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Changing Chalk: Downs from Above

Aerial Survey of the South Downs north of Brighton

Edward Carpenter, Dave Knight and Fiona Small.
With Matthew Oakey

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2023

South Downs National Park and Low Weald
East and West Sussex

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Summary

The Downs from Above project is the aerial survey component of the National Trust-led and National Lottery Heritage Fund-supported Changing Chalk partnership. The project focussed on the area of the South Downs National Park to the north of Brighton and Hove. The archaeological mapping and interpretations from the Downs from Above project are available via an online Geographical Information System (GIS) portal and provide a framework for volunteer activities coordinated by the National Trust. The archaeological remains identified from lidar and aerial photographs on the South Downs ranged in date from the Neolithic to the Cold War. The lidar was particularly valuable in showing the low earthworks that define extensive later prehistoric and Roman field systems across the Downs. Medieval and post medieval archaeological features mainly comprised enclosures and dewponds related to sheep farming as well as the chalk pits and quarries of the local lime industry. 1940s aerial photographs provided a useful overview of the 20th-century military activity on the Downs, as well as a unique snapshot of the open grassland before conversion to arable. The project results contribute a lasting legacy in terms of better understanding of the form and extent of this archaeological landscape. This will inform future management and should inspire further archaeological investigation of this special area.

Contributors

Edward Carpenter, Dave Knight, and Fiona Small of Historic England's Aerial Survey team carried out the aerial survey mapping and reporting. The mapping data was cleaned by Sally Evans and Simon Crutchley developed the online GIS. The project manager was Matthew Oakey. Helen Winton edited the report.

Acknowledgements

The authors thank James Brown and Gary Webster of the National Trust for instigating the project and their continued advice and support throughout. Thanks also to Historic England Archive staff for supply of aerial photographs; staff of the West Sussex and East Sussex Historic Environment Records for supplying data and advice; West Sussex Record Office and National Library of Scotland for supply of research material; and Henry Finch for the use of the Goodchild letters.

Archive location

Historic England Archive, the Engine House, Firefly Avenue, Swindon, SN2 2EH archive@HistoricEngland.org.uk.

The project is recorded through OASIS, the online system for reporting archaeological investigations, as nmr1-506477.

Date of survey/research/investigation

The mapping and recording were undertaken between April 2022 and March 2023.

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Illustrations

Front cover image: A view along the northern scarp of the chalk downs, looking east from Ditchling Beacon. 29322_025 17-FEB-2015 © Historic England Archive.

Introduction

The Downs from Above

The ‘Downs from Above’ project is one of 18 projects being delivered as part of the Changing Chalk partnership (www.nationaltrust.org.uk/visit/sussex/the-changing-chalk-partnership) which commenced in April 2022 and is running for four years until April 2026. The partnership is supported by a National Lottery Heritage Fund (NLHF) grant and funding from People’s Postcode Lottery and is led by the National Trust. Its aim is to ‘work with local communities and landowners to connect people with nature and address challenges facing the Sussex Downs to protect this fragile chalk grassland landscape for future generations’. The specific objectives of the Historic England contribution are to:

- Work with people to build the skills, knowledge, confidence and motivation to fight for, and look after, their historic environment through encouraging long-term engagement by local communities in the area.
- Improve our digital capability to open our collections, assets, knowledge and expertise to everyone by providing an interactive online portal where volunteers can access and add to our aerial survey to achieve heritage protection results.
- Engage diverse audiences and achieve an inclusive workforce, ensuring that the historic environment is for everyone, by helping the National Trust to engage local communities and non-heritage focused groups.

The Historic England contribution supports the objectives of the Downs From Above project, which are:

- Engage a wider range of people with the Downs to increase their wellbeing and connection with the landscape.
- Inspire change in ideas and actions to encourage active participation in caring for the Downs, sustaining its long-term future.
- Improve habitat and species richness and connectivity of rare chalk grassland.
- Support and work with landowners and farmers to enable sustainable management of chalk grassland.
- Engage communities as active participants in the discovery, interpretation and celebration of the cultural heritage of the Downs.

Historic England is a project delivery partner on the Downs from Above project. This report summarises the first stage of work on the project – aerial archaeological mapping of 192 sq. km of the South Downs to the north of Brighton and Hove. The mapping is the result of the systematic analysis of aerial photographs and airborne laser scanning data (lidar) and provides a landscape-scale understanding of how human activity has shaped the Downs since the Neolithic period.

The aerial mapping forms the basis of an interactive online Geographic Information System (GIS) portal, which allows the public to explore the results of the project and use the data to add their own ground-based observations. It will also underpin a training programme for local volunteers which will run throughout the lifetime of the project.

Aerial mapping

Project area

The project area covers 192 sq. km of the South Downs to the north of Brighton (Fig. 1). It abuts two previous projects – *The South Downs NMP Pilot Area 1 - Worthing to the Weald* (Carpenter 2008) to the west and *South Downs Beachy Head to the River Ouse* (Small et al. 2013) to the east. The coastline to the south was mapped as part of the *South East Rapid Coastal Zone Assessment project* (Dickson et al. 2017), although this is separated from the Downs from Above project area by the urban conurbation of Brighton and Hove. These urban areas were outside the remit of this project.

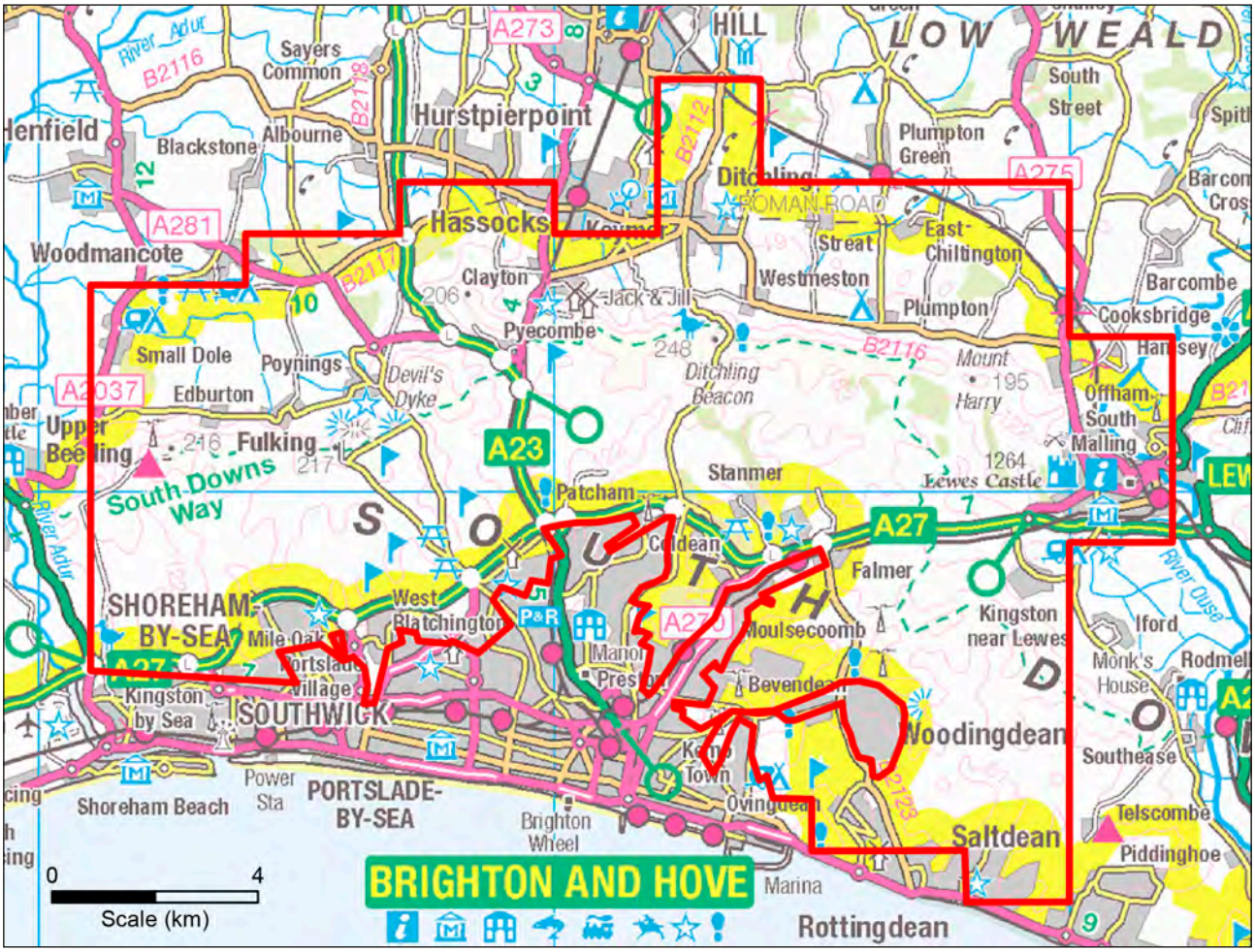

Figure 1: The Project area. Base map © Crown copyright and database right 2023. All rights reserved. Ordnance Survey licence number 100019088.

Topography, geology and soils

The project area is sited within two National Character Areas (NCA). NCA 125 – South Downs, covers the largest portion of the project area. This comprises the broad and high chalk ridge (the downland) with a steep northern escarpment. This area is mainly covered in large arable fields and free-draining open grassland (Natural England 2015, 7). The downland is sandwiched between the urban areas of Brighton, Hove and Shoreham-by-Sea to the south and the Low Weald to the north (NCA 121). The weald mainly consists of small enclosed pastoral and arable fields interspersed with areas of deciduous woodland, parkland and small watercourses (Natural England 2013, 6).

Geologically, the region comprises a sequence of horizontal beds of Triassic and Jurassic beds overlain by progressively younger beds of High Weald sandstones, Low Weald Clay, Lower Greensand Gault Clay, and Upper Greensand topped by Cretaceous chalk beds (British Geological Society 2023). These beds were folded, forming an anticline with an east-west axis which arched over the area of the Weald. Subsequent erosion removed the upper curve of the anticline leaving the truncated beds sloping southwards to the south of the centre line of the Weald and northwards to the north. The opposing chalk escarpments of the North and South Downs are the result of the upper edges of the eroding sloping chalk beds. With a sharp abrupt face and gently sloping away, down to the coastal plain in the case of the South Downs and to the London Basin from the edge of the North Downs.

These natural factors as well as historic and current land-use have affected the visibility of the archaeology. Historically, the open grassland of the downland was far more extensive and large-scale agricultural ploughing, which denudes archaeological earthworks, was only introduced in the mid-20th century. For this reason, there is an abundance of archaeological earthworks dating from as far back as the Neolithic through to the medieval and later periods. Pockets of archaeological earthworks are visible, but they largely relate to medieval and post medieval activity only. Buried archaeological remains are revealed as cropmarks in arable and grass, especially in the areas with the freely-draining soils and chalk geology of the Downs.

Methods

The project team used the standard Historic England approach to assessment and mapping of large areas using aerial photographs and lidar (Evans 2019). This systematic analysis provides accurate digital archaeological maps linked to interpretations and descriptions suitable for planning, management and research.

The primary sources used for mapping were Historic England Archive vertical and oblique aerial photographs. Environment Agency lidar was visualised as 2D raster images to show earthworks in relief. Additional vertical orthophotography was supplied through the Aerial Photography for Great Britain (APGB) agreement by Next Perspectives.

All archaeological features visible on available aerial photographs and lidar were assessed and mapped. These included buried remains recorded as cropmarks and soilmarks, and surface remains seen as earthworks and structures, including those seen on historical photographs but which are no longer extant.

Full technical details, methods, scope and sources are outlined in Appendix 1.

Aerial Survey and the Downs from Above

This section provides an overview of archaeological sites mapped. It includes a brief introduction to the aerial sources, and to the mapping data available in the project GIS portal (Fig. 2).

The sources

The range of aerial sources used for the project provided different and complementary information on the archaeological features in the area. These included over 9,500 aerial photographs taken in the last 100 years as well as recent airborne laser scanning data (lidar). The project team carried out detailed analysis and comparison of the sources to identify archaeological remains. They were then interpreted, mapped and recorded, often from more than one source. The archaeological remains took many forms and included earthworks, structures and buried remains seen as cropmarks. As older sources were used, sometimes sites were recorded that have been subsequently ploughed level, demolished, buried or built over.

Most of the archaeological features mapped were identified from lidar – a technique that uses an aircraft-mounted laser to build a 3D digital elevation model (DEM) of the ground below (Historic England 2018). As well as recording the well-preserved archaeological earthworks across the project area, lidar also revealed very low earthworks that are difficult to see on other aerial sources or on the ground.

Over 9,500 Historic England Archive aerial photographs were assessed, dating from the 1920s to 2018. This important national collection includes historic and recent aerial photographs in either black and white or colour. They consist of negatives, prints and born-digital images. Archaeologists took many of these photos, but most were taken by the Royal Air Force (RAF) and the Ordnance Survey. These comprise oblique photographs, which were taken at an angle to the ground and usually have a specific archaeological, architectural or landscape subject. Vertical photographs were usually taken of large areas and for non-archaeological purposes and so serendipitously recorded historic features (*see* Appendix 1).

The quality of the vertical photography for archaeological prospection varied depending on many factors such as the lighting, cloud cover, or exposure. The usefulness of aerial photographs for mapping earthworks is reliant on the time of year and day that the photography was captured. Ideal conditions are when the sun is low on the horizon, revealing archaeological earthworks through strong shadows and highlights. Typically, commercial vertical photography is taken when the sun is at its zenith so there is less shadow obscuring the features to be mapped such as houses or roads. This is therefore of limited use for mapping archaeological earthworks but some of the sources for the project were taken when the lighting was particularly good. Some 1940s and 1950s RAF vertical runs show the later prehistoric/Roman field systems before they were reduced by modern ploughing, allowing a useful insight into their original form. These mid-century vertical

photographs also recorded ephemeral Second World War features before they were removed. They also showed the remains of First World War military activity that remained as earthworks into the 1940s but were subsequently levelled or built over by the expanding housing estates of Brighton and Hove.

Later oblique photographs were particularly useful in understanding the change and condition of sites over time, especially where intensive agricultural practices were gradually denuding earthworks. They were also useful for identifying buried archaeological remains revealed as cropmarks or soilmarks. The freely-draining soils and geology of the South Downs are conducive to cropmark formation but most buried remains were recorded as soilmarks when sites were ploughed up during the change in farming from pastoral grassland to arable.

The mapping

Archaeological features were transcribed from rectified photographs and lidar visualisations using ESRI ArcMap GIS (*see* Appendix 1). The original form of the feature (bank, ditch, structure etc.) is recorded as this provides a basic understanding of the form of features that is unlikely to change. Other information, such as what it is (barrow, enclosure, practice trench etc.), date, main sources, latest evidence (earthwork, cropmark, structure) is also attached to the mapped features. A monument polygon was drawn around groups of features corresponding to a single archaeological site or 'monument' which links to the relevant historic environment record number. The historic environment record includes a written description of the monument and a record of any other investigations as well as the indexing information in the GIS.

The mapping is available via Historic England's Aerial Archaeology Mapping Explorer where it can be viewed alongside the results of other mapping projects. It comprises vector data: lines and polygons (*see* Appendix 1: Table 1) and each part of data is accompanied by attribute information mentioned above.

The mapping is also available in a project-specific online GIS portal which will remain live for the lifetime of the project. The portal will be interactive and accessible by the public, so that the information can be enhanced by volunteers throughout the project. Users will be encouraged to monitor and comment on the state of features on the ground, and to add their thoughts, memories and stories.

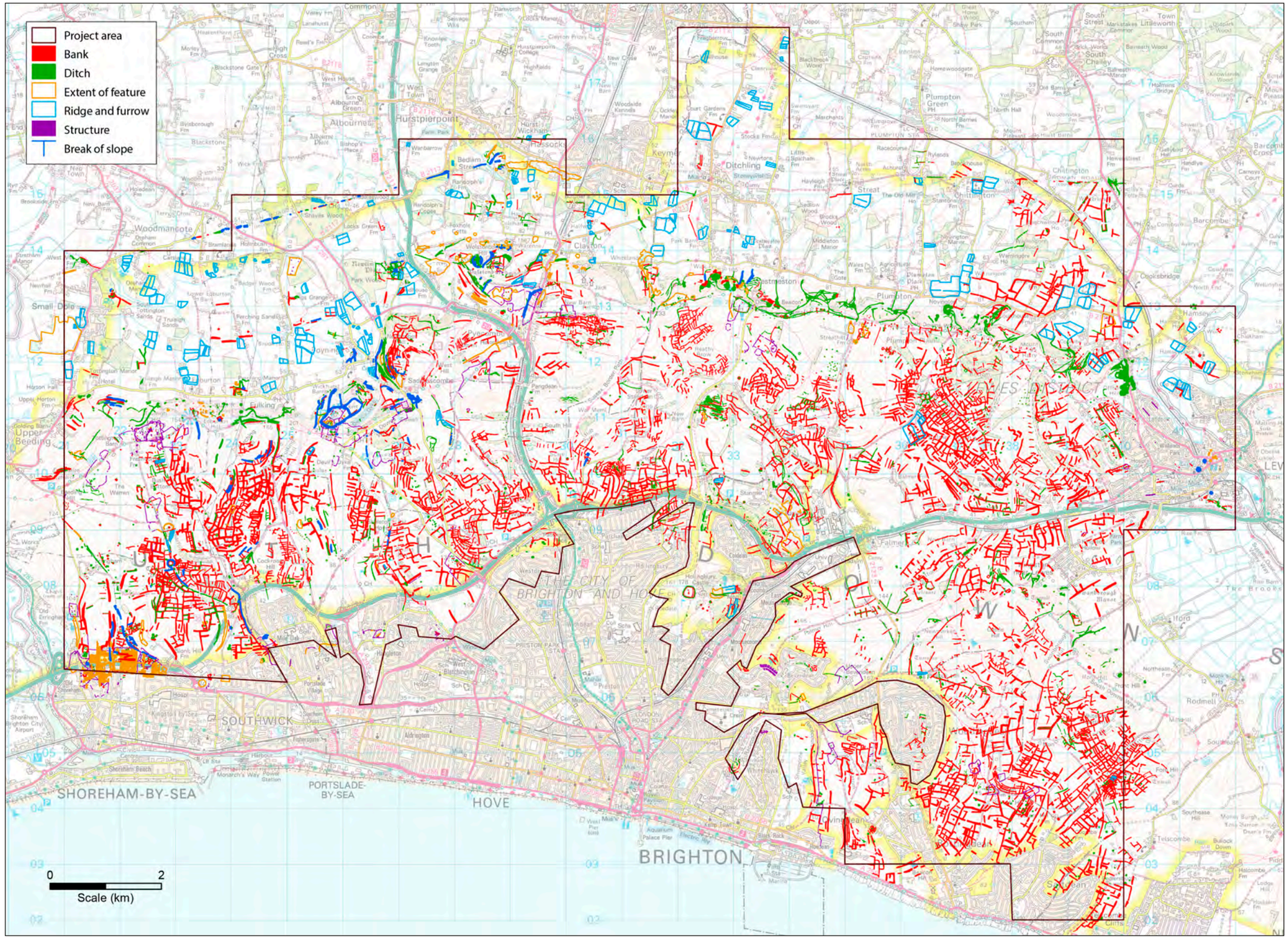

Figure 2: Overview of mapping. Archaeological mapping © Historic England. Base map © Crown copyright and database right 2023. All rights reserved. Ordnance Survey licence number 100019088.

Summary of mapping results

This report explores some of the key themes from a great variety of archaeological features visible across the South Downs. Details of each site and area can be explored using the online GIS Portal. This summary provides an overview of the different categories of archaeological remains recorded during the project. There are more detailed case studies in the following chapters.

Some of the earliest sites in the area are only briefly mentioned in this report as they have already undergone thorough investigation or survey. These include the Neolithic causewayed enclosures at Whitehawk and Offham (Ross Williamson 1930; Drewett et al. 1977). These sites are just two examples of the many large prehistoric enclosures in the project area with varying construction dates and functions including ceremony and defence. The largest is Devil's Dyke Iron Age hillfort, and other notable enclosures are found at Thundersbarrow Hill (Bronze Age/Iron Age), Ditchling Beacon (Iron Age), Wolstonbury Hill (Later Bronze Age) and Hollingbury Castle (Later Bronze Age/early Iron Age) (Fig. 3). Most are located on high points. Thundersbarrow has clear associations with the neighbouring coaxial field system, and the aerial evidence suggests that it once had a funnelled entrance to the north, not unlike a banjo enclosure. Later defended enclosures include the medieval motte and bailey castle on Edburton Hill.

