the NMP to record military features which pre-date 1945, but a large part of the use of Savernake by the military took place in the immediate post war years so the remit of the project was extended to cover this period. Furthermore, as a rule within NMP projects whilst isolated military structures such as pill boxes, air raid shelters and buildings associated with searchlight batteries are mapped, individual buildings within military complexes such as prisoner of war camps and military shipyards are not generally recorded, but rather the extent of the sites are mapped and their presence noted on the Map Note Sheet. Because of the importance of military activity within the forest, and especially because of attempts to tie in features picked up by the lidar survey with those features dating from the war every individual shelter and structure related to the use of the forest for ammunition storage was recorded wherever they were visible on the aerial photographs.

Geological and geomorphological marks

Geological features visible on aerial photographs were not plotted, although their presence may sometimes have been in the AMIE record. This was especially the case where the nature of the marks was such that they could be confused with those of archaeological origin, which was particularly true with reference to certain of the hollows seen on the lidar derived imagery.

APPENDIX 2 – METHODOLOGY

NMP methodology

Digital Transcription

All available NMR oblique and vertical photographs were consulted for each map together with those photographs from the Unit for Landscape Modelling (ULM) and those from Wiltshire County Council. Transcriptions were produced with the aid of the computer-based AERIAL rectification programme when using aerial photographs. Control information was taken from digital OS 1:2500 scale base maps with an expected level of accuracy of 1m. Certain parts of the project area, particularly the scarp slopes contained major variations in height so the digital terrain model (DTM) function in AERIAL was used for most sites. To assist in this 1:10,000 Land-Form Profile digital height information was obtained from the OS. In certain cases, particularly in the centre of the wooded area the lidar tiles were also used for control where nothing was visible on the maps. In a number of cases this meant aligning on the intersections of trackways that may have moved over time and be in slightly different positions to those seen on early aerial photographs. Once rectified, images were imported into the AutoCAD drawing for the appropriate map and archaeological detail was transcribed using the appropriate layers and conventions for the form of archaeological remains. Features associated with a particular site were linked to Object Data tables containing details of the UIDs (unique identifiers) for associated monument records created in the AMIE database.

Appendix 00 illustrates the NMP conventions and layers in AutoCAD.

Database Records

AutoCAD

Object data, consisting of a single field with the relevant AMIE unique identifier number was attached to groups of objects that comprise each site within each drawing. In addition a second table was created consisting of the AMIE UID, the proposed date, interpretation and form of the feature recorded together with details of the image from which the feature had been mapped.

AMIE

An Event and a skeleton Collection record were created for the project (English Heritage: Savernake Forest NMP Event UID: 1465032; Collection UID: MD002319). Skeleton collection records, linked to the parent collection record, were also created for each map sheet. Individual Monument records were created for each site transcribed, and where a record for the site already existed, this was updated.

Lidar Methodology

Part of the reason behind the Savernake project was an opportunity to test the latest methodology for using the lidar data within a mapping project. One of the early drawbacks with using lidar data was the problem of getting it into a suitable package where it was possible to draw features accurately, whilst at the same time maintaining the 3D elements that make the lidar data so useful. The real benefits of the lidar data come when the data can be manipulated to exaggerate heights and control the positioning of illumination. Previously it had been possible to create 2D hillshaded images (including composite and PCA images) that could be imported into a drawing package from which

features could be mapped or to have interactive 3D models where height and illumination could be controlled “on the fly” to maximise the potential of seeing features; it was not possible to have both. The latest versions of AutoDesk Map (2007 onwards) include the facility to view raster surfaces with interactive hill shading defined by a user-controlled light source together with height exaggeration. Placing these facilities within the CAD environment means that, it is now possible to combine the mapping elements of CAD with the 3D facilities that allow the enhancement of lidar data, which are so crucial in its interpretation.

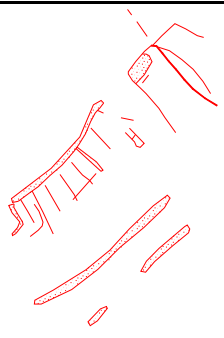

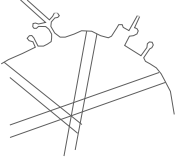
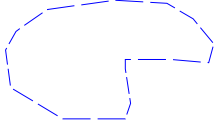
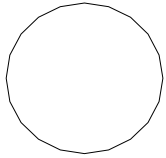
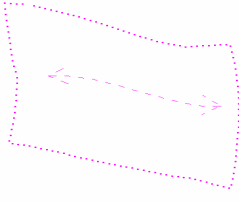
Although the latest versions of AutoDesk Map allow the manipulation of illumination they do not do so completely interactively. It is necessary to set the angle and elevation via a menu which then applies the settings to the raster surfaces. This means that it was still useful to be able to view the models completely interactively when moving the cursor changes the light source almost instantaneously. This facility was provided by the Quick Terrain programs (Modeler to create the models and Reader to view them - www.appliedimagery.com).