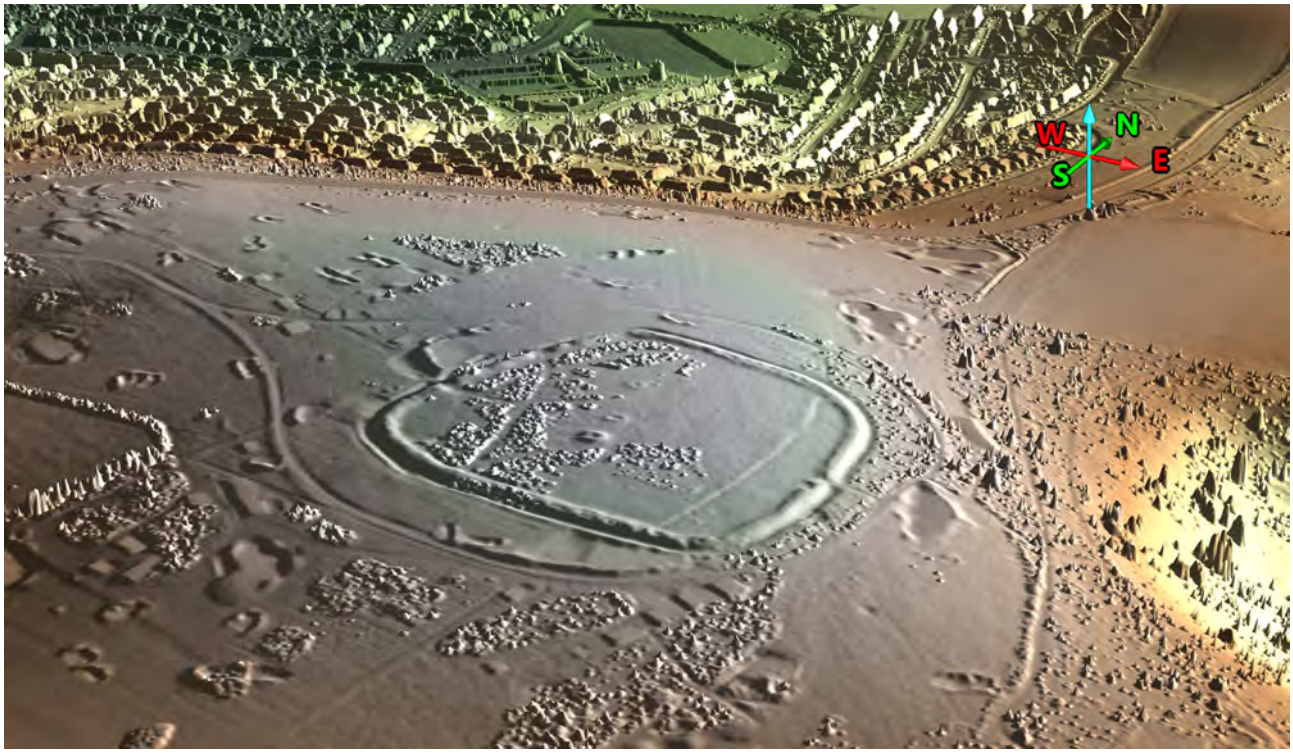

Figure 3: Hollingbury Castle, an early Iron Age hillfort. LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

There are burial mounds from the Neolithic, Bronze Age and early medieval periods situated across the Downs, with the greatest concentration along the northern edge (Fig. 4). The most numerous types appear to be Bronze Age round barrows constructed before the field systems discussed below were laid out. The mapping shows some of the ways these barrows were included or avoided during the laying out of those fields. Some field boundaries appear to be aligned on barrows while other barrows were enclosed within fields. Numerous barrows survive as earthworks, but others have been levelled and their buried remains are revealed as cropmarks and soilmarks. In some instances, lidar revealed the low spread remnants of the barrow mound.19th-century Ordnance Survey maps depict some barrows which have are not visible on the aerial sources.

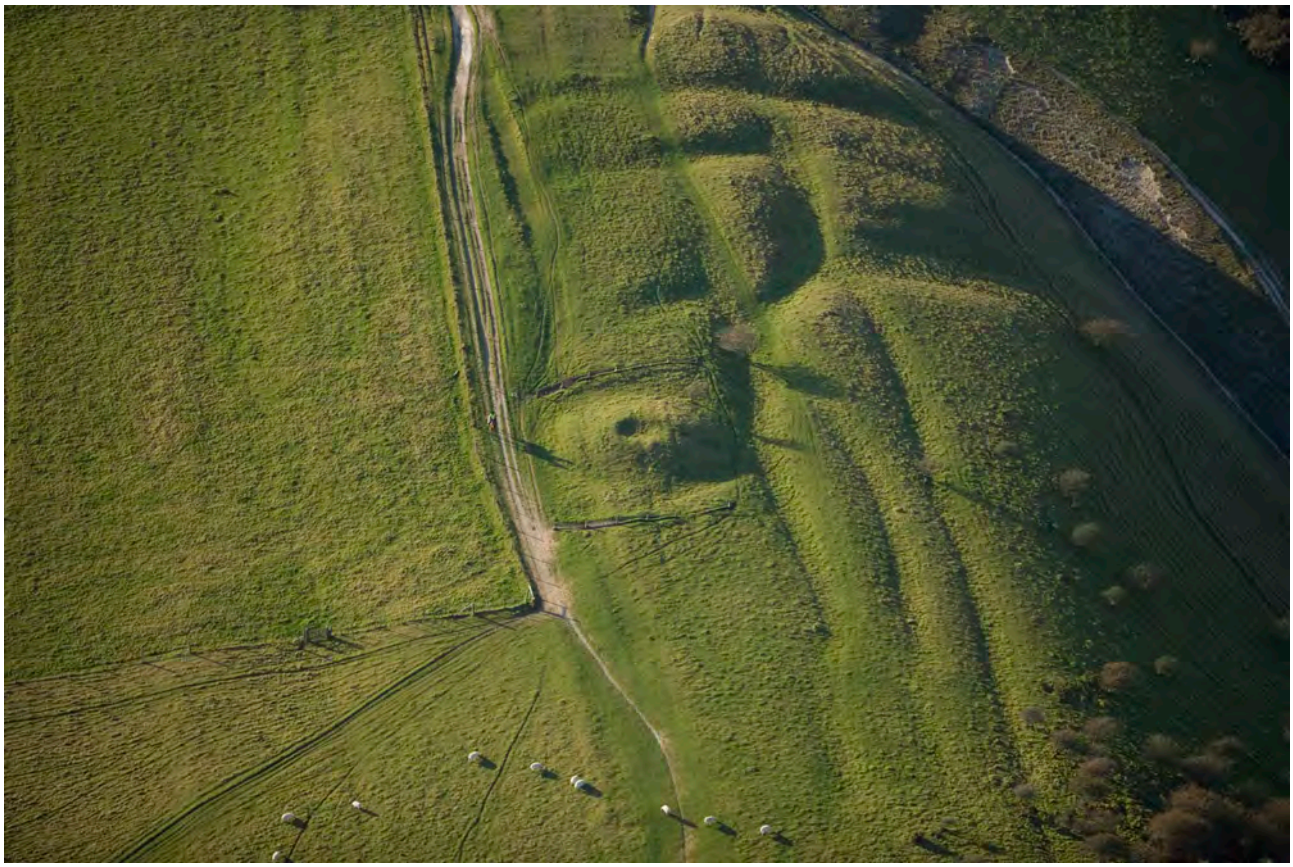

Figure 4: A Bronze Age bowl barrow on the northern edge of the chalk downland, at Perching Hill. 24800_011 29-OCT-2007 © Historic England Archive.

The most prevalent archaeological features of the Downs are the extensive field systems (Fig. 5). These are defined by banks or lynchets that were formed as plough soil accumulated at the field edge. These field systems are found across chalk downland elsewhere in the south of England and are usually thought to have origins in the Bronze Age with development and use continuing through the Iron Age and Roman periods. A sizable proportion of the field systems in the project area survive as earthworks and were mapped from the lidar data but in many areas they have been much reduced and may be difficult to see on the ground.

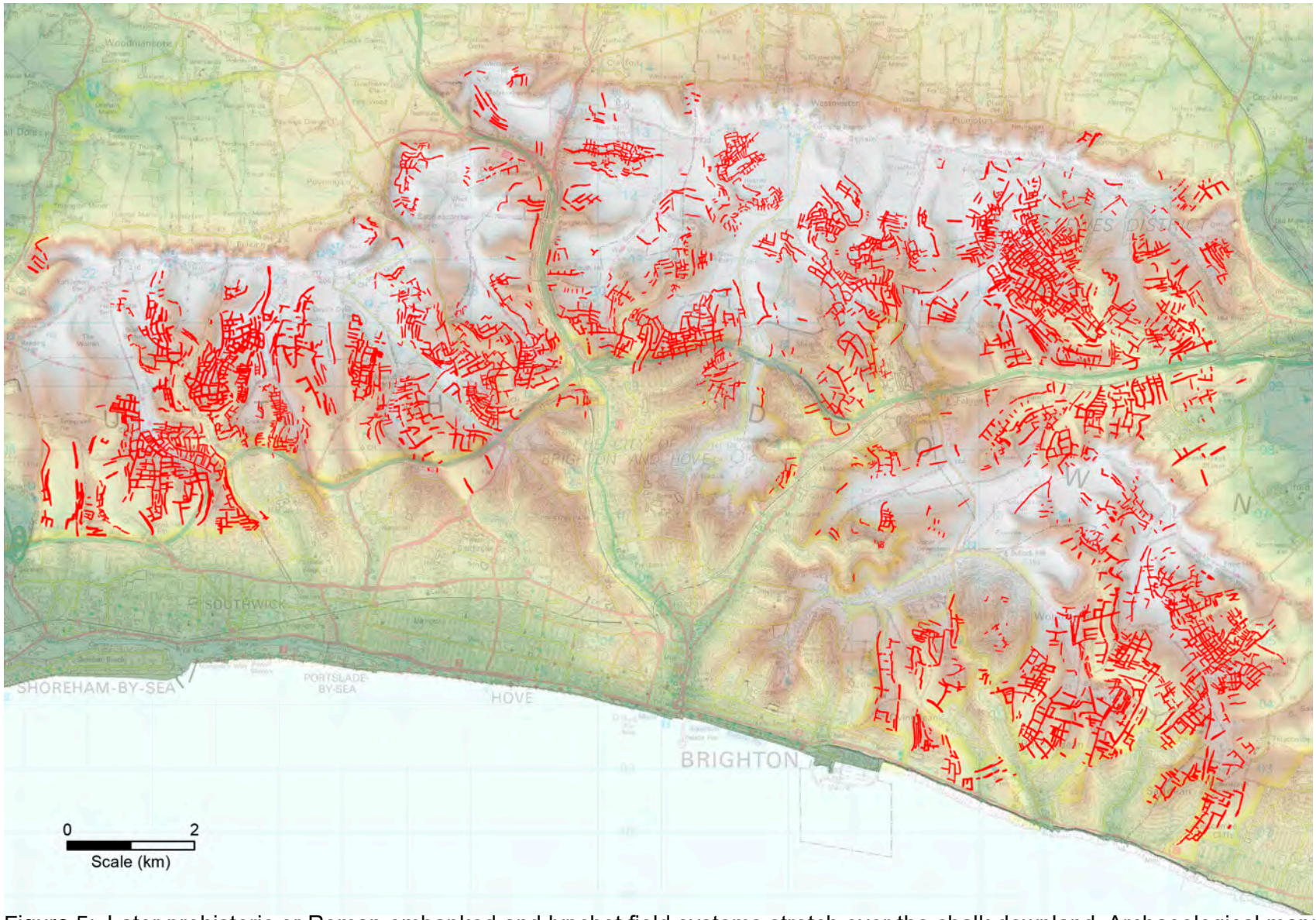

Figure 5: Later prehistoric or Roman embanked and lynchet field systems stretch over the chalk downland. Archaeological mapping © Historic England. Terrain *data ©Bluesky International/Getmapping PLC.* Base map © Crown copyright and database right 2023. All rights reserved. Ordnance Survey licence number 100019088.

Identifying settlements within these field systems can be difficult on morphological grounds only and few were identified from the air, but excavations within the project area have revealed others. This shows that although aerial photographs and lidar have given us the most complete picture of the field systems to date, there are still discoveries to be made using other investigative techniques.

Prehistoric ‘cross dykes’ are another common type of land division on the South Downs. Comprising one or more banks and ditches constructed across a ridge, these dykes are thought to be Late Bronze Age or Early Iron Age in date. Many have already been identified, but the project recorded several previously unknown examples, such as south of Devil’s Dyke and on Truleigh Hill. Others are visible as earthworks on historic aerial photographs but since levelled. In several instances, the evidence from aerial photographs and lidar shows they extend much further than the previously known extent.

Remains linked to medieval arable farming in the project area consist of strip lynchets which are mostly confined to the steeper combe sides. There are some lynchets on gentler slopes where they cut across prehistoric and Roman fields. Areas of ridge and furrow in the Weald mostly appear to be post medieval in date as the ridges are narrow, regularly spaced and straight. The windmill mounds identified in this project are another surviving element linked to arable farming and indicate that the milling of cereals was carried out locally.

The medieval and post medieval use of the South Downs is most associated with livestock – sheep farming in particular. Previous work using aerial sources highlighted the evidence for this (Carpenter 2008, 37-40, Small, Carpenter and Barber 2013, 28-32) and similar livestock enclosures and dewponds were seen across the Downs from Above project area. These were constructed to provide shelter and water for the flocks.

There has also been a long history of small-scale extraction on this part of the Downs. The evidence for this is seen as numerous chalk pits and quarries. The largest of these are along the northern slope but there are smaller chalk pits elsewhere. Chalk had long been a requirement for building in the form of mortar and limewash, but lime was also used to improve farmland. Based on map evidence, some of the largest quarries were in existence in the first half of the 19th century, although most had been abandoned by the date of the earliest aerial photographs, around the mid-20th century. Historic maps also offer evidence for the limekilns that were built alongside some of these pits.

Hollow ways, known locally as bostalls, wind their way up onto the Downs from the Weald towards several of the chalk pits, although most are thought to predate this industry. These routes are most prominent along the northern edge of the Downs and current footpaths and rights of way hint at the continuation of these routeways southwards.

20th-century military activity across the South Downs was widespread but short-lived. Remains of the mostly demolished large First World War camp and training area on Slonk Hill were recorded on mid-20th century aerial photographs. Early in the Second World War the South Downs became a focus for heavy defences in case of invasion. Later, as that threat abated, the rough open grassland was used for intensive tank, artillery and

infantry training. As the military pulled out of the Downs from 1944 onwards, the landscape gradually gave way to arable farming, changing the nature of the downland for good.

The project also included a large area of the Weald to the north. This lowland terrain was subjected to various agricultural practices over centuries, and the present-day field pattern is a result of post medieval enclosure. Due to the soils and geology, cropmark formation in the Weald is uncommon so most archaeological features were visible as earthworks, though not in the same density as on the Downs. Sites of note include the manorial complex at Newtimber (Fig. 6), which includes a medieval or post medieval moated site and complex water management ponds and channels; the remains of the landscape park of Danny; and the Roman road from Barcombe Mills to Hardham which skirts the northern boundary of the project area and survives as earthworks at several locations.

Figure 6: The earthworks at Newtimber reveal a complex and medieval and later manor. LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

Downland Barrows

Leslie Grinsell carried out a study of Sussex barrows, providing useful definitions of the known barrow types and discussing the difficulties of dating. Somewhat a forward-thinker, Grinsell made useful recommendations for additional study, including using aerial photographs, to identify further barrows.

> If anyone desires to improve upon this account I would recommend him to start by making careful surveys of each barrow, and photographing from the ground and air where possible. He should find many undiscovered examples on the tops of the downs, and should note for excavation those which are under plough or which are in any other danger of destruction or damage. (Grinsell 1934, 217)

The results of the Downs from Above project highlight some issues with archaeological prospection using different techniques almost 100 years apart. The project greatly added to the known distribution of barrows in the area but some barrows in Grinsell's list were either not visible on aerial sources. Therefore the following chapter discusses broad trends observed in the Downs form Above project results.

The Neolithic

The only Neolithic long barrow previously identified within the project area is located on the top of a slope on Plumpton Plain. It is defined by a low elongated mound with a ditch on the south side and is scheduled as an oval barrow: National Heritage List for England (NHLE) 1012625. Aerial photographs record disturbance of the mound over the decades. 1940s photography shows the ditch and mound of a Second World War anti-aircraft obstruction butting up to the south side of the barrow as well as a trackway going over the top of it (Fig. 7). The latter remained in use until at least the late 1950s. Grinsell (1934, 258, number 46) recorded a saucer barrow with ditch and outer bank at this location, but the feature we see today does not resemble a saucer barrow. It appears to have been first recorded as a long or oval barrow in the 1950s (Historic England Research Record 402704), yet it is not clear to what extent the mound is in its original form. The site therefore requires further investigation to better understand the form of the earthworks and therefore confirm a Neolithic date.

A possible Neolithic long barrow was identified as a low earthwork on the northern slope of Newmarket Hill, south of Falmer. This comprises a bank, flanked by ditches faintly visible on lidar imagery. There is a pronounced circular mound on the west end of the bank, which has a form typical of a Bronze Age round barrow – suggesting a later reuse of the Neolithic monument. A later boundary, part of a later prehistoric/Roman coaxial field system, is aligned on the round barrow. It is important to note that the possible long barrow bank extends at a perpendicular angle to the field boundary, so could be part of the field system. Further work is required to determine the chronology of the earthworks and to see if the short length of bank is earlier, and therefore potentially Neolithic in date.

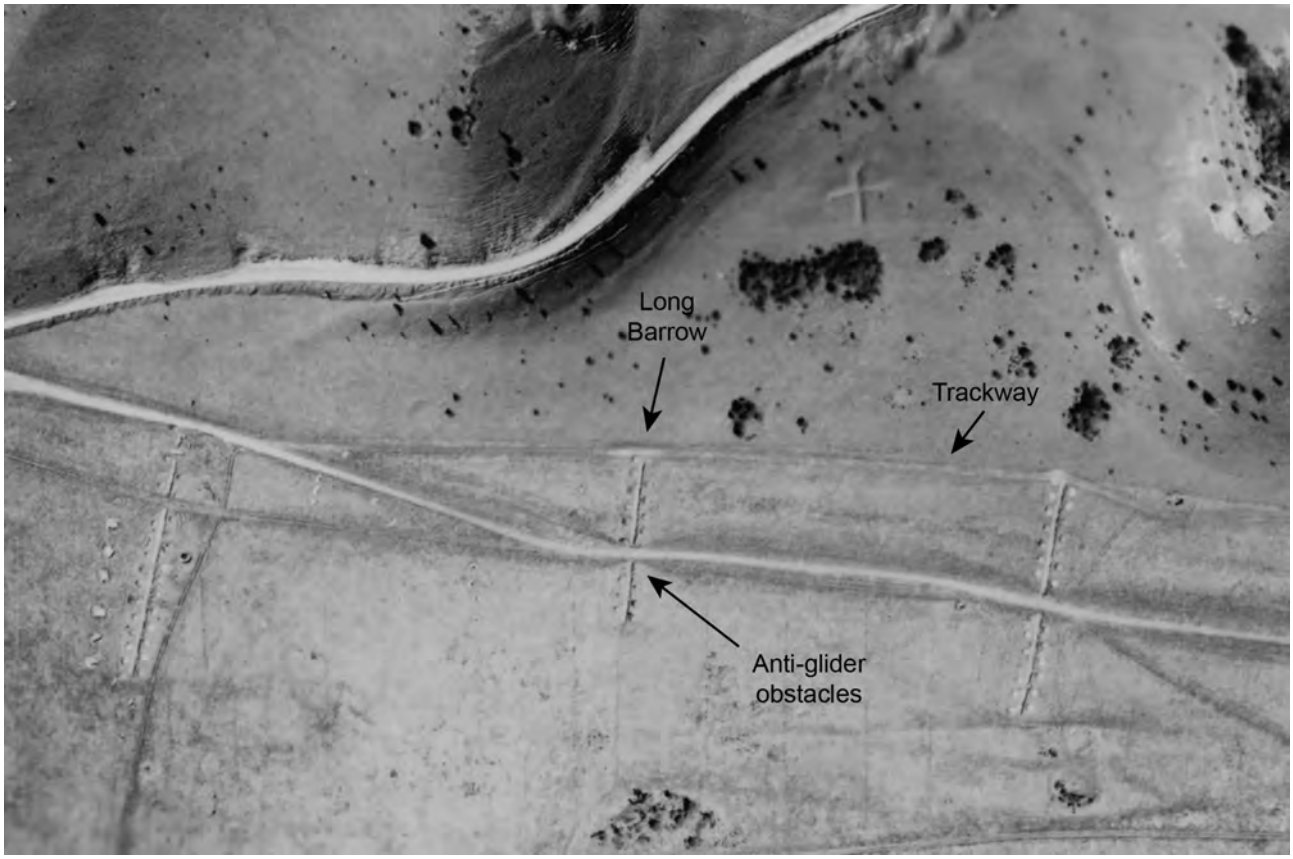

Figure 7: The possible Neolithic long barrow is visible as a low mound on 1940s photography. A trackway goes over the top of the mound and it is abutted by an anti-glider trench to the south. Detail of RAF/3G/TUD/UK/157 V 5173 19-APR-1946 Historic England Archive (RAF Photography).

Bronze Age round barrows

The most prolific form of funerary monument on the Downs is the Bronze Age round barrow (Fig. 8). Grinsell provides an excellent description of the various forms. These include platform barrows, saucer barrows, bell barrows and, most commonly, the bowl barrow (Grinsell 1934, 221-7). It should be noted that some barrows may have later Neolithic origins and that many will have been used and adapted over potentially long periods during the Bronze Age.

Most of the barrows recorded in this project were distributed across the higher ground but with a few exceptions located on the edge of the downland to the south. This trend is mirrored in neighbouring downland (Carpenter et al. 2016, 21). There are particularly dense concentrations to the east and along the north-eastern edge of the Downs. Grinsell noted others outside the project area to the south which were subsequently subsumed by urban development. There is a distinct lack of evidence for barrows in the lowland weald to the north but there is a barrow on a spur of higher ground called Lodge Hill to the north of Ditchling. The distribution on the downs suggests there was a local preference for locating barrows on higher ground, but it is not clear if the lack of barrows on the weald is a genuine distribution or a lack of archaeological evidence. The soils, geology and land use of the Weald are not generally conducive to the formation of cropmarks so there is a lack of evidence for barrows surviving as subsurface deposits.

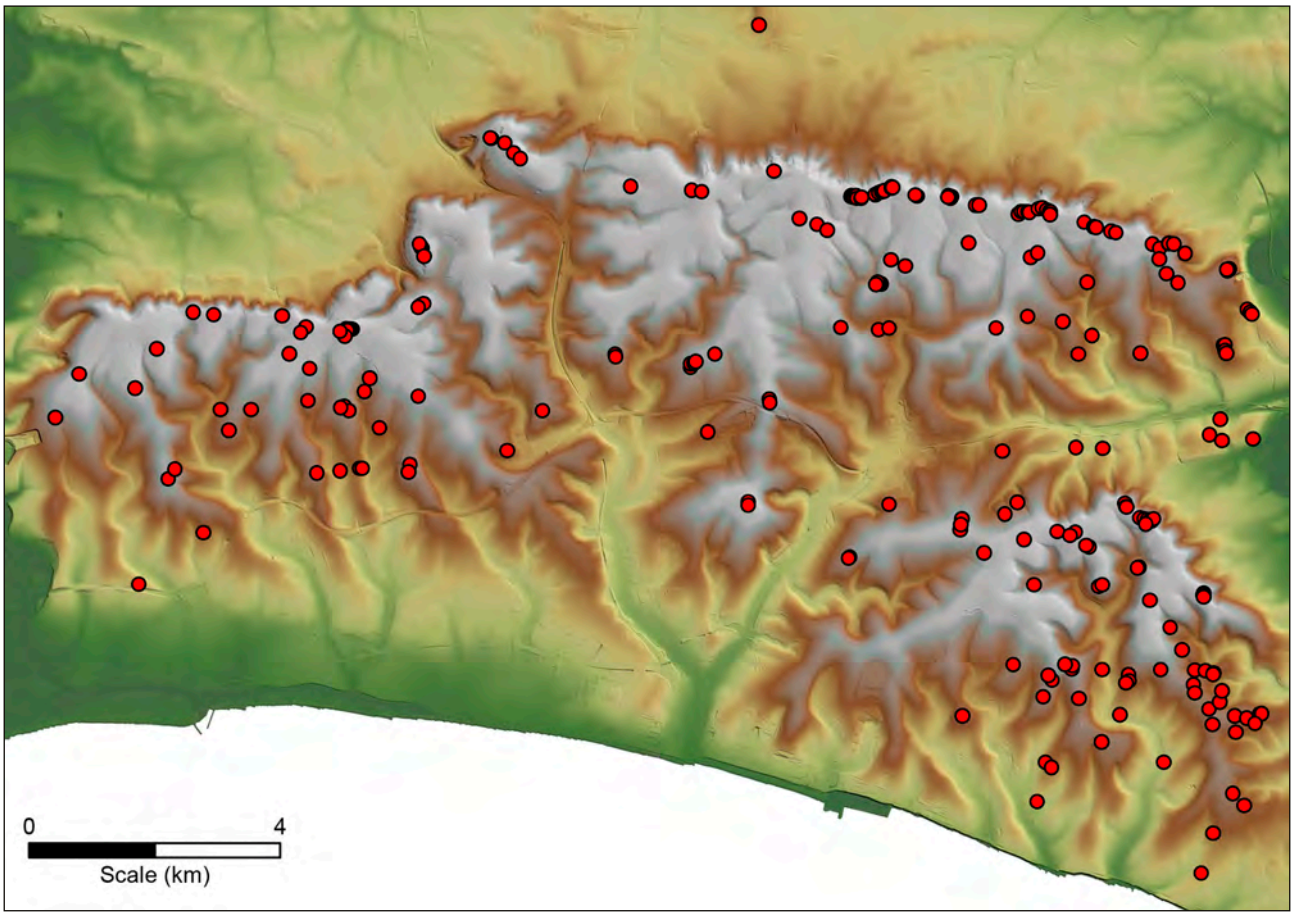

Figure 8: Distribution of Bronze Age round barrows recorded in the project area. Terrain *data ©Bluesky International/Getmapping PLC.*

Prehistoric barrows clearly retained significance throughout later periods. Some of those located along the northern ridgeline have concentrations of early medieval barrows clustered around them. Others, as is evident from excavation, were reused for later inhumation. For example, the round barrow on Beeding Hill was reported to have Roman finds within (Historic England Research Record 398707). Three mounds within Hollingbury Camp are interpreted as Bronze Age and the presence of Roman coins (Sickelmore 1815, 119) was thought to represent secondary inhumation. Black Burgh barrow north of Golf Farm also produced Roman pottery (Historic England Research Record 398455). A rescue excavation of a Bronze Age barrow on Slonk Hill in the 1960s revealed a Roman period structure on top of the barrow (Hartridge, 84). A cluster of barrows on Western Brow, of various sizes, is thought to be a mix of Bronze Age and early medieval in origin (Historic England Research Record 403097 and 1630180).

Some barrows were not visible on aerial sources although they were known from other evidence such as historic mapping, recorded by Grinsell, the Local Authority Historic Environment Record (HER) or Historic England's research records database.

New discoveries

Most newly discovered round barrows were identified from lidar as this source is effective at highlighting subtle changes in height that were often difficult to see on aerial photographs. Many of these were seen as isolated, low, roughly circular mounds. They often display no association with other features, so their morphology and topographic location, especially when located on the higher areas of the chalk Downs, were used to determine a Bronze Age funerary function. The level of certainty of interpretation based solely on aerial evidence varies, with some features only tentatively recorded as barrows. In several instances, such as on Beeding Hill, the interpretation is supported by soilmarks. Ploughing reveals or brings buried remains to the surface and in this case showed a compacted circular mound surrounded by a plough-spread ring ditch. This demonstrates how sites can show differently on aerial sources. For example, on The Warren, south of Truleigh Hill, the buried and surface remains are variously recorded as a soilmark, cropmark and earthwork on different sources (Fig. 9). These show that the barrow comprised a mound, surrounding ditch and a central pit – possibly a grave cut or from later digging into the mound.

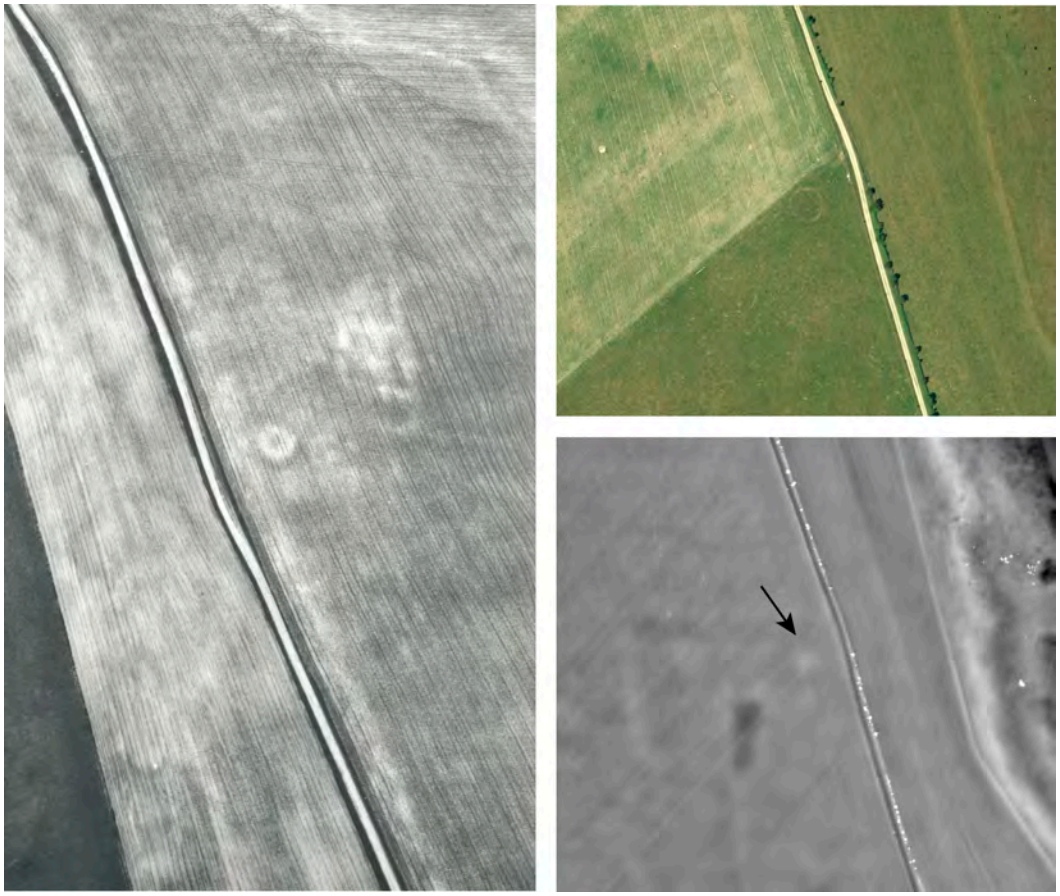

Figure 9: A newly discovered Bronze Age bowl barrow at The Warren, south of Truleigh Hill. It is visible as a soilmark (left), cropmark ring ditch (top right) and faint earthwork mound on the lidar (bottom right). Detail of NMR 1124/72 05-APR-1977 © Crown copyright. Historic England Archive; Detail of TQ2279 26-JUN-2018 © Bluesky International/Getmapping PLC; LIDAR DSM 08-JAN-2019 © Historic England. Source Environment Agency.

In several instances, Iron Age field boundary banks appear to have been deliberately aligned along lines of low mounds. A similar association was noted in the High Woods from Above project, where mounds appeared to have been incorporated into later field systems. However, some of these were thought to be stack stands, contemporary with the field systems (Carpenter et al. 2016, 21). Clearer associations between barrows and field systems were observed in the South Downs – Beachy Head to River Ouse mapping project (Carpenter et al. 2013, 21-2)

The location and morphology of the low mounds suggest that they may be Bronze Age barrows but further investigation is required to ascertain this. There are further examples on Tennant Hill, Falmer Hill, Balmer Down and Stanmer Down. To the east of the Thundersbarrow Hill enclosure, there is an example where both the mound and surrounding ring ditch are visible as soilmarks providing more definitive evidence that it was a burial mound. Further work should examine the form of the field systems where they appear to incorporate low mounds, especially where the details were not distinguishable on aerial sources.

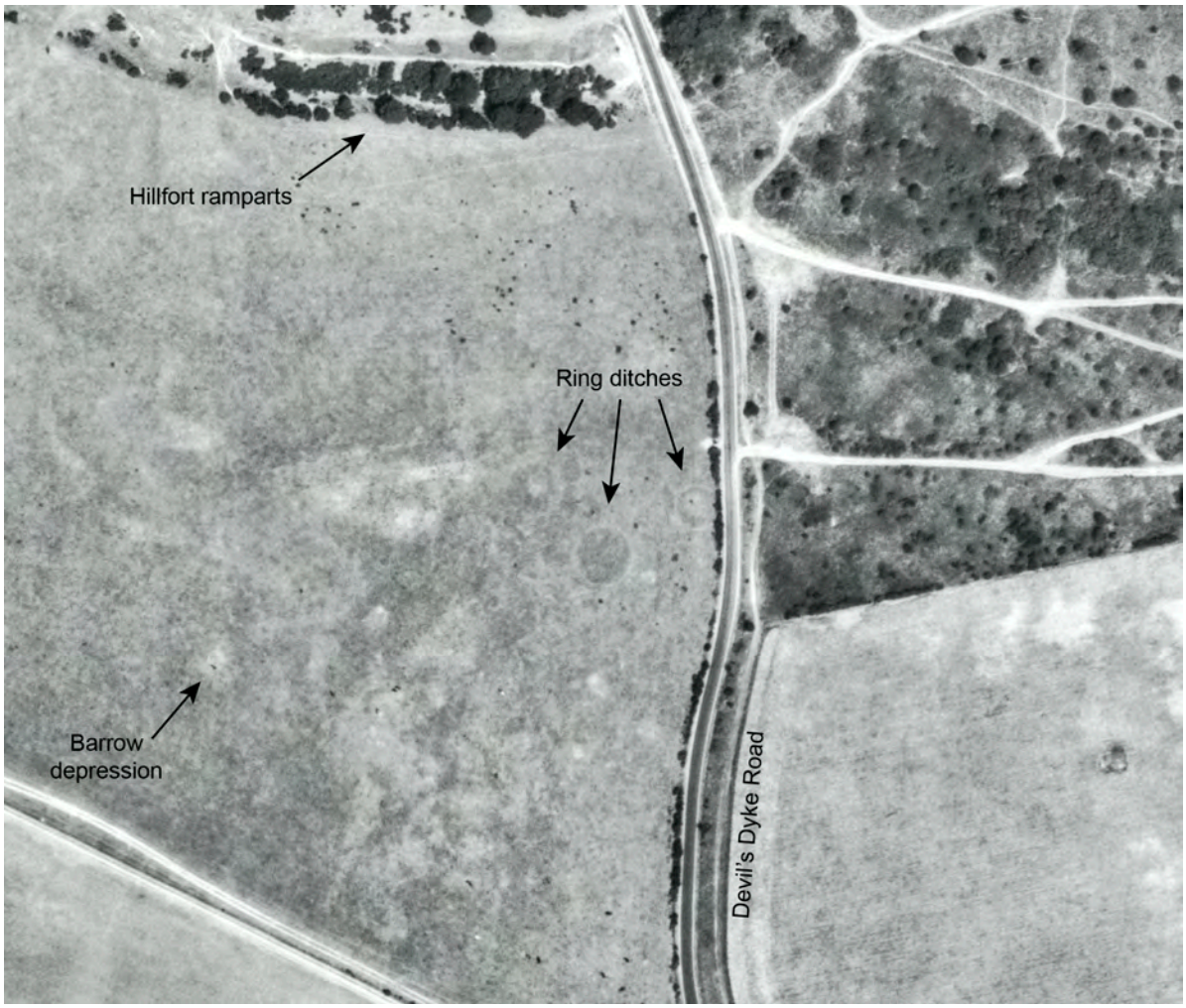

Figure 10: A Bronze Age round barrow cemetery partly identified from parchmarks. OS/76146 V 133 08-JUL-1976 ©Crown copyright. Ordnance Survey.

An exciting discovery during the project was the association of sub-surface remains with the earthworks of a Bronze Age barrow cemetery south of Devil's Dyke hillfort. Inspection of 1976 Ordnance Survey vertical photography revealed buried remains of three large ring ditches (Fig. 10) visible as parchmarks in grazed grass. These were exhibiting 'reversal' where – contrary to normal – the ditches appear pale and the central compacted areas dark. This phenomenon can occur when the fill of buried ditches becomes rapidly depleted of moisture, inducing stress in the crop growing over them, while the surrounding soils more steadily release water. When rectified, mapped, and compared with the lidar, it became immediately obvious that two of the ring ditches correspond with mounds visible on the lidar. Further examination of the lidar revealed additional broadly circular mounds, which are probably also barrows although there is no evidence for associated ring ditches.

The westernmost of the barrows is also visible as an extant earthwork. Within the ring ditch (seen as a parchmark), which measures 16m across, there is a small mound within a circular bank. This form is unusual as it resembles a disc barrow, but for these the ring bank is usually located outside the ring ditch. A larger ring ditch, with a diameter of 17m, lies to the east of this. There is no evidence for an earthwork mound here, though the cropmark suggests a possible compacted centre. The third ring ditch is located adjacent to the road. This feature has a diameter of 12m and has a level central mound visible on lidar, so might be a platform barrow.

Lidar revealed a further two possible platform barrows on the east side of (and partly truncated by) Devil's Dyke road (Fig. 11). A possible fourth, forming a row with the other three, is visible as a disturbed flat-topped mound between the two larger barrows. There is no evidence for a ring ditch to this feature. A little further to the west is a classic bowl barrow shape, though much denuded. With a diameter of approximately 17m, this mound has a clear earthwork depression in the centre, which also shows up as a cropmark on the 1970s photography, but again there is no evidence for a ring ditch. Finally, there is a large ring bank to the south of the field. This example is very disturbed, with the bank appearing thicker on the south side with a possible outer ditch and no evidence for a bank on the west side. Again, there appears to be a central mound. There is no cropmark evidence for a ring ditch with this feature and the interpretation as a barrow is extremely tentative but should not be dismissed due to the similar form and proximity to the others.

It is important to consider other possible interpretations for some of these features due to the unusual form and evidence. Many of the now-denuded earthworks visible in the same field are either associated with a lady's golf course that existed there in the inter-war period, or with Second World War armoured vehicle and infantry training. A poor-quality oblique photograph taken in 1934 shows the golf course in use. The core of the barrow group is covered by considerable vegetation, probably gorse, and so was clearly unrelated to the golf course. However, the golf club house stood immediately north of the southernmost and most tentative earthwork barrow. Although faint, there are hints of a possible green with two adjacent bunkers immediately south of the house. It is possible that this relates to the earthwork and that subsequent damage during the Second World War resulted in its current shape and condition. It seems that the club house was either demolished before the war or during target practice.

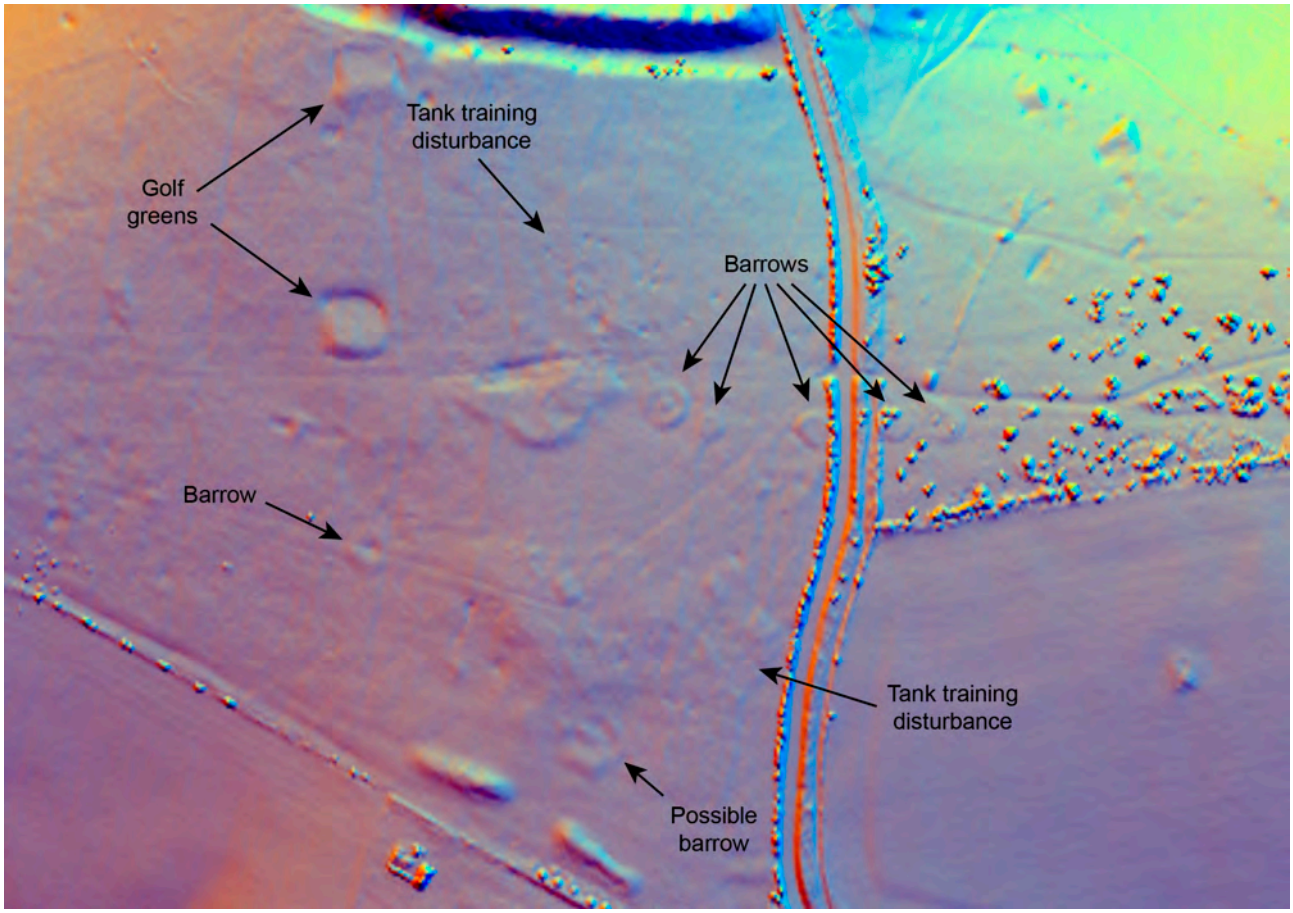

Figure 11: Barrow mounds visible on lidar. LIDAR DSM 08-JAN-2019 © Historic England. Source Environment Agency.

There was extensive military activity in this area throughout the war, but examination of aerial photographs suggest that the earthwork mounds are unrelated. Photography from July 1945 shows that the main group of barrows remained at least partly covered by vegetation. Military vehicle tracks, craters and weapons pits are recorded on aerial photographs but none relate to any of the barrows. However, there are vehicle tracks on the east side of the road that loosely correspond with the east slope of the eastern-most barrow. This said, the raised platform in a line with three others suggests that this is still more likely a barrow. Further work, including earthwork analysis, could focus on establishing if the mounds were barrows, associated with prehistoric settlement or had a more recent function.

Early Medieval barrow cemeteries

The greatest concentrations of early medieval barrows (often termed ‘Saxon’) within the project area, are along the north-east ridge of downland. Early medieval barrows are generally of a smaller size than Bronze Age barrows and tend to be clustered in groups (Grinsell 1934, 227-8), often surrounding or adjacent to a Bronze Age barrow. But dating based on morphology alone can be problematic.

Definitive evidence of use in the early medieval period is provided by excavation such as at one of the barrows to the west of Ditchling Beacon where in 1962 this revealed an iron scramasax (knife) at the hip of the inhumation (Peters and Peters 1963, 27). At Western Brow (Fig. 12) the complex mix of barrow sizes and spatial groupings has been used to tentatively distinguish the prehistoric from medieval. The mounds on the east of the group are smaller and delineated by ring ditches and thought to be early medieval while the larger mounds are likely to have Bronze Age origins.

Figure 12: Bronze Age and early medieval barrow cemeteries on Western Brow. Facing south-west. 29322_017 17-FEB-2015 © Historic England Archive.

Similar groupings were noted on Blackcap and on the east slope of Mount Harry. The latter were opened in the early 19th century to reveal two skeletons and multiple other bones covered in flints, but no dating evidence was uncovered (Horsfield 1824, 45). An early medieval date was assigned by Grinsell (1934, 228), probably based upon the size and clustering. Another barrow group was identified on Falmer Hill but has been so plough-levelled and disturbed by Second World earthwork defences that only three remain faintly visible on lidar.

Kingston barrows (Fig. 13) form the largest cemetery in the area and are the only grouping to have been surveyed in detail by the Royal Commission on the Historical Monuments of England (Historic England Archive Reference: MD000879). The complex cemetery is scheduled (NHLE 1013912) and comprises two larger mounds, interpreted as Bronze

Age, surrounded by a large number of much smaller early medieval mounds. Additional mounds, much plough-levelled, are visible outside the scheduled area. It is uncertain whether these represent a continuation of the cemetery, are geological in nature or the remains of flint extraction.