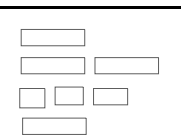
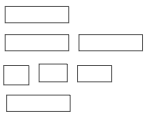
The lidar data was supplied to English Heritage by the Forestry Commission in several formats; there were 2D image tiles and raster gridded ASCII Z GRID files for the filtered data used to create the DTM after the application of a vegetation removal algorithm; there were also simple ASCII tables recording the x, y, z and intensity data of both the first and last laser return. In both cases the ASCII tables and grids were imported directly into the Quick Terrain Modeler program (www.appliedimagery.com) and saved in their proprietary QTT format. In the case of the ASCII tables they were also exported as ASCII Z GRID files for import to AutoDesk where they were read as a raster surface for which the height and illumination can be manipulated as noted above. Because the files are geo-referenced they appear in their true location in the map and it is simple to draw features direct into the drawing using the standard NMP conventions, or to compare them with conventional aerial photographs.

Field Methodology

Survey was undertaken by M Bowden and D Field in November 2007 using a Trimble total station to supply a 6-leg closed traverse which included nearly all archaeological detail. Further detail was supplied into this control by tape-and-offset. The survey scale is 1:1000. In spite of the survey being carried out in November the dense vegetation on site was a severe restriction on the ability to see slight surface features.

APPENDIX 3 – NMP CONVENTIONS

Layer name	Colour	Linetype	
BANK	1 (red)	CONTINUOUS	
<p>The outline of all features seen as banks or positive features, eg platforms, mounds and banks; also to be used for the agger of Roman Roads.</p> <p>Thin banks will appear on this layer as a single line.</p> <p>BANKFILL 1 (red) FILL: DOT SCALE: 2.25 ANGLE: 53</p> <p>A stipple that fills the bank outline 'bank'.</p>			
DITCH3	3 (green)	CONTINUOUS	
<p>All features seen as ditches; also excavated features, eg ponds and pits.</p> <p>DITCHFILL 3 (green) FILL – SOLID</p>			
EXTENT OF AREA	8 (grey)	DASHEDX2	
<p>The extent of large area features such as the perimeters of airfields, military camps, mining/extraction areas.</p>			
LARGE CUT FEATURE	5 (blue)	ACAD_ISO02W100	
<p>Formerly the 'T-hachure', now represented by a dashed line. To be used for large cut features such as quarries, ponds, and perhaps scarps that can not easily be depicted with the use of either bank or ditch.</p>			
MONUMENT POLYGON	7 (white)	CONTINUOUS	
<p>Used to define the extent of a group of AutoCAD objects corresponding to a single monument in the NMR database.</p>			
RIGARRLEVEL	6 (magenta)	ACAD_ISO03W100	
<p>Arrow depicting direction of rig in a single block ridge-and-furrow, seen as earthworks or cropmarks, but known to have been ploughed level.</p> <p>RIGDOTSLEVEL 6 (magenta) DOTX2</p> <p>Outline of a block of ridge-and-furrow, seen as earthworks or cropmarks, but known to have been ploughed level.</p>			

Layer name	Colour	Linetype	
RIGARREWK	4 (cyan)	CONTINUOUS	
Arrow depicting direction of rig in a single block of ridge-and-furrow seen as earthworks on the latest available aerial photographs.			
RIGDOTSEWK	4 (cyan)	DOTX2	
Outline of a block of ridge-and-furrow still surviving as earthworks on the latest available aerial photographs.			
STRUCTURE	9 (grey)	CONTINUOUS	
Used for features which do not easily fit into other categories because of their form, e.g. tents, radio masts, paint (camouflaged airfields).			
Other Layers:			
(VIEWPORT)	7 (white)	CONTINUOUS	
Used in conjunction with the printing macros			
(SHEET)	7 (white)	CONTINUOUS	
Used in conjunction with printing macros			
GRID	7 (white)	CONTINUOUS	
Drawn automatically by a macro at correct NGR			
RASTER	7 (white)	CONTINUOUS	
Used to load raster images so they can be easily switched off.			



ENGLISH HERITAGE RESEARCH DEPARTMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for sustainable management, and to promote the widest access, appreciation and enjoyment of our heritage.

The Research Department provides English Heritage with this capacity in the fields of buildings history, archaeology, and landscape history. It brings together seven teams with complementary investigative and analytical skills to provide integrated research expertise across the range of the historic environment. These are:

- * Aerial Survey and Investigation*
- * Archaeological Projects (excavation)*
- * Archaeological Science*
- * Archaeological Survey and Investigation (landscape analysis)*
- * Architectural Investigation*
- * Imaging, Graphics and Survey (including measured and metric survey, and photography)*
- * Survey of London*

The Research Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support outreach and education activities and build these in to our projects and programmes wherever possible.

We make the results of our work available through the Research Department Report Series, and through journal publications and monographs. Our publication Research News, which appears three times a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities. A full list of Research Department Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

For further information visit www.english-heritage.org.uk