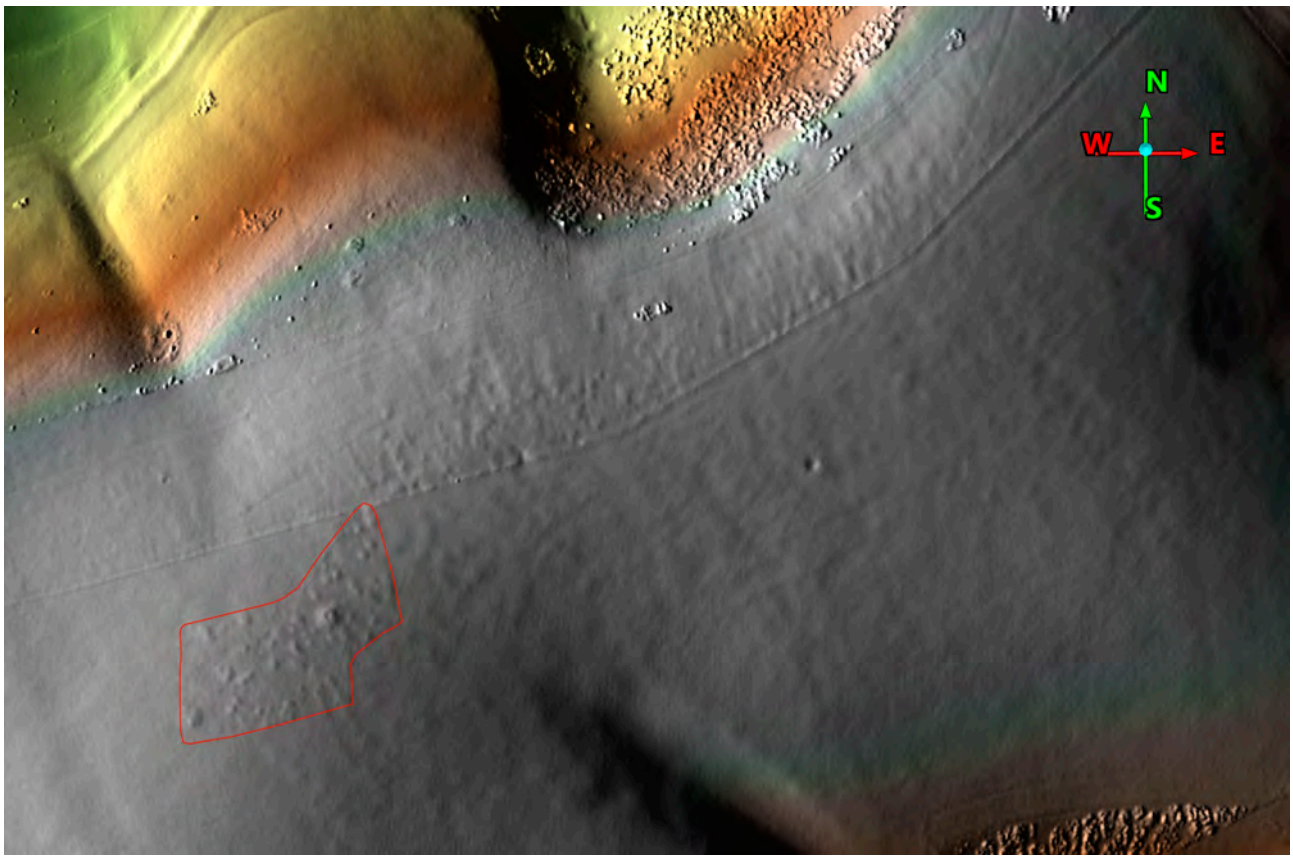

Figure 13: Kingston Barrows. Primarily early medieval barrow mounds visible on lidar. The area of arable reversion is outlined in red, but surrounding disturbance may suggest additional barrows. LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

The barrow cemetery on The Bostle, east of Woodingdean, was subjected to extensive excavation in the 1930s, but these interventions focussed on recovery of artefacts and did not analyse the structure of the barrow itself. A more systematic excavation was undertaken of one of the small barrows in 1949 but revealed no dating evidence. The excavators however still determined that the cluster was generally of early medieval date (Burstow and Norris 1951, 129-31).

Survival and protection

With the exception of Falmer Hill which is largely plough-levelled, the early medieval barrow cemeteries are scheduled. The designated area usually covers the entire site, but evidence from aerial photographs and lidar suggests that there are additional barrows beyond this at Kingston Barrows, The Bostle and Blackcap.

247 confirmed or potential Bronze Age round barrows were identified in the project area. Of these, most are sited along the northern ridge of the Downs – an area which has been subjected to less plough damage and has therefore greater earthwork survival. Further to the south, on the open downland, intensive farming has levelled or heavily denuded many of the previously known barrows. Lidar has been crucial to the identification of new barrows because of their poor earthwork survival, and many of these sites remain under arable cultivation. Despite this levelling, the slightest earthwork mound could have important implications for the survival of subsurface deposits as it can protect buried deposits from plough damage. Other barrow mounds have been completely levelled (Fig. 14) and survival of sub-surface remains is demonstrated by cropmarks and soilmarks.

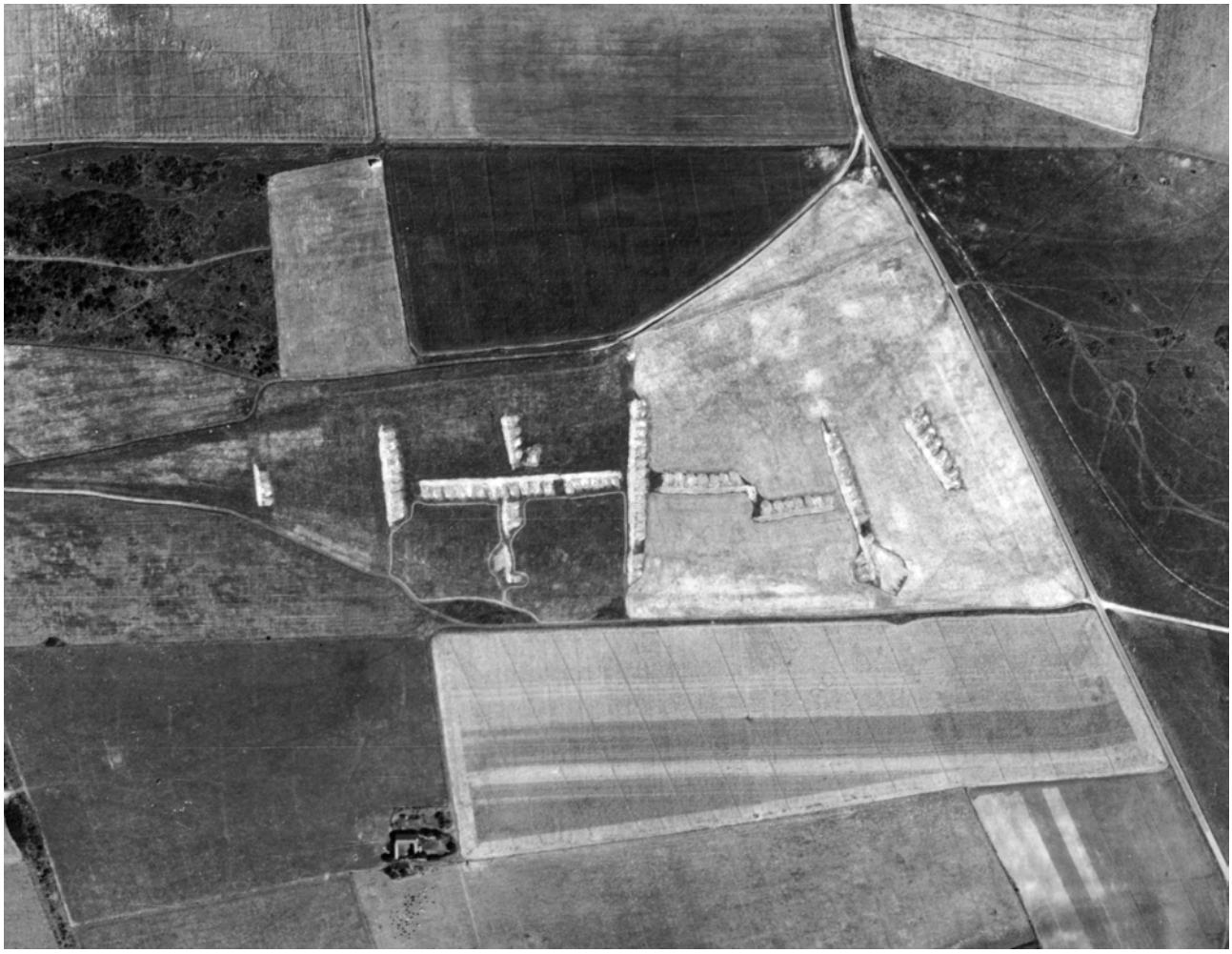

Figure 14: As well as arable farming, the construction and removal of Second World War anti-aircraft obstructions on Falmer Hill in 1945 caused considerable damage to both Bronze Age and early medieval barrows. Detail of RAF/106G/UK/559 RP 3003 29-JUL-1945 Historic England Archive (RAF Photography).

Farming and Settling the Downs

Prehistoric and Roman fields

The remains of later prehistoric and Roman fields form the bulk of the archaeological features mapped in the Downs from Above project. Earthworks such as these were recognised as being part of extensive field systems by Reginald Blaker in the fieldwork he carried out in South Malling, Sussex in the early 20th century (Yates 2007, 4). His work was built on by other Sussex based archaeologists including Herbert Toms (ibid.), Elliot and Cecil Curwen (Curwen and Curwen 1923) and George Holleyman. Holleyman studied the Downs north of Brighton, and produced a map showing the estimated extent of the ancient field systems and the location of prehistoric and Roman settlements (Holleyman 1935).

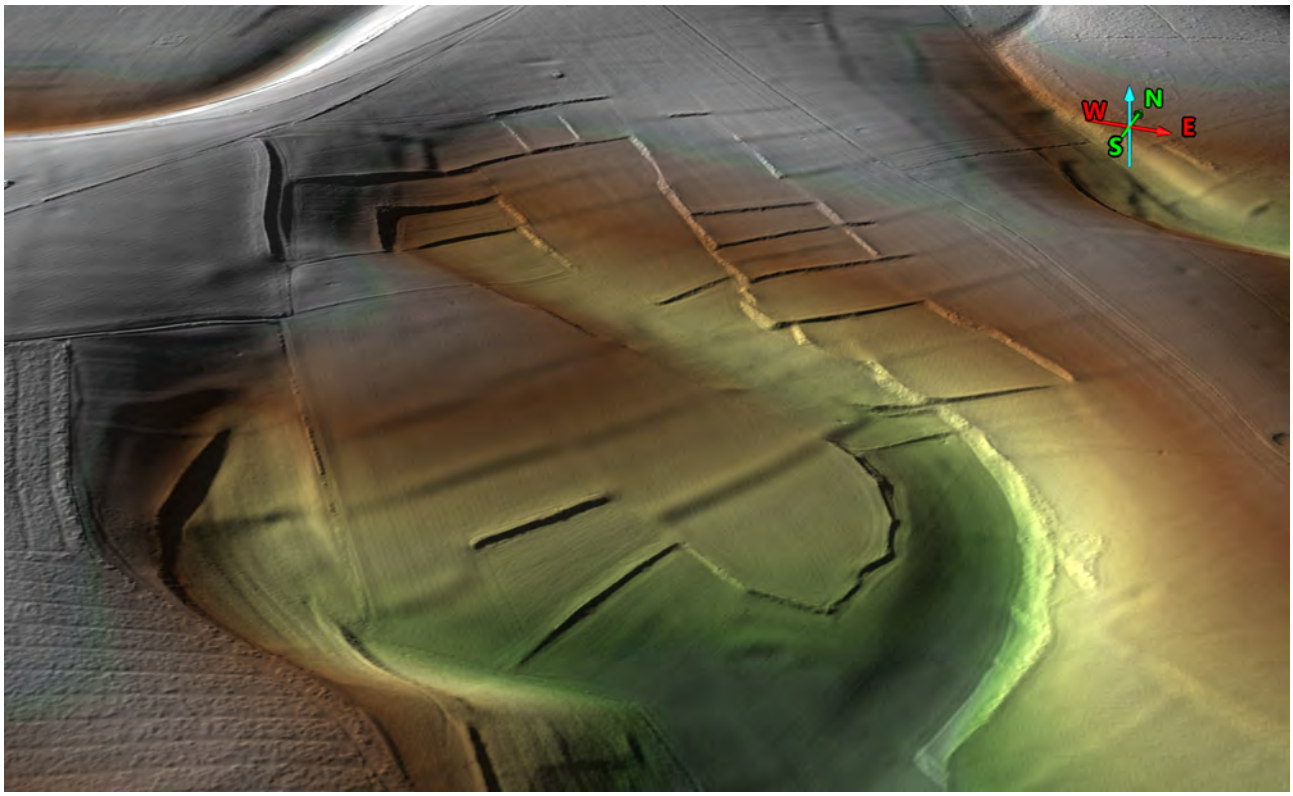

Figure 15: Lidar showing part of the field system on Balmer Down. LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

These small rectangular fields are defined by lynchets - banks formed as the plough soil accumulated along the field boundaries. These fields are grouped together to create field systems. Some lynchets such as those on Balmer Down survive up to 3m high (Fig. 15) but many others that may be difficult to see on the ground can be identified in lidar imagery which reveals slight earthworks only a few centimetres high. The archaeological mapping from lidar and aerial photographs illustrates the widespread uptake of agriculture across the South Downs that began in the Middle Bronze Age.

Evidence for Bronze Age fields on the South Downs is concentrated in East Sussex, although most of these sites have left no surface trace and are known through excavation (Yates 2007). Environmental evidence from the South Downs suggests there was open country in the Middle Bronze Age which implies woodland clearance for agriculture (Rudling 2005, 253). Surviving earthworks of Bronze Age fields within the project area are the lynchets on Plumpton Plain which are overlain by enclosures that form part of a Late Bronze Age settlement (McOmish and Tuck 2004). On Bullock Down, Sussex (outside this project area) Bronze Age fields were abandoned, but some were later expanded and developed in the Late Iron Age and Roman period (Drewett 1982). The excavated fields at Eastwick Barn, Patcham, suggest that the fields were in use by the Early Iron Age, abandoned and then recultivated in the Roman period (Rudling 2005, 132). A similar pattern of abandonment of early fields and then reuse in the later Iron Age and Roman periods has been identified elsewhere in the country, for example on the Marlborough Downs and Salisbury Plain, both in Wiltshire (Fowler 2000, 225).

Layout

Various patterns of field system have been identified across England. On Salisbury Plain fields were laid out on a common north-east/south-west axis regardless of the terrain creating what is known as a coaxial field system (McOmish et al 2002). However, generally the pattern of ancient field systems follows the undulations of the landscape. This is seen on the Marlborough Downs in Wiltshire (Yates 2007) and for most of the field systems mapped across the High Woods area of West Sussex (Carpenter et al. 2016).

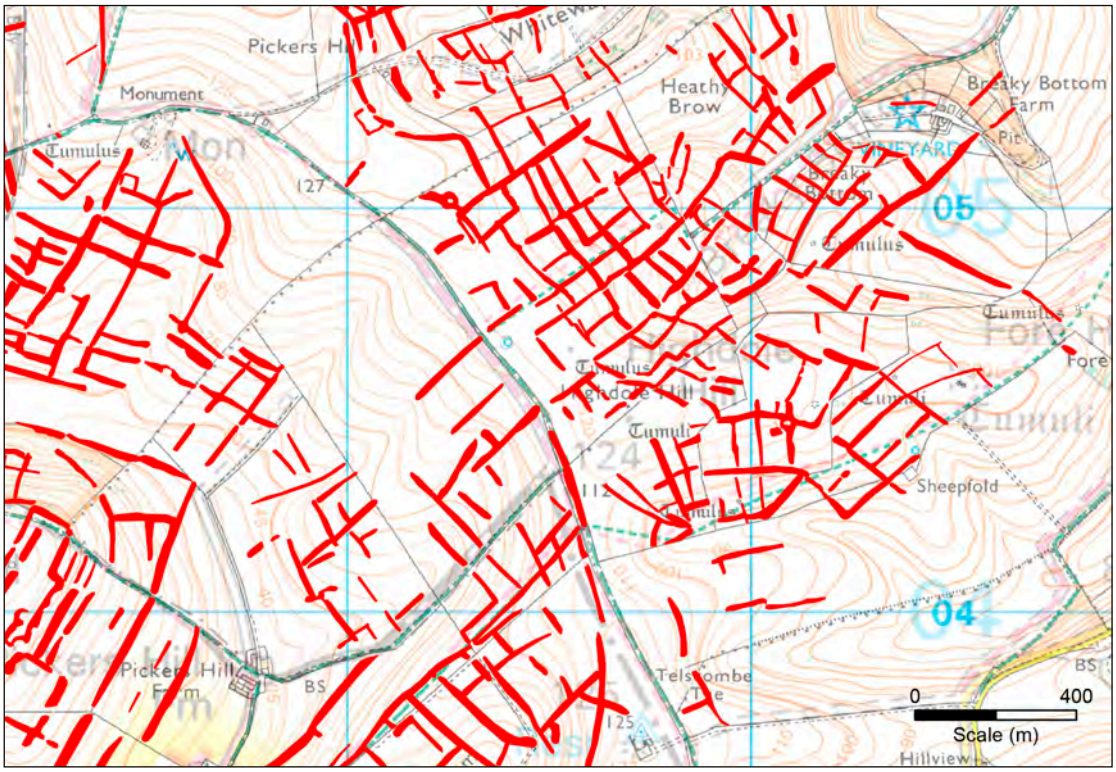

Figure 16: Later prehistoric and Roman field system on Balmer Down. Archaeological mapping © Historic England. Base map © Crown copyright and database right 2023. All rights reserved. Ordnance Survey licence number 100019088.

This also seems to be the case in the Downs from Above project area and field layout seems determined by the topography although there are some small areas of co-axial fields, for example, the fields on Balmer Down. These have a north-west/south-east orientation along the main ridge (Fig. 16) and follow the same alignment across the northern part of the slope into Buckland Hole showing that some ploughing was carried out across the contours. This covers an area measuring about 1km by 200m after which the fields change direction to follow the contours in the southern part of Buckland Hole and this new orientation continues across the next ridge to the south-west that leads up to Balmer Huff. To the north-east the fields turn to a north to south orientation dictated by the curve of the combe onto Plumpton Plain.

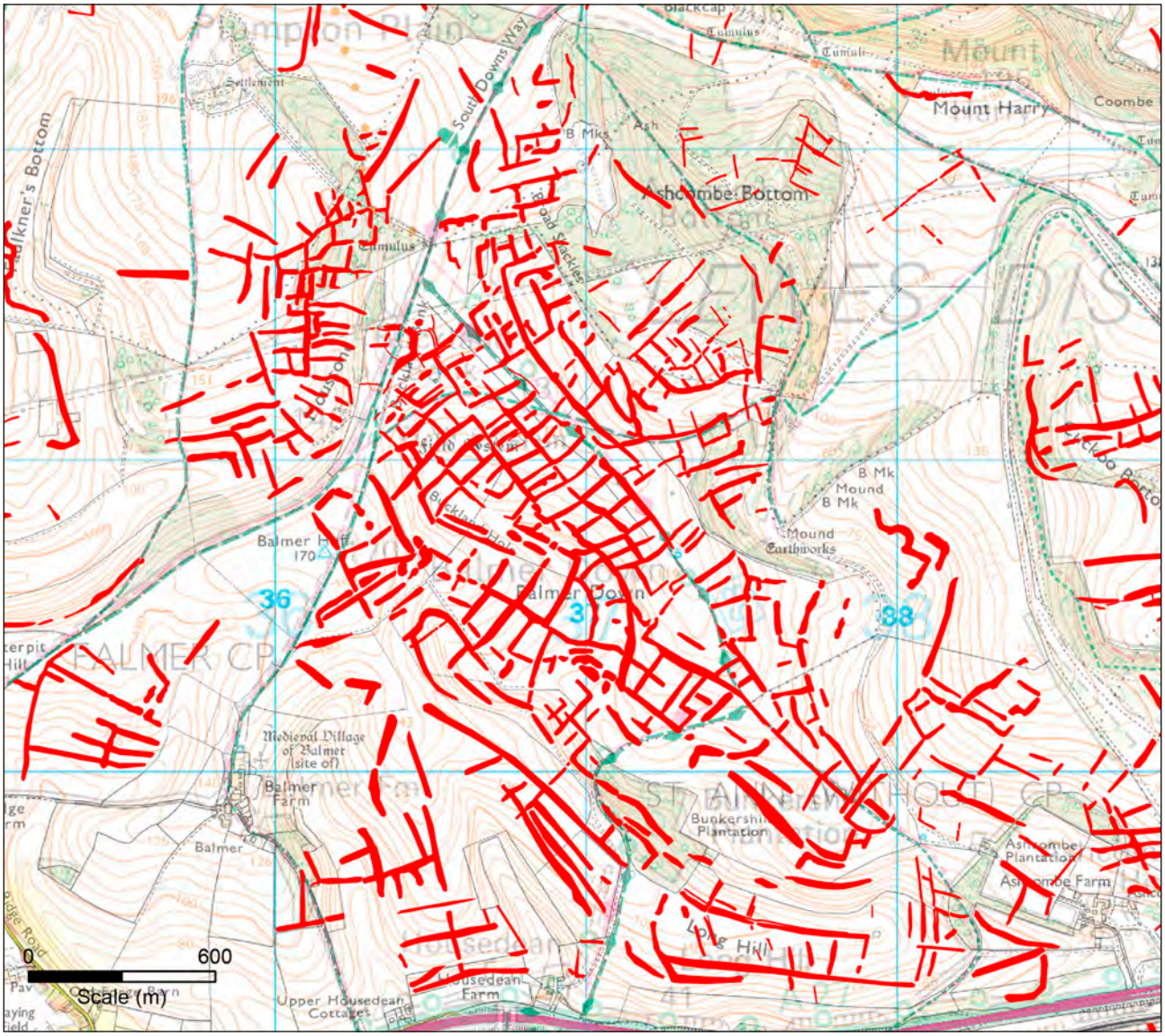

Figure 17: Field system on Highdole Hill. Archaeological mapping © Historic England. Base map © Crown copyright and database right 2023. All rights reserved. Ordnance Survey licence number 100019088.

North of Saltdean, fields laid out across Combe Bottom, Highdole Hill and Heathy Brow largely follow a south-west/north-east orientation (Fig. 17). This dominant orientation only covers an area of about 1.8km by 1.2km after which the fields then follow the contours as seen along the edge of Whiteway Bottom, the south-western slope of Pickers Hill and the southern slopes of Highdole Hill.

Other areas of fields were laid out on a single orientation for hundreds of metres such as on the southern side Tegdown Hill but as with the previous examples the orientation is not maintained across adjacent combes. At Pyecombe the field system across what is now a golf club runs east to west, but the field boundaries are not straight but instead follow the gently undulating contours of the side of the combe.

Elsewhere the changes in field orientation may be more frequent. On Tenant Hill north of Portslade-by-Sea (Fig. 18) the fields do not follow a dominant orientation but gradually change direction as they extend north towards Perching Hill.

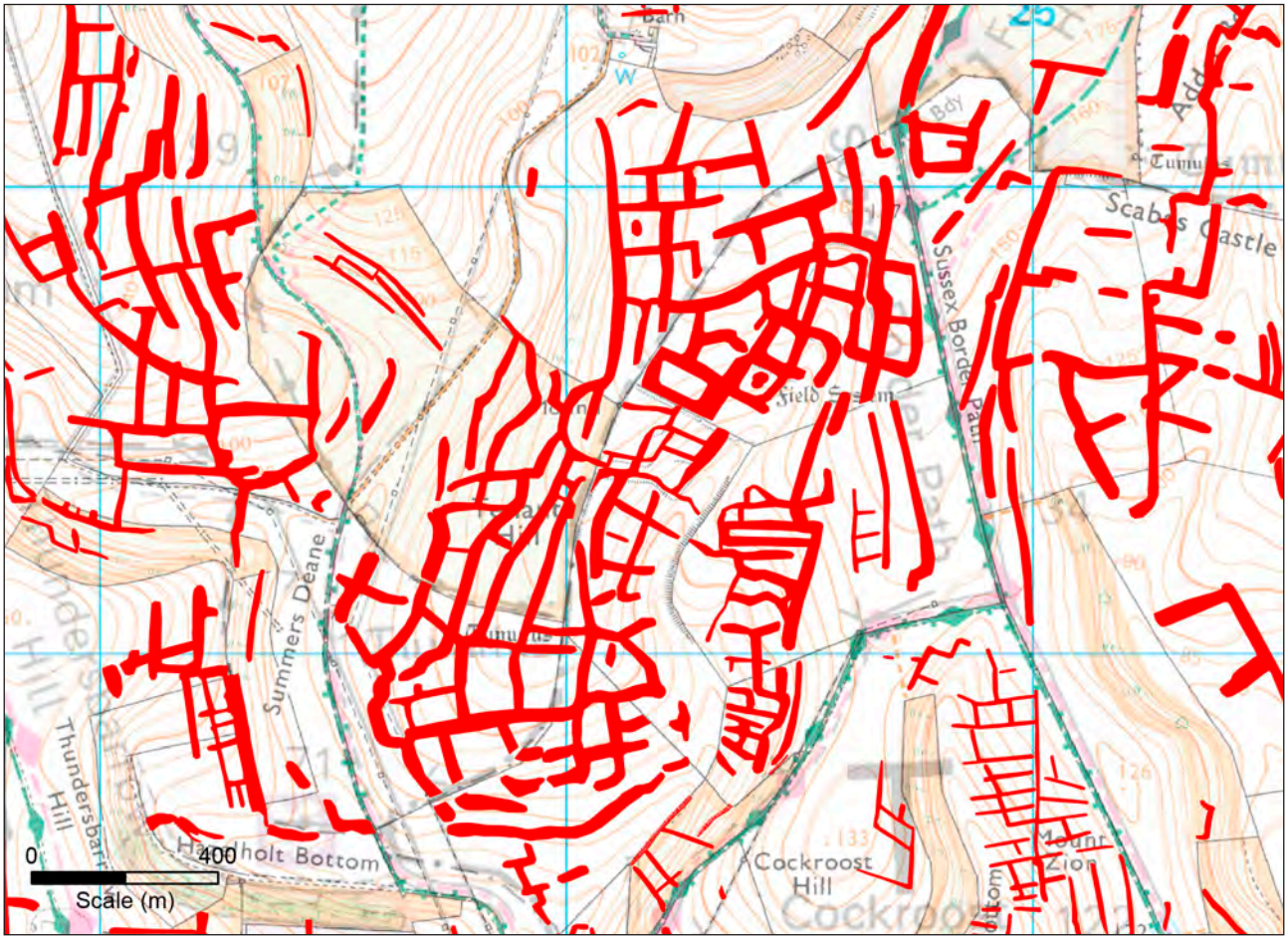

Figure 18: Field system on Tenant Hill. Archaeological mapping © Historic England. Base map © Crown copyright and database right 2023. All rights reserved. Ordnance Survey licence number 100019088.

Overall, the mapping shows what appear to be several field systems independent of each other and that these groups may have evolved over time as new fields were added. It is possible that areas of coaxial fields formed the core of some of these larger systems.

Evidence for movement through these field systems is limited. The Bronze Age settlement on Plumpton Plain includes a trackway which may have originally been part of the underlying field system. At Pyecombe a double lynchet defining a trackway runs for 1.5km along the entire length of the surviving field system. Other parallel lynchets have been seen on Round Hill. Elsewhere ploughing has lowered and spread some of these earthworks making potential trackways difficult to identify. On Tegdown Hill the lidar shows an east to west lynchet forming the boundary to an ancient field. Aerial photographs of the same area show cropmarks of this field system which reveal that beneath the spread earthworks are the buried remains of two parallel banks and flanking ditches defining an east to west trackway through the fields (Fig. 19).

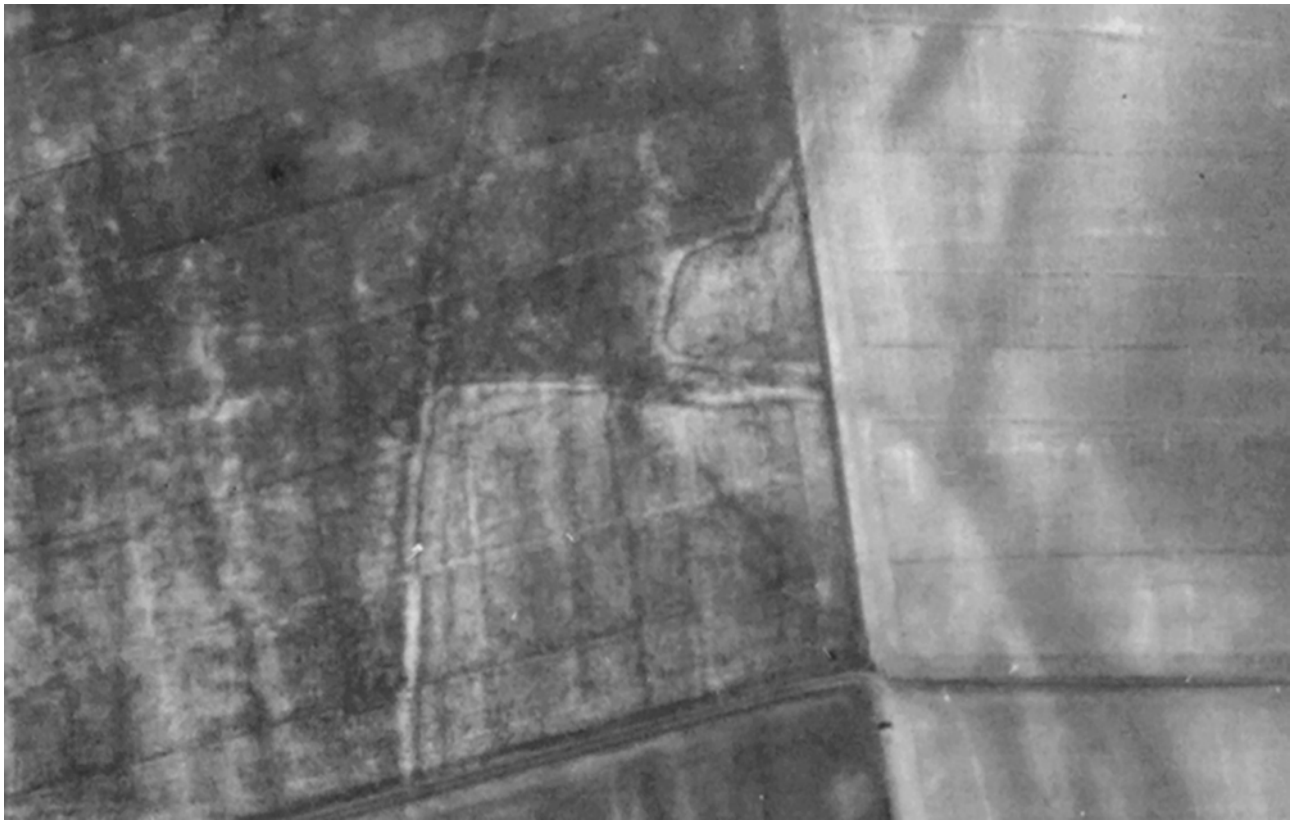

Figure 19: Cropmarks of a trackway and field boundaries on Tegdown Hill. RAF/82/1121 F22 120 21-MAR-1955 Historic England Archive (RAF Photography).

The Neolithic and Bronze Age barrows pre-date the prehistoric field systems (see also chapter above) and the relationship between barrows and the later fields varies. On Tegdown Hill a field boundary appears to have changed direction to avoid a barrow. Elsewhere some field banks appear to have been aligned on and perhaps incorporated pre-existing barrows. At the southern end of Stanmer Down are the remains of a barrow first identified on the 1873 Ordnance Survey map and 150m to the east is another mound

that may also be the remains of a Bronze Age barrow. Both can be seen in lidar, although the western barrow is harder to see as it is covered by trees and brambles. The lidar also shows the faint earthwork remains of prehistoric or Roman field system across this area. One of these field banks is aligned on the western barrow and may possibly continue to the north. An even fainter field bank can also be seen aligned on the possible barrow to the east (Fig. 20). To the north of Rottingdean the field banks were not aligned on the barrows there but instead avoided them and so they were incorporated into different fields (Fig. 21).

Elsewhere it appears that the fields avoided areas with barrow groups on them although variable survival makes this difficult to be certain. For example, no field remains have been identified within about 60m of a barrow group seen as cropmarks on Bow Hill.

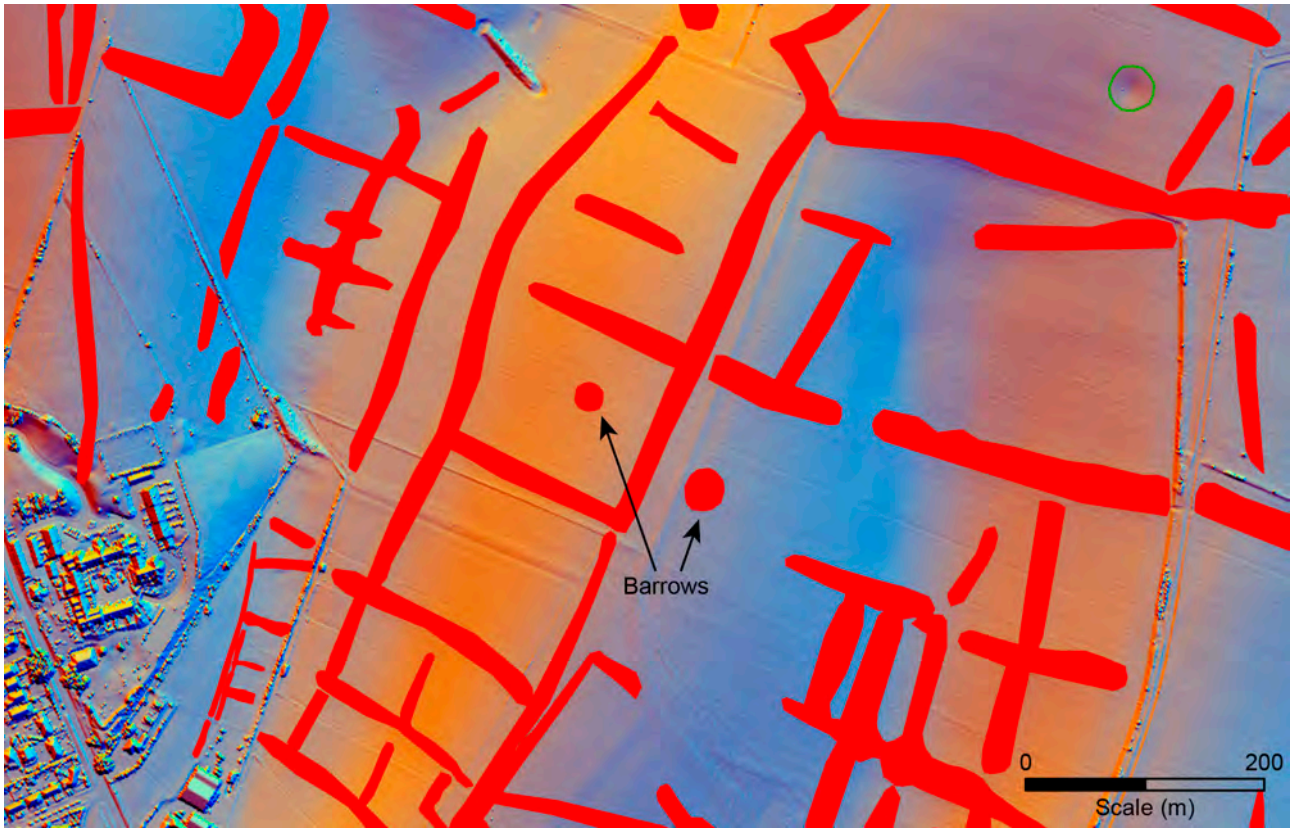

Figure 20: The apparent alignment of prehistoric or Roman field banks on possible Bronze Age round barrows seen on Stanmer Down. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

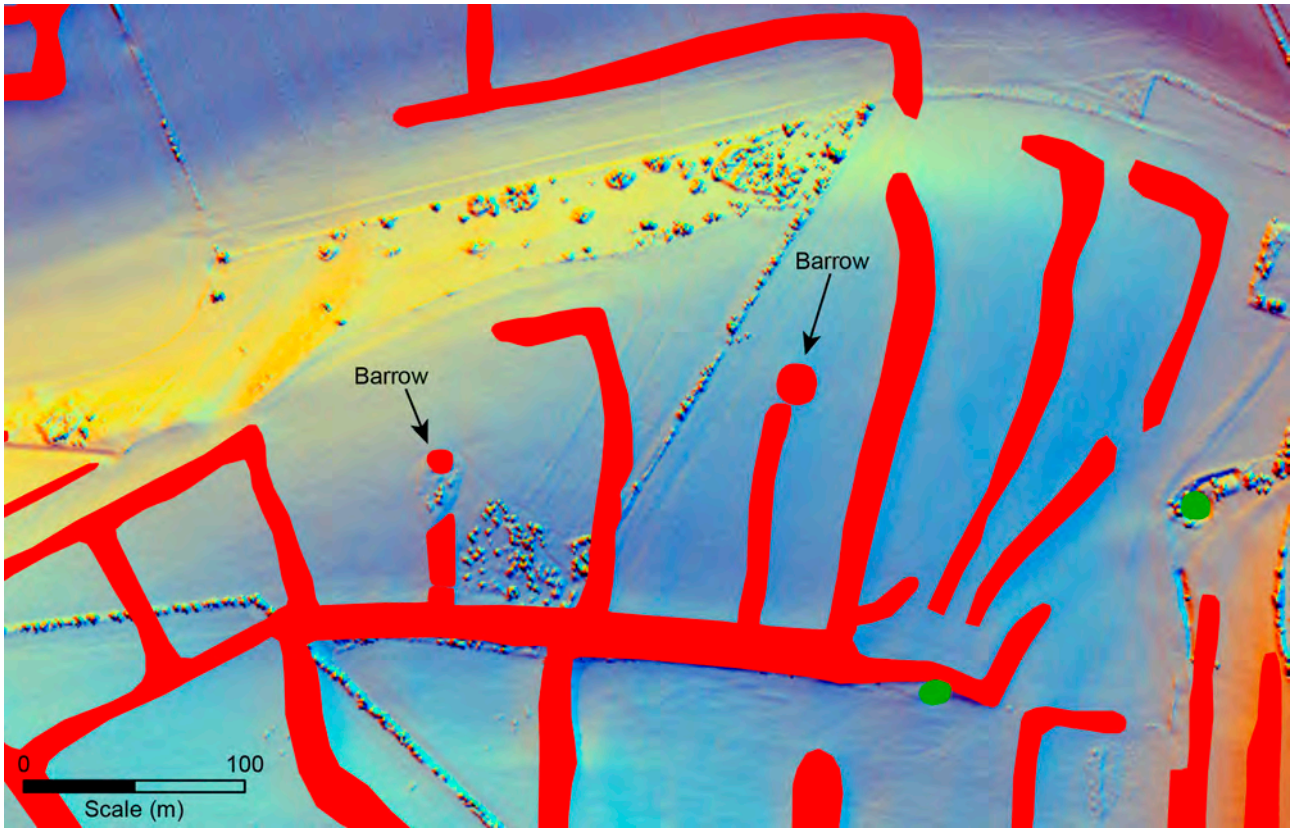

Figure 21: Bronze Age barrows within prehistoric or Roman fields to the north of Rottingdean. A third barrow with a similar relationship to the fields is about 500m to the south. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

Prehistoric settlement

Previous archaeological work identified several prehistoric settlements across the South Downs. Some survive as earthworks while others were identified from cropmarks or through the discovery of archaeological finds, and distribution maps of these sites are provided in *An Historical Atlas of Sussex* (Leslie and Short 1999). Settlements can be identified by enclosure banks and ditches, but smaller settlement features such as hut circles or pits are not always visible and so unenclosed settlements can be difficult to identify form the air.

A well-preserved Bronze Age settlement on Plumpton Plain consists of at least four embanked enclosures (without ditches) linked by trackways (Fig. 22). About 700m to the south-west are the earthworks of another enclosure thought to be of the same date. Plumpton Plain is contemporary with other settlements identified in Sussex such as Itford Hill, Kingley Vale, New Barn Down and Blackpatch.

Figure 22: The earthworks of the Bronze Age settlement on Plumpton Plain. 26481_006 08-SEP-2009 © Historic England Archive.

Several enclosures, some of which may represent settlements have been seen as cropmarks. On the southern slope of Tegdown Hill cropmarks show a possible Iron Age or Roman settlement comprising a rectangular enclosure and pits within a field system. Cropmarks indicate two possible Iron Age enclosures close to the Plumpton Plain settlement. These partially show an enclosure about 40m across with traces of an outer ditch. At the north of this and against a modern field boundary a curving ditch may be remains of a second similar sized enclosure.

About 1km to the south-west are two similar sized enclosures near St Mary's Farm on Stanmer Down, both seen as cropmarks. One of these partly survived as an earthwork when it was surveyed in the early 20th century (Toms 1927, 191-193) but now appears to be totally levelled, although there is a chance that part of its southern side survives within the earthworks that define the present field boundary. An enclosure of a similar shape and size about 240m north, positioned against a lynchet of a field system (Fig. 23). The phasing of the lynchet and enclosure is unclear but a slight kink in the field bank may indicate that it was later and formed against the side of the enclosure. About 150m west of this are the slight earthwork remains of another similar sized enclosure also connected to a field system, however this is within woodland and the lidar is difficult to interpret.

Figure 23: The cropmark showing buried remains of a possible Iron Age enclosure on Stanmer Down. NMR 905/199 04-MAR-1976 © Crown copyright. Historic England Archive.

Medieval and later fields

There is limited evidence of medieval or post medieval arable farming on the South Downs, but traces of ploughing on some slopes have been identified in the form of earthwork strip lynchets, a type of feature not common in Sussex (Whittington 1962, 115). Ploughing on steep slopes would have been a difficult undertaking and suggests that ploughing on these marginal lands, not normally used for arable, was a result of population pressures during the 13th and early 14th centuries (Muir 2004, 247). There are earthworks of strip lynchets on the south facing slope of Newtimber Hill and on the adjacent North Hill. Those on North Hill cut across the prehistoric or Roman fields (Fig. 24).

There is little ridge and furrow in the project area, and most is within the Weald. The ridge and furrow in several of these fields is straight and narrow, a form suggesting they were ploughed in the post medieval period.

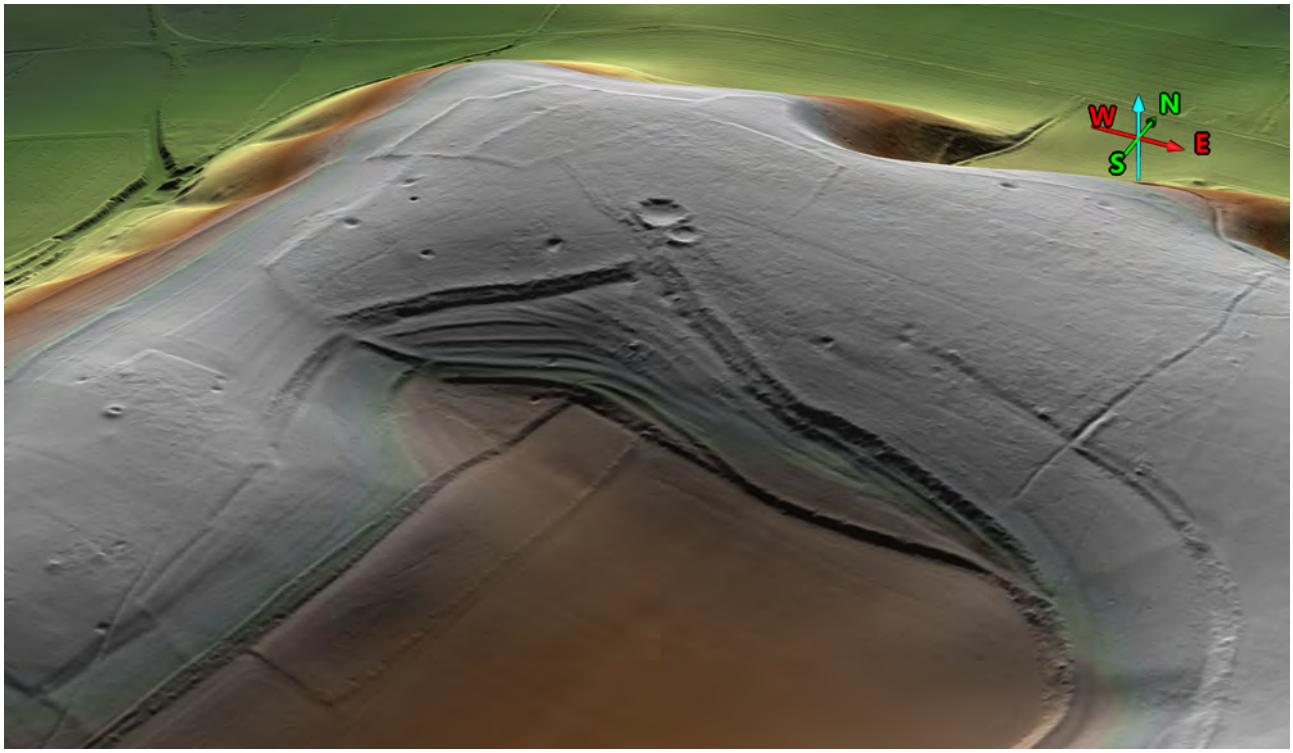

Figure 24: Medieval strip lynchets on Newtimber Hill and North Hill. LIDAR DTM 17-JAN-2019 © Historic England. Source Environment Agency.

More recent periods of ploughing on the South Downs are recorded in various sources. The 18th-century Yeakell and Gardner map indicates land use and shows areas of arable cultivation, including areas of ploughing as dark parallel lines. In places these may be confused with map shading but generally the plough lines are more widely spaced. The mid-19th century tithe apportionments record field use which shows a mixture of arable and pasture on the Downs. Some of the fields listed as arable have downland names suggesting that they had not long been converted to arable when the tithe apportionments were compiled. This is seen in Patcham, where plot 200 in the 1842 tithe was named 'Part of East Down' but the state of cultivation was arable. In other examples the tithe apportionment records that land had recently been broken up. A field south of Upper Bevedean was recorded as 'Down broken up' (Falmer parish, 1838 tithe, plot 258).

Not all the arable fields recorded in the 1800s continued to be ploughed and the 1940s aerial photographs show some had reverted to pasture; see the example of New Barn Field, Stanmer in the chapter on Dewponds. The Army's requisition of the South Downs during the Second World War meant that the area was less affected than other parts of the country by the wartime ploughing up campaign but continuing food shortages in the post-war period and the introduction of bread rationing meant that the demand for cereals and other crops remained high. The government gave grants to encourage ploughing up of grassland. In 1952 it was offering £5 an acre to plough up land that had been under grass for four years or more. This was followed by a £10 an acre grant intended to help with the cost of clearing difficult to work grassland of scrub and boulders in advance of ploughing (Carpenter 2008, 63). It is likely that some of the post-war ploughing seen in the aerial photographs across the Downs was part of these ploughing up campaigns.

Medieval and later settlement

Some evidence of medieval settlement shrinkage can be observed in the project area. Settlement earthworks at Ovingdean are situated within a field to the north of the church called Hog Croft. Earthworks of low banks mark out property plots and these are arranged either side of a former lane that appears to have been a continuation of Ovington Road which is the main route through the village.

A more extensive and better-preserved set of earthworks can be seen at Saddlescombe (Fig. 25). These medieval or post medieval earthworks form building platforms, yards and hollow ways. Some of these earthworks are cut by a post medieval hollow way, first depicted on the 1813 Ordnance Survey map, which provided access to Saddlescombe from the main road.

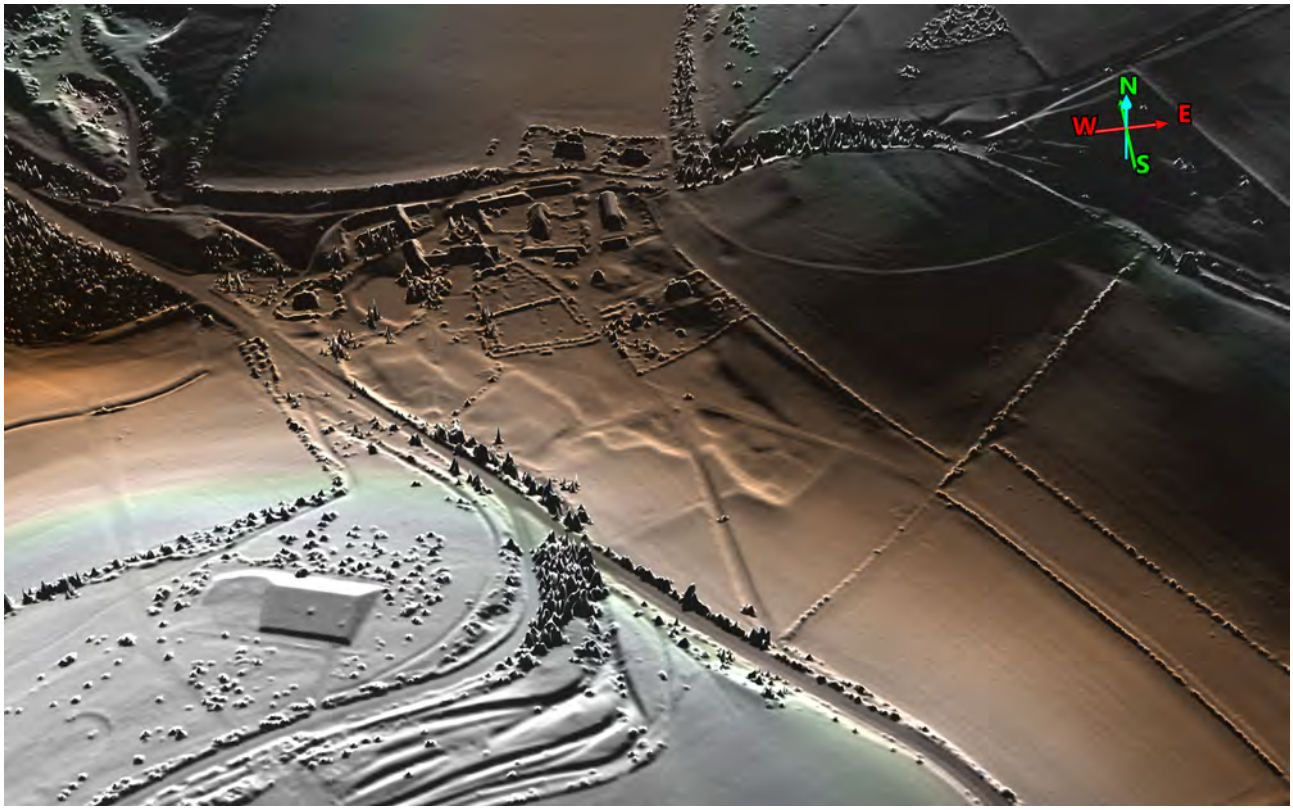

Figure 25: Medieval and later earthworks associated with settlement at Saddlescombe. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

There are several phases of settlement at Balmer Farm. The earthwork remains of the medieval settlement are located to the north of the farm. These are not clearly defined but seem to include the remains of building platforms. The farm was evacuated during the war and in common with others across the South Downs, was badly damaged in the army training exercises carried out during the Second World War. Damaged and roofless buildings can be seen in aerial photographs taken in 1946 but the farm was subsequently rebuilt and modernised (Fig. 26).

Figure 26: The damaged and roofless buildings of Balmer Farm because of Second World War army training exercises. Detail of RAF/CPE/UK/1768 RS 4218 7-OCT-1946 Historic England Archive (RAF Photography).

Conclusion

The map produced by the Downs from Above project has been able to build upon the pioneering work looking at the ancient fields and settlements north of Brighton conducted by George Holleyman (Holleyman 1935). His map included shaded areas where he could identify field systems, and areas which he speculatively marked the original extent of these fields. Lidar has confirmed that field systems existed across those areas suggested by Holleyman. The project has also identified the remains of ancient fields across some of the blank areas on Holleyman's 1930s map. Many of these field banks survive as very low earthworks which are difficult to see on the ground and their poor condition may explain why some have not been recorded before this project. The poor condition of some of these fields is due to episodes of more recent ploughing, in particular during the 18th, 19th and 20th centuries. In places a hundred years or more of ploughing has completely levelled field banks. This survey has also provided the detail of field shape, size and orientation of these field systems and the resultant map provides a detailed view of these fields and their relationship to other features in the landscape from which we can better understand this landscape. It also enables future studies to compare this part of the Downs with other areas of ancient fields elsewhere on the South Downs and across the country.

Livestock on the Downs

The South Downs has a strong association with sheep. The flocks had a prominent place in the farming regime not just for the wool and meat they provided, but also for their role in manuring the arable fields, a system known as sheep and corn farming. Some evidence of sheep faming exists across the South Downs in the form of dewponds and livestock enclosures. These features have seen little archaeological work (Barber 2019, 9).

Dewponds

Figure 27: A dry dewpond, Streat Hill in 2015. Detail of 29321_044 17-FEB-2015 © Historic England Archive.

Dewponds are situated across the South Downs on ridges, hilltops and within combes. These ponds are found across the chalk landscapes of England, but they have a strong association with Sussex and in the 1930s it was claimed that ‘no guide-book to Sussex is complete without a picture of a dewpond’ (Pugsley 1939, 28). The chalk landscape that makes up the Downs is freely draining, and these ponds were constructed to provide livestock with water which meant that they didn’t have to be driven long distances to spring lines or streams off the Downs. An air of mystery once surrounded these ponds because

of their location high up on the Downs, with no obvious explanation as to how they were supplied with water and claims that they never ran dry even during a drought. They can still have an otherworldly quality and the Ditchling Beacon dewpond has been the subject for the photographer Jem Southam (Exhibition: Bringing to Light – Towner Eastbourne). Speculation that they were filled by fog, mist or dew led to various names such as cloud ponds, mist ponds or the name they are best known by, dewponds (Pugsley 1939).

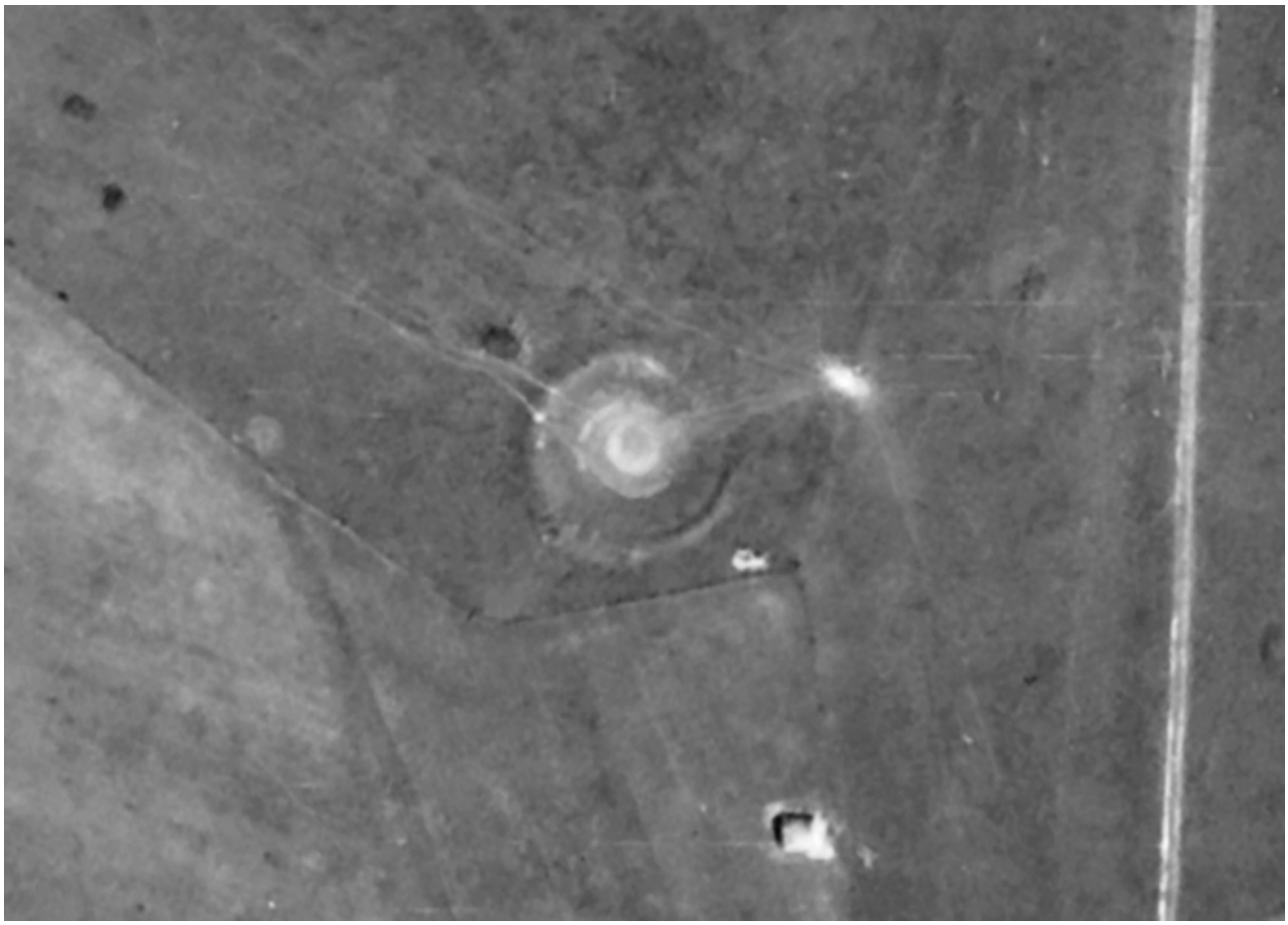

Figure 28: Ewebottom Hill dewpond in 1945. This is one of the dewponds that didn't dry out during the 1911 drought. The earthwork survives but appears to no longer hold water. Detail of RAF/106G/UK/559 RP 3044 29-JUL-1945 Historic England Archive (RAF Photography).

Because of the belief held by some that these ponds were filled by dew, several studies carried out in the late 19th and early 20th century were largely focussed on determining how these ponds were filled. Some of the various experiments measuring condensation, amount of rainfall, rate of evaporation etc. are discussed in *Dewponds in Fable and Fact* (Pugsley 1939) and Edward Martin's *Dew Ponds, History, Observation and Experiment* published in 1915. Both include Sussex dewponds and Martin's research was carried out on the South Downs in the vicinity of Brighton (Martin 1915). The conclusion of these studies perhaps unsurprisingly showed that the ponds were not filled by dew but were filled by rain, or a combination of rain and runoff from the surrounding area. This uncertainty as to how dewponds were filled seems strange as dewponds were still being constructed and

used in the first half of the 20th century and some 18th and 19th-century writings simply refer to them as ponds. It is clear from the comments made by one farmer discussing ponds in the *General View of the Agriculture of the County of Sussex* (Young 1808, 324) that they were filled by rain. He claimed that rain filled ponds never needed cleaning, while those which were part-filled by run off from the surrounding area were 'perpetually choked up' (ibid). The studies also established that in drought conditions some ponds would eventually dry up as was the case in the dry summer of 1911. Nevertheless a few ponds did keep going although the water level was reduced. These ponds were at Ewebottom Hill (Fig. 28), Upper Standean and at the head of Ditchling Bostall (Martin 1915 175).

Construction

Almost all the dewponds identified during this project are circular and range in diameter from around 10m to 35m, although most are probably in the region of 20m across. An oval pond is located on the Downs in Streat and beyond this project area a small group of oval ponds were identified around Findon (Carpenter 2008, 38). On Salisbury Plain (Wiltshire), ponds of a standard shape and size were all constructed by a single family (McOmish et al. 2002, 1) but it is not known if there is any link between the oval ponds at Streat and Findon. Some dewponds were built with a wide margin to increase the catchment area of the pond and on steeper slopes pronounced retaining banks were built. There are various methods of construction with a variety of different layers used. The simplest consist of a watertight base made of puddled clay or chalk but other ponds may have additional layers above and below the watertight layer. These included lime or soot to prevent earthworms boring through from below or a layer of flints or rubble as a top layer to prevent the wading animals breaking-up the bottom of the pond. An excavated pond near Eastbourne (outside the project area) was located on a natural cap of clay with no evidence of puddling over which was a layer of flints (Stevens 1990, 259). Some Sussex ponds were made of concrete from around the early 20th century. A variety of different construction methods, including some Sussex examples is outlined by Pugsley (1939, 34a) and by Martin, who includes some profile drawings of ponds (Martin 1915, 83-111).

Age

Dewponds may have been constructed during the prehistoric period and evidence of possible ponds from the Bronze Age were identified in Sussex at Blackpatch (Field 1999, 30) and Plumpton Plain (Holleyman and Curwen 1935). Evidence from the early medieval period comes from Wiltshire where a surviving dewpond on a parish boundary is linked to the pond Oxna Mere, named in a boundary charter of AD 957 (Grundy 1919, 214). Very few of the dewponds identified on the South Downs have a stratigraphic relationship with other earthworks, one example is the pond above Home Bottom in Ditchling parish which was built on a prehistoric cross dyke.

Historic maps provide evidence of dewponds in Sussex over the last 250 years. Nine dewponds are shown on Yeakell and Gardner's 1778-1782 Sussex map within the Downs from Above project area and this number had increased by the early 19th century as shown on the 1813 Ordnance Survey map. The tithe maps of the late 1830s and early 1840s provide more detailed mapping of Sussex and include dewponds for some parishes.

Figure 29: One of the dewponds in Ditchling in 1982 with a retaining bank on the lower (left) side. It appears to hold some water, but perhaps not well maintained. Built on top of a prehistoric cross dyke. For a 2019 view of this pond see figure 29. Detail of NMR 2103/423 22-FEB-1982 © Crown copyright. Historic England Archive.

These maps roughly coincide with a period of dewpond construction and appear to reflect their growing numbers. However, there are some inconsistencies between what is shown on the earliest maps and those produced in the later 19th century which suggests that they cannot be completely relied upon. At least one pond shown by Yeakell and Gardner north of Buckingham House, Shoreham-by-Sea is not shown on the 1844 tithe map but is depicted on the 1874 Ordnance Survey map.

Distribution

Evidence of dewponds can be seen across the downland of the project area although the number of ponds within any one parish does vary. The parish of Hamsey's only known dewpond can be compared with the evidence for 14 identified in Ditchling. The different locations in which the ponds were built (hilltops, valley bottoms etc.) suggest that there were few natural restrictions on the number of ponds that could be built in any given block of downland. Although some ponds may have been constructed on the natural caps of clay-with-flints present in parts of the Downs there is no correlation between the location of dewponds and these less permeable areas.

The early 19th century tithe maps provide details of the land divisions within each parish, the owners, and occupiers of the various parcels of land. The 1840 tithe map shows the bulk of Newtimber Hill divided between two occupiers: Stephen Bine and Richard Tapsall. Three ponds were mapped from lidar on the hill, two side by side in Bine's block of land, one in Tapsall's area of downland, and this pattern of occupation may explain the distribution of dewponds across this area.

Land ownership may have been a factor in the distribution of ponds. In Ditchling in 1840 a farmer named William Tanner owned and occupied several parcels of land on the Downs. This included one large area of downland (counted as two blocks for tithe purposes) which had three dewponds and an arable field (counted as four blocks for tithe purposes) surrounding a small plot just large enough to enclose a fourth dewpond (also owned by Tanner). In this example the multiple dewponds owned by Tanner may have been the result of buying up separately owned plots which already had dewponds.

Figure 30: Two dewponds owned by Scrase family farmers, above Home Bottom, Ditchling. The pond on the right can also be seen in figure 28. Next Perspectives APGB Imagery TQ3112-3-TQ3213 01-APR-2019 © Bluesky International/Getmapping PLC.

The sometimes-desperate need for water on the South Downs is reflected in Arthur Young's comment that in dry weather some flocks with no water of their own were 'driven to their neighbours' ponds, sometimes at a considerable distance' (Young 1808, 323-4). Even in less extreme weather there was a requirement for vast quantities of water. In 1808 it was estimated that 270,000 ewes were kept on the South Downs between Eastbourne

and Steyning (ibid., 304). Although the downland within this project equates to just under half the area outlined by Young, this figure gives some idea of the number of sheep that required watering in the Downs from Above project area. Young also notes that every farm has an ‘opportunity of collecting any quantity of water’ which suggests that some farmers maximised the amount of water they had access to by constructing multiple dewponds on their land, the additional ponds perhaps reflecting the ownership of larger flocks. This need for plenty of water may explain why the Scrase family in Ditchling had two ponds both about 20m across within 200m of each other (Fig. 30). However, the comment that sheep were sometimes driven to neighbours’ ponds, and the presence of some dewponds alongside trackways does hint that a direct relationship between the number (or size) of ponds and flock size may not be exact.

Some dewponds were dug side by side and this can be seen on Newtimber Hill (Fig. 31) and on Bullock Hill (formerly Rottingdean parish). This may reflect convenience in having both ponds close together, although in a Dorset example it was suggested that one pond was an overflow from the other (Pugsley 1939, 27), although as these ponds were primarily filled by rain it may be more likely that they would fill at the same rate.

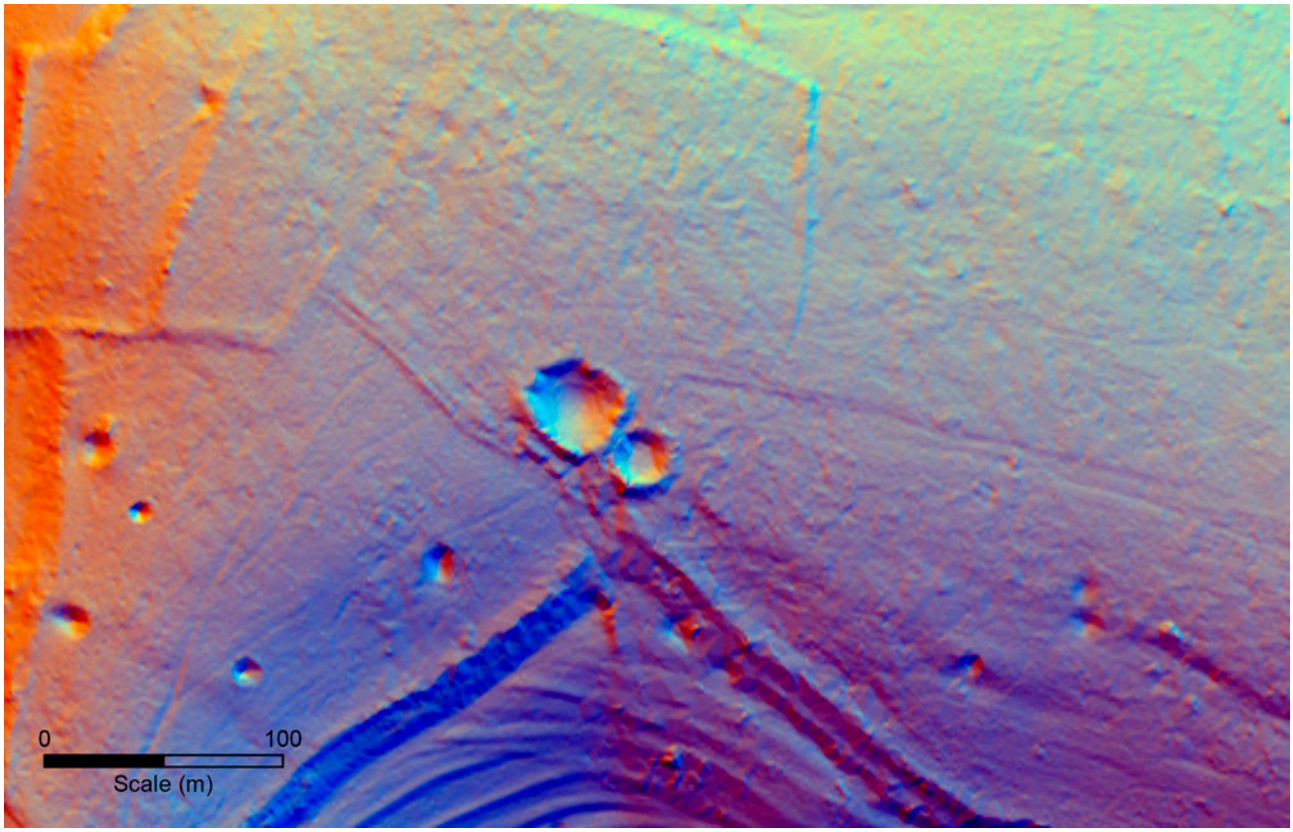

Figure 31: Side by side dewponds on Newtimber Hill. LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

While some tithe maps give a detailed distribution of dewponds across a parish, the associated apportionments provide detail of land use for each plot and sometimes reveal that not all fields with dewponds seen on the tithe maps were in pasture during the early 19th century. In Stanmer the 1839 tithe map shows New Barn Field (Fig. 32), defined by hedgerows on three sides with Coldean Lane along the eastern side with a narrow plantation beyond. There was a barn at the south-east corner and a dewpond at the north-east corner. These features all suggest a pasture field and this field is shown as pasture on the 1799 Stanmer estate map. However, the 1839 the apportionment records the field as arable. The pond was perhaps then little used, although it may have been accessed from Coldean Lane. By 1945, the aerial photographs show that New Barn Field was again under grass. After 1945, much of the surrounding area was developed with the building of Coldean, but this dewpond survives at the northern end of the school grounds. Seen on lidar under trees it is not known if it holds any water.

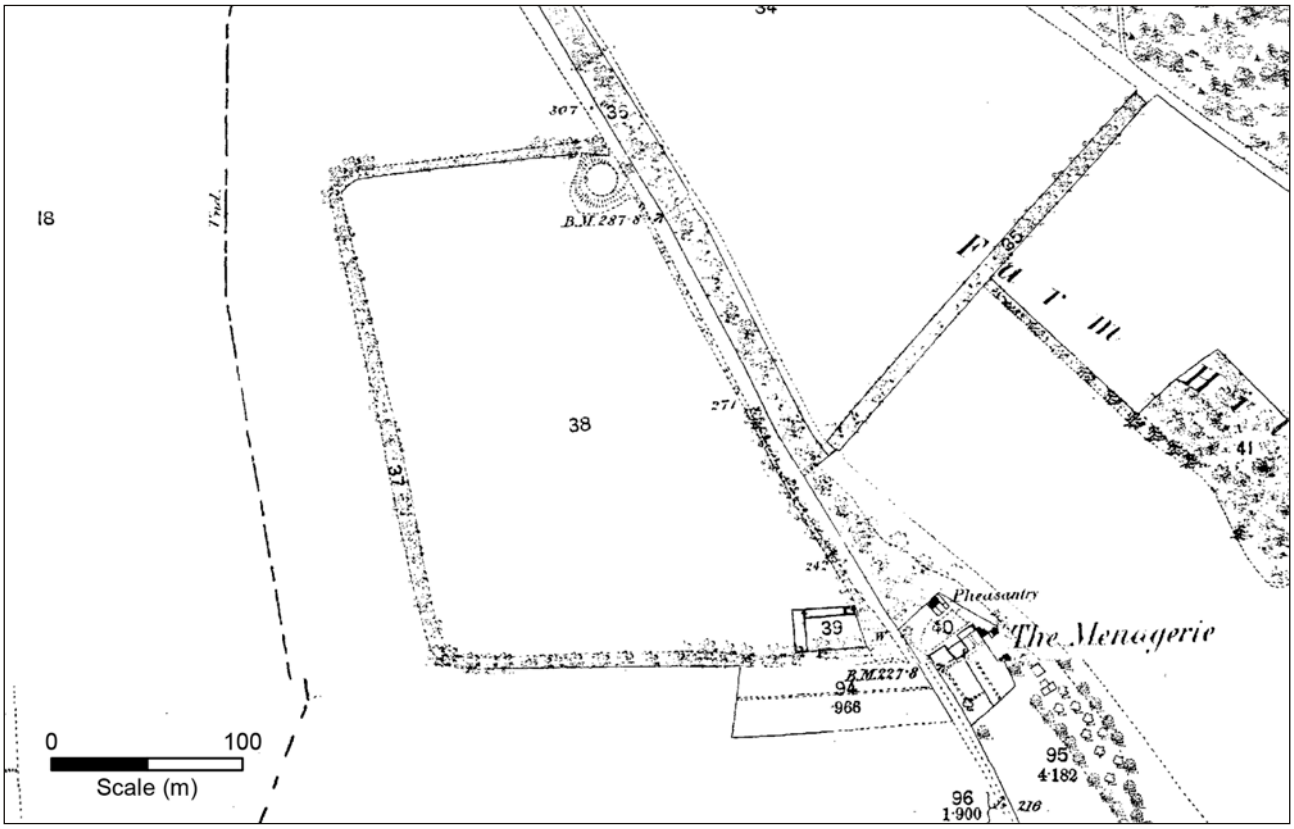

Figure 32: New Barn Field at Coldean shown on 1:2,500 1873 Ordnance Survey map. © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2023) Licence numbers 000394 and TP0024.

The 1799 Stanmer estate map also shows a dewpond on the other side of Coldean Lane opposite the pond described above. However, at that date this was located on the edge of an arable field (as it is today). As a result, the dewpond has been levelled, perhaps not long after 1799 as it does not appear on any subsequent maps or left any trace in aerial sources. Other fields with dewponds shown on the Stanmer estate map were also

converted to arable by the early 19th century but the dewponds have survived, although they do not necessarily hold water.

Areas of downland shown on the tithe maps were subsequently converted to arable as shown in the Ordnance Survey first edition maps of the 1870s. However, the continuing presence of livestock is indicated by the retention of dewponds as downland was ploughed up, something that could result in awkward sized fields. Part of Bullock Hill had been converted to arable by 1873 but the two dewponds within this field, which were up to 100m from the field edge, were retained and could be accessed by a narrow corridor of downland from the south (Fig. 33). The downland corridor has since been ploughed up, but the ponds survive as grass and scrub covered depressions with the ploughing tight to their edge.

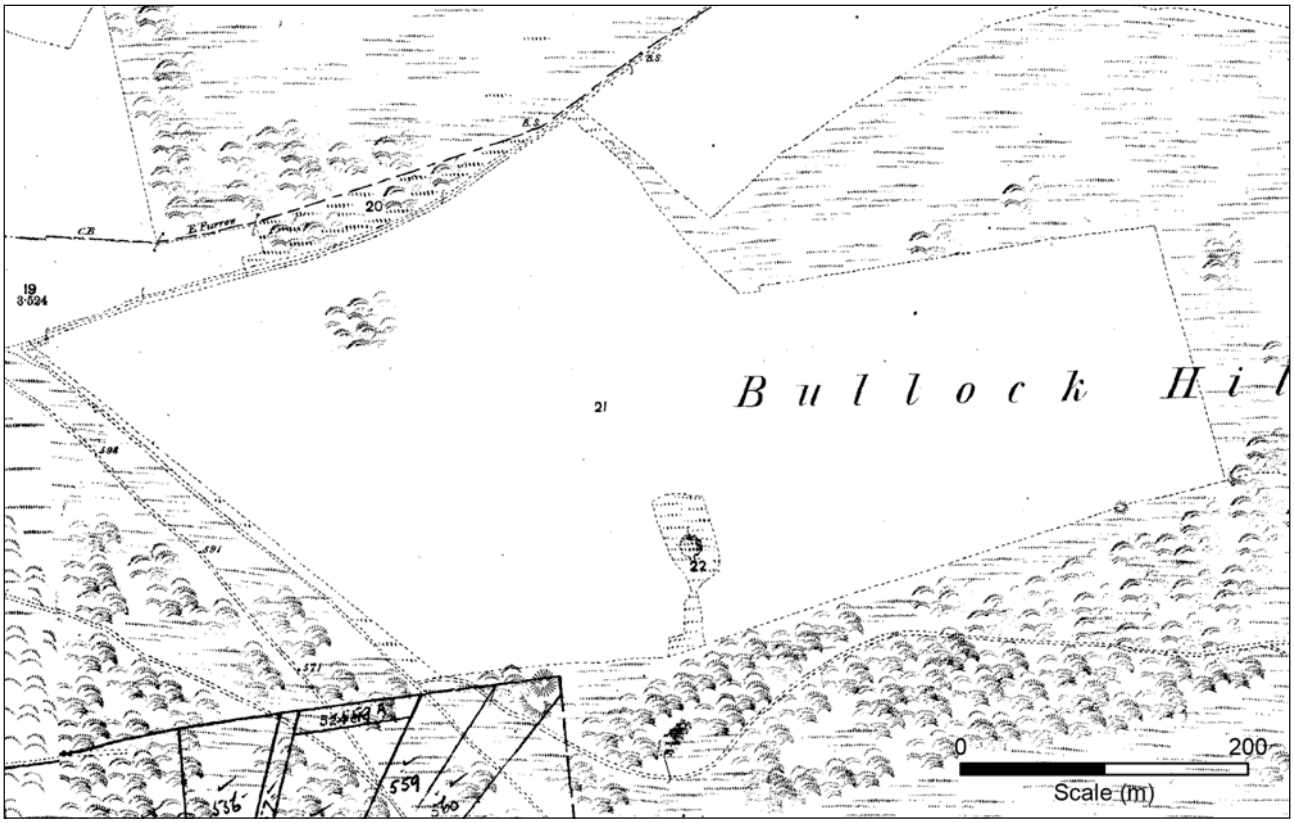

Figure 33: Bullock Hill arable field with corridor of downland linking ponds to pasture shown on 1:2,500 1873 Ordnance Survey map. © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2023) Licence numbers 000394 and TP0024.

A similar arrangement is also seen on West Hill (Newtimber) where a corridor of downland about 80m long and 30m across linked surviving downland to a dewpond in an arable field. This field has since reverted to grass and the dewpond survives and appears to hold water.

At Bevendean, part of the south-facing slope overlooking the town (now part of Bevendean Down Nature Reserve) was retained as downland as the immediately surrounding areas were ploughed up. This was joined to the pasture to the north by a narrow corridor of downland within which a dewpond was retained and located. This dewpond survives and holds water. At the northern end of Poor Brow, near Lower Standean a narrow corridor of downland was retained during arable conversion in the 19th century, its course apparently determined by the presence of a dewpond about halfway along its length. This corridor of downland and the dewpond were subsequently ploughed over, and the pond only survives as a shallow depression in the arable field (Fig. 34).

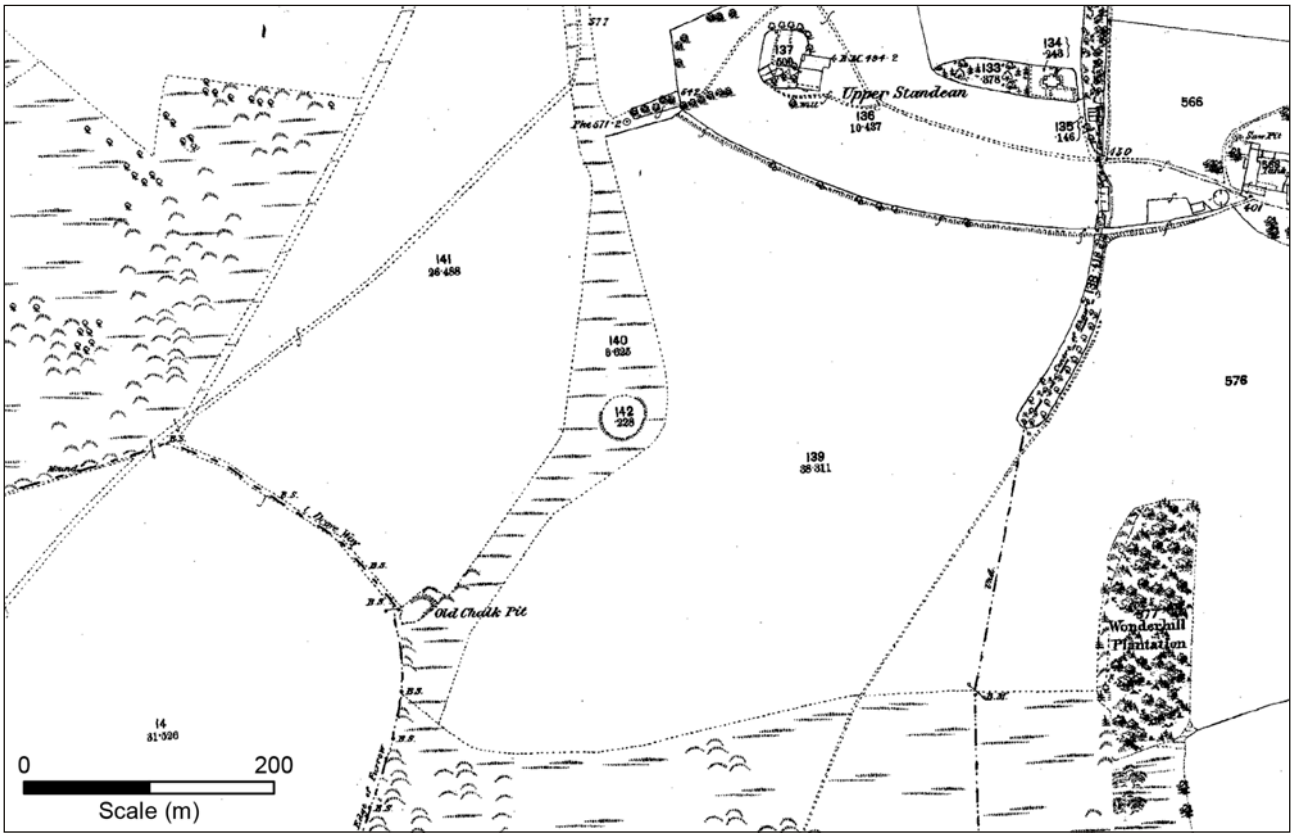

Figure 34: Corridor of downland with dewpond at Upper Standean shown on 1:2,500 1874 Ordnance Survey map. This pond, which survived the 1911 drought, is now under the plough but still shows as a slight earthwork in the lidar imagery. © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2023) Licence numbers 000394 and TP0024.

Lifespan

Pugsley claimed that the longest functioning dewpond he knew of was in Berkshire. Constructed in 1840 it was still in use although in need of a clean in 1938 (Pugsley 1939, 54). Far more common in his fieldwork were dry ponds, ‘So many of these failures have been noticed that the writer no longer troubles to record them’ (ibid). A high failure rate was also noted in early 19th-century Sussex in the neighbourhood of Eastbourne. It was stated that new ponds functioned well, but ‘are apt to become leaky, and a hard frost spoils them’

(Young 1808 324). Martin records an observation by an elderly inhabitant of Rottingdean who had lived in the area for about 50 years that he had never known the local dewpond to have contained water (Martin 1915, 204).

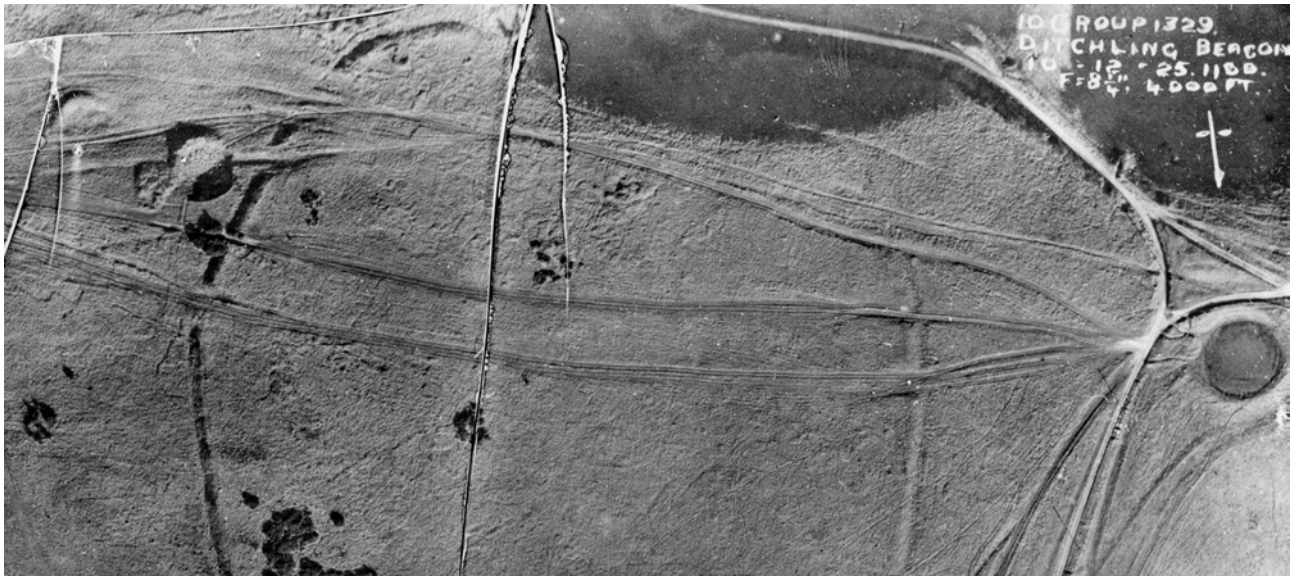

Figure 35: Old dry dewponds can be seen to the left of the photograph, Ditchling Beacon dewpond is on the right. This is one of three dewponds that did not run dry during the 1911 drought. The lines running top to bottom near the centre and top left of the image are the result of a damaged negative. Detail of CCC 11784/351 10-DEC-1925. © Historic England Archive. Crawford Collection.

Based on the depiction of dewponds on the late 18th-century and 1813 maps, several of the dewponds within the project area remained in use for 100 years or more and were presumably maintained. On downland in Kingston near Lewes a dewpond was built by 1910 about 150m east of the pre-existing pond that had been constructed by 1873. The 1945 aerial photographs shows that the original pond no longer held water (Fig. 36). It is not clear if the original pond had failed, and the second pond was dug to replace it, or if they had both been in use at the same time. Both ponds survive but are now dry.

Pugsley notes that one disadvantage of lining a dewpond with flints or rubble is that this make pond repair difficult as this layer would have to be removed before the base layer could be made watertight again (Pugsley 1939, 32). He suggests not including flints and instead keeping the animals out of the pond and syphoning the water out to a trough (ibid). This arrangement may have been in place at a dewpond within Stanmer Park (now largely levelled) which is shown on the 1898 Ordnance Survey map with a turncock on the downslope side, possibly associated with a tank about 55m to the south-west.

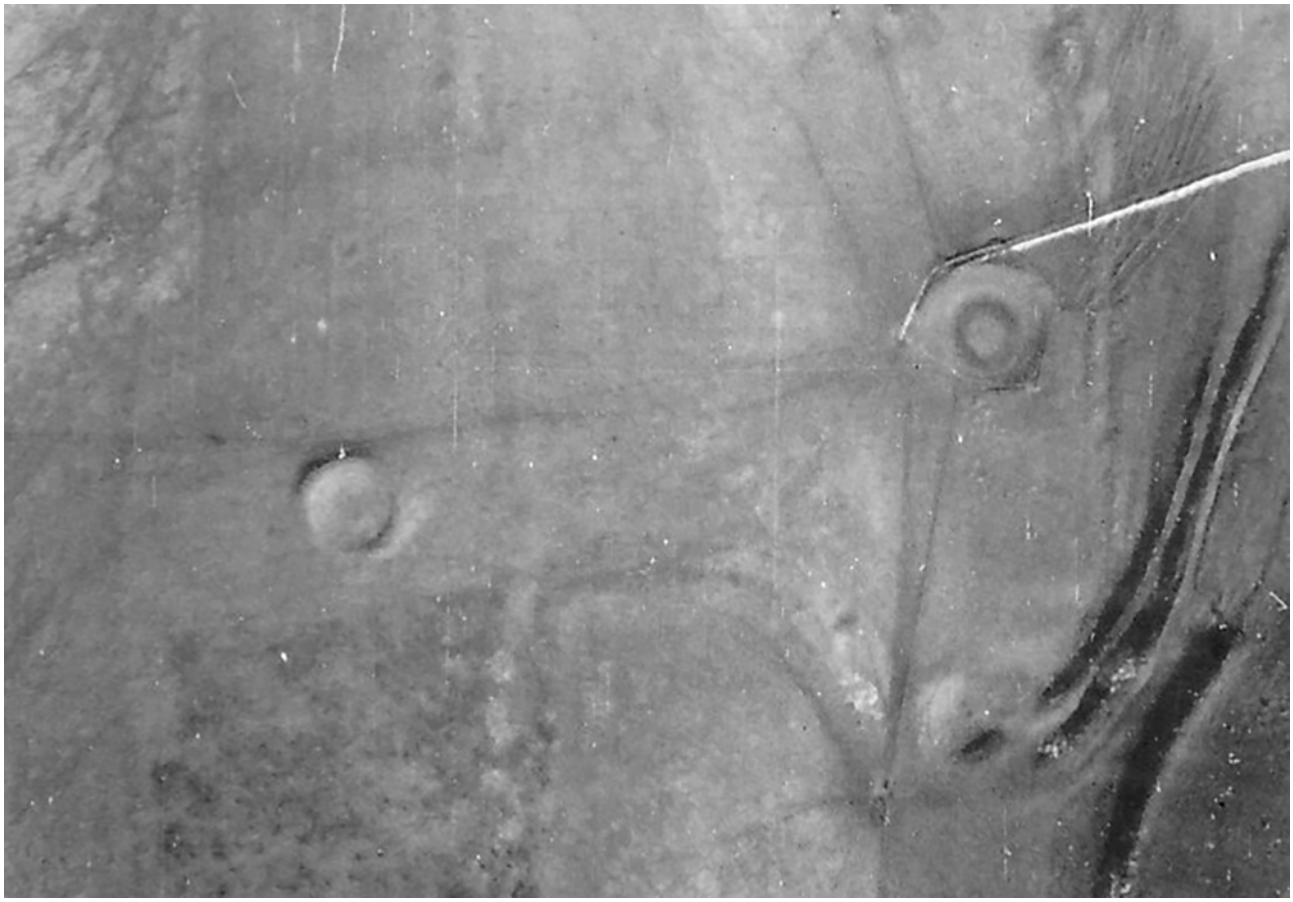

Figure 36: Two ponds by Kingson near Lewes seen in 1945 by which date the pond on the left was dry. Detail of RAF/106G/LA/169 FS 2032 9-MAR-1945 Historic England Archive (RAF Photography).

Some ponds have been lost through building development and others levelled when the downland was ploughed-up, although some ponds that appear ploughed away do survive as very slight depressions in arable fields (Fig. 37). One iconic Sussex dewpond at Ditchling appears to have been levelled after the war (Fig. 38), perhaps in error at the same time as wartime earthworks were cleared. This is one of several ponds that have been restored on the Downs.

Figure 37: A dewpond near Highpark Corner photographed in 1928. This has largely been levelled but the lidar shows it survives as a slight depression. Detail of Historic England Archive CCC 8848/2952 11-JUL-1928. © Historic England Archive. Crawford Collection.

Figure 38: The dewpond east of Ditchling Beacon after it had been levelled in 1947. This pond, seen with water in figure 29 has since been restored. Detail of RAF/CPE/UK/2051 RP 3008 1-MAY-1947 Historic England Archive (RAF Photography).

Livestock enclosures

Several medieval and later enclosures of various shapes and sizes, mainly surviving as earthworks were identified across the project area. Despite this variation in form, they are all positioned across combes which suggests that they were for livestock, with the combes used to funnel the flocks into the enclosure. This same relationship between enclosure and combe has been noted in Wiltshire on the Marlborough Downs (Smith 2005) and on Salisbury Plain (McOmish et al. 2002, 114; Carpenter and Winton 2011, 69). The Wiltshire examples tend to be positioned on the sheltered south-facing slopes and while this is the case for some Sussex examples, others face east, south-east and in one case north. Two Sussex enclosures that are on south facing slopes are situated close on the northern edge of the Downs and both overlie earlier earthworks. The rectangular enclosure in Plumpton parish overlooking Faulkner's Bottom was built over a trackway defined by parallel banks (Fig. 39 *top left*). This is defined by a bank with traces of an outer ditch and measures 150m by 90m. Within the enclosure are two raised square platforms about 13m across surrounded by a ditch which may have been used for fodder storage. To the east in Ditchling parish is an enclosure constructed on top of, and partly utilising, the lynchets of the prehistoric or Roman field system (Fig. 39 *top right*).

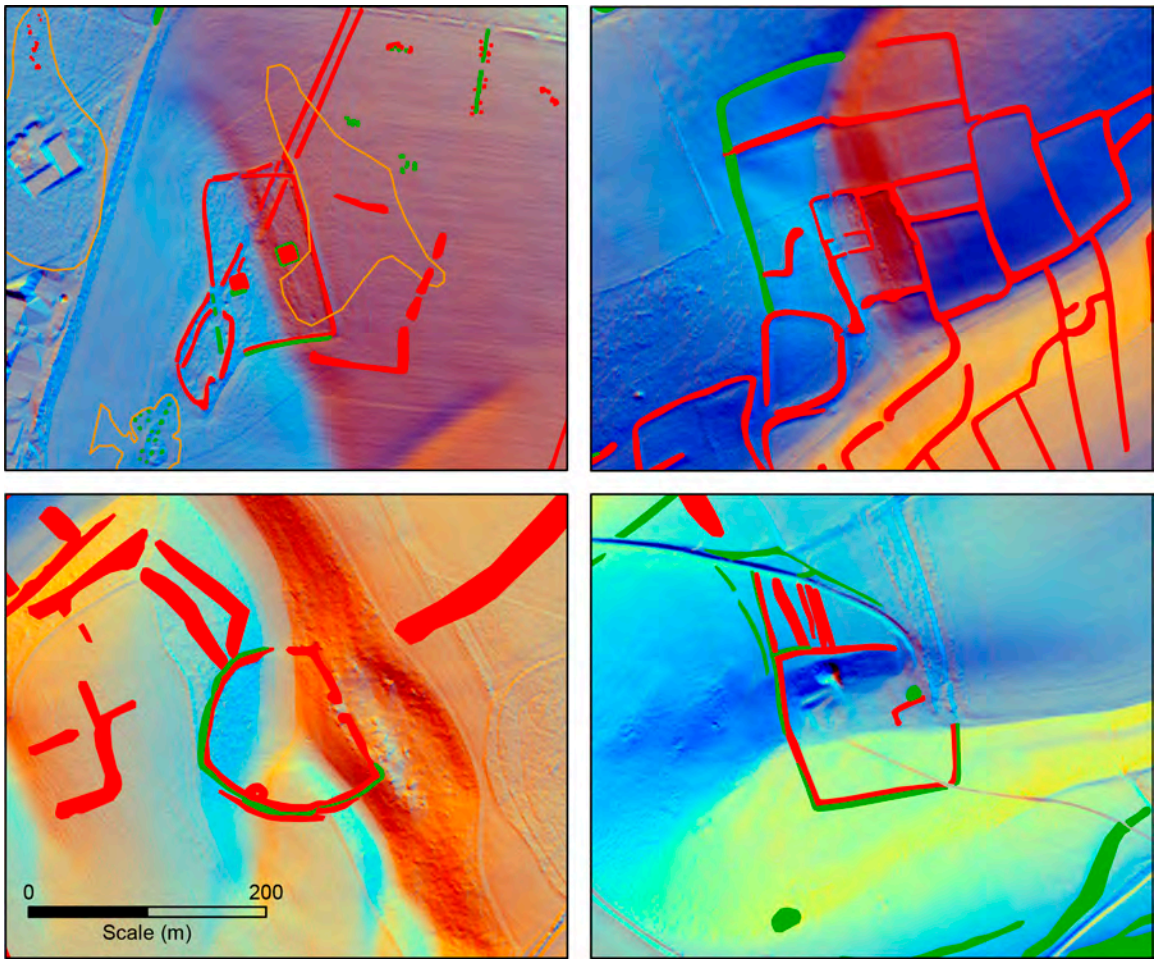

Figure 39: Livestock enclosures clockwise from top left, Plumpton, Ditchling, Falmer, Iford. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

In Falmer there is a D-shaped enclosure across a north facing coombe on the northern slope of Newmarket Hill which measures 150m by 125m (Fig. 39 *bottom left*). In Iford is an almost square enclosure, about 140m by 130m, across an east facing combe through which Breach Road (a track) passes (Fig. 39 *bottom right*). Both enclosures are defined by banks about 6m wide and have outer ditches.

Two enclosures are situated within what was the parish Patcham (now within the bounds of Brighton and Hove). These are both square with rounded corners and defined by banks around 2m to 3m wide. The smaller of the two, located in a combe to the west of Varncombe Hill measures about 55m across but the earthworks have been reduced and are barely visible (Fig. 40). The larger enclosure measures about 100m across and is positioned on a slope in Ewe Bottom combe (Fig. 41). Earthworks within the enclosure include a levelled area which may have been the site of a building or buildings, a depression and a mound which has also been suggested to mark the site of a building. About 30m north of this is a square earthwork about 35m across showing as a stepped depression and may also be associated with livestock.

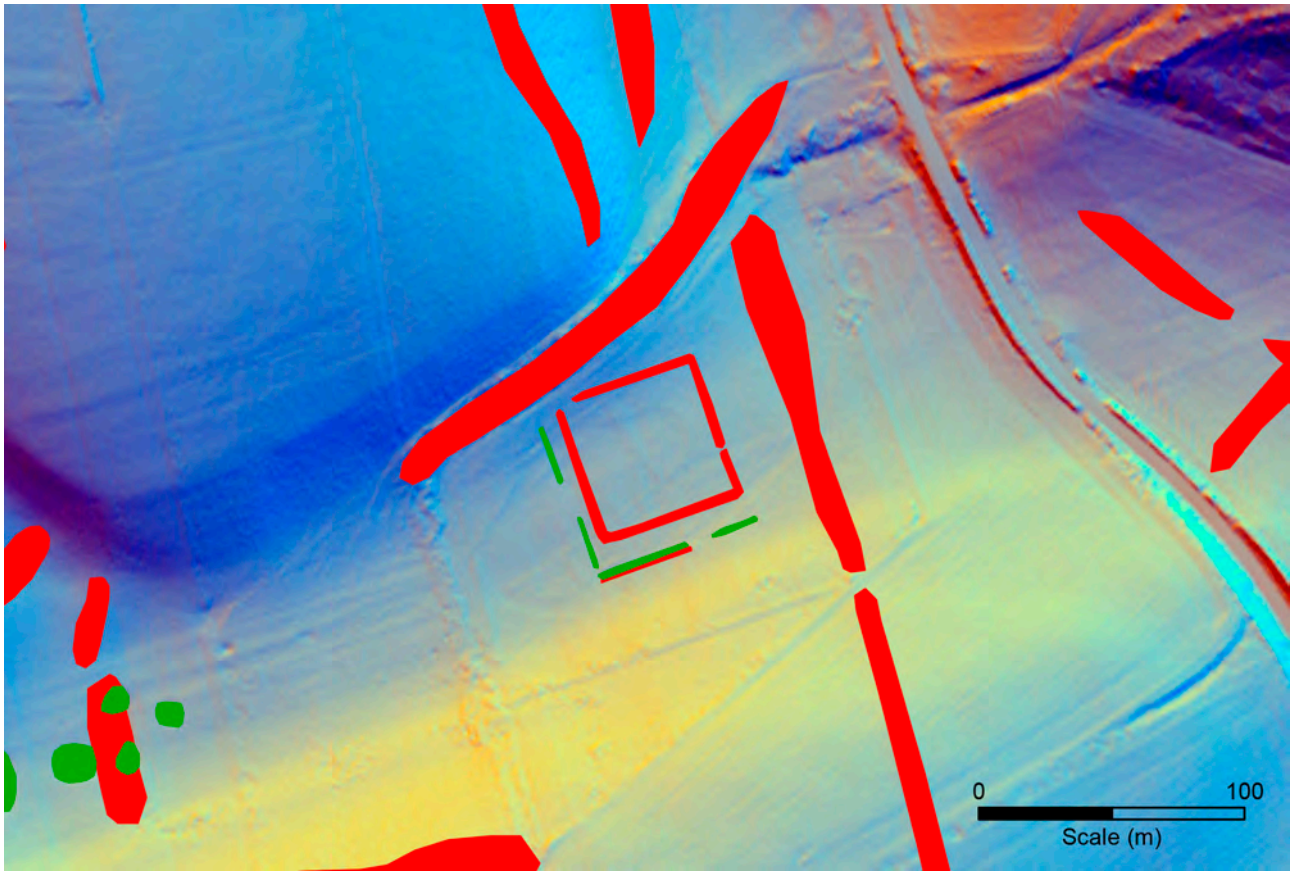

Figure 40: Small livestock enclosure south of Saddlescombe. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

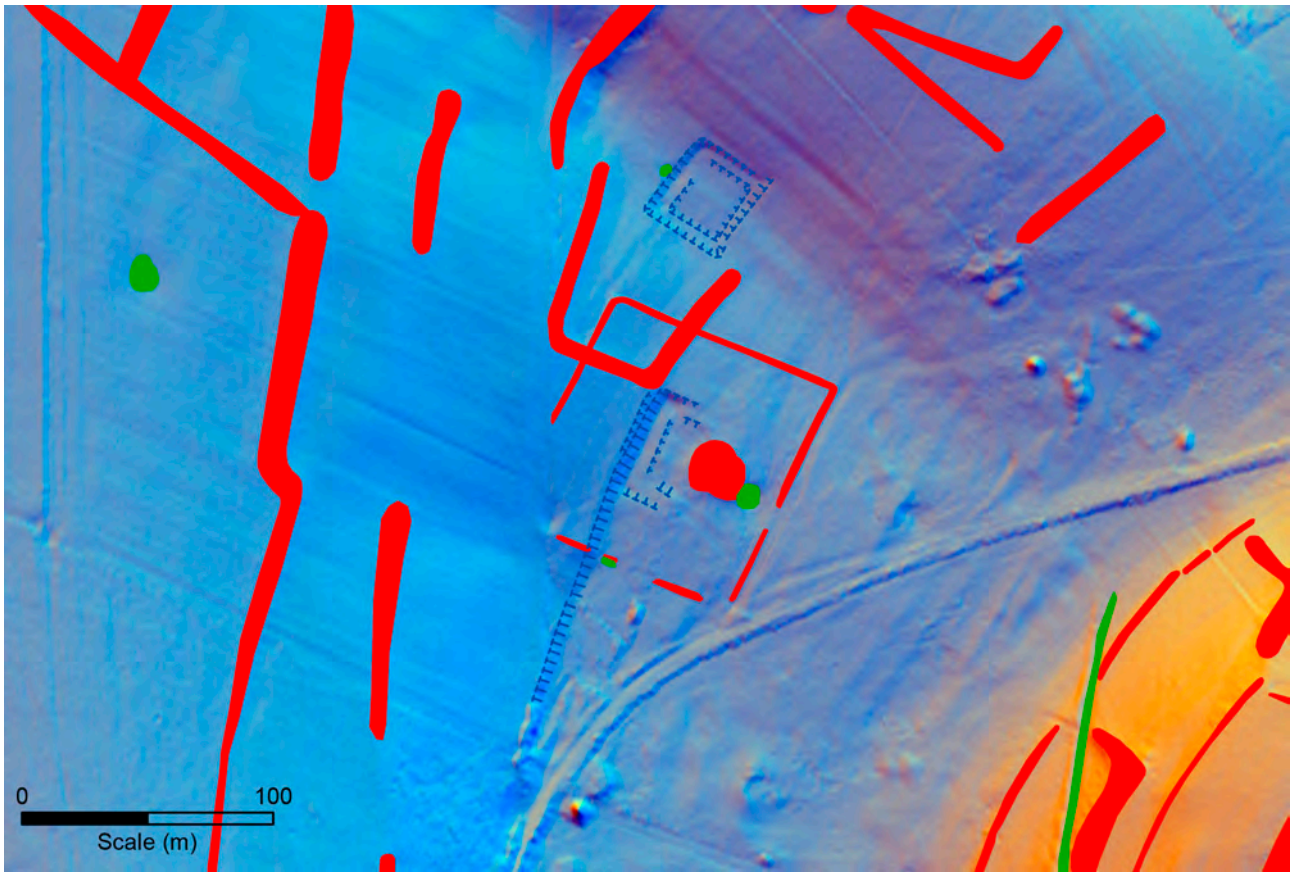

Figure 41: Large livestock enclosure north of Patcham. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

The name Ewe Bottom links this site to sheep farming and is located alongside Ewebottom Hill, Tegdown Hill and Hogtrough Bottom. The enclosure near Varncombe Hill is also less than a kilometre from another Ewe Bottom and linked to it via a combe. Both ‘teg’ and ‘hog’ are words for young sheep, and it is possible that these square enclosures were used to managing the lambing and raising of young sheep. Patcham’s connection with sheep is also noted in what is the only reference to South Down shepherds in the Domesday book (Brandon 2006, 57).

Some of the Wiltshire sheep enclosures are also closely associated with dewponds. Some are positioned immediately alongside the enclosures and in one case a dewpond is located within one. None of the South Downs enclosures are that close to dewponds; in most cases the distance to the nearest pond within this project area varies from 150m to 275m, with the enclosure opposite Varncombe Hill over 400m from a dewpond. The proximity to a dewpond does not appear to be crucial and another Wiltshire enclosure that was built across a combe and contained the earthwork remains of a sheepcote had no dewpond in the immediate vicinity (McOmish et al. 2002, 114).

Cropmarks seen in what was the parish of Portslade-by-Sea (now Brighton and Hove) show a different type of livestock enclosure (Fig. 42). This rectangular feature was situated above a combe, and measured 70m by 52m. Within the enclosure are the cropmarks of a rectangular building about 25m by 10m which may have been a sheepcote. A depression across much of the site seen in lidar maybe the result of animal trampling over time.

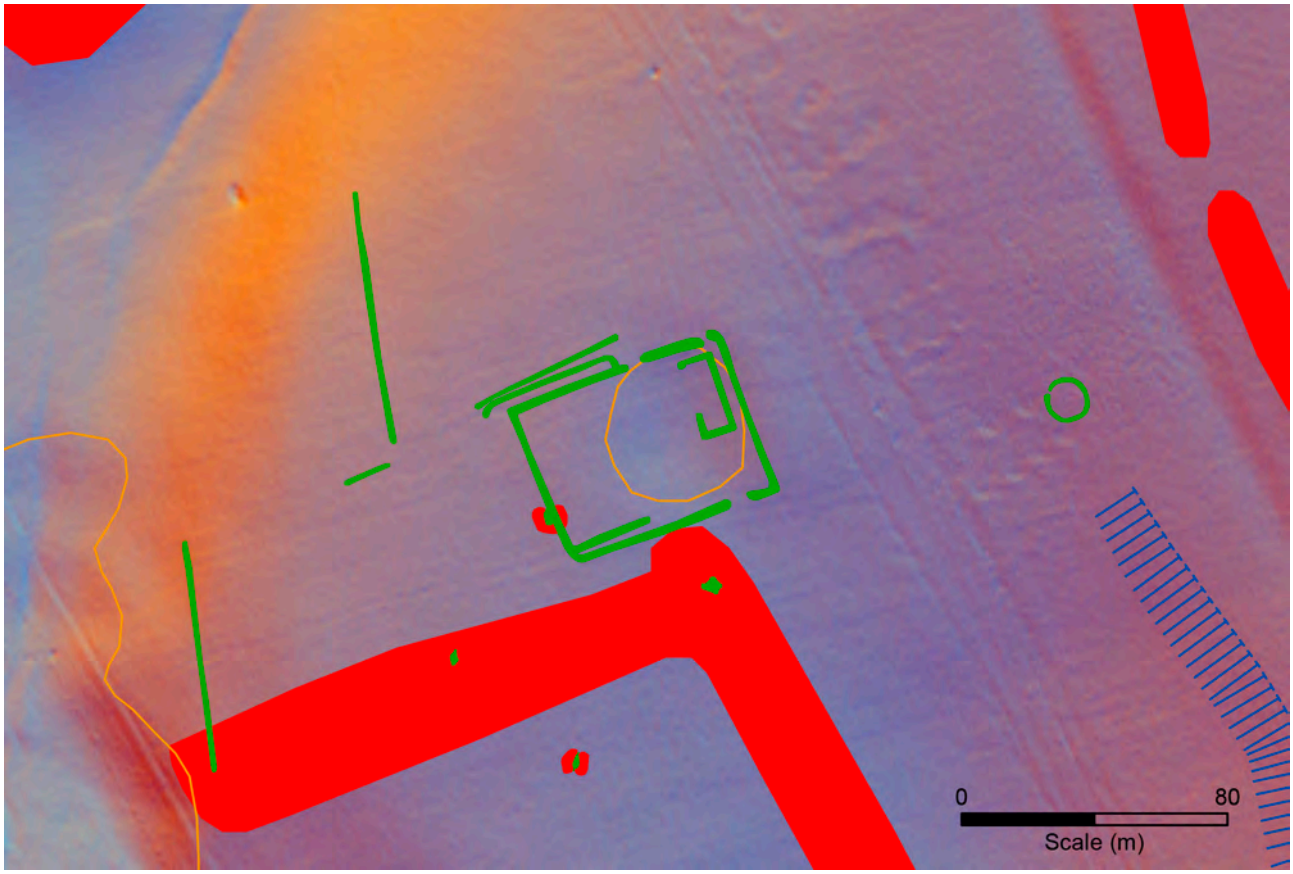

Figure 42: Livestock enclosure Portslade-by-Sea. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

There are similarities between the Portslade-by-Sea enclosure and the field barns and associated yards that are first seen on the late 18th-century maps and in greater numbers on the first edition Ordnance Survey maps of the 1870s. These isolated sites consisted of a rectangular yard about 30m by 20m with a building at one end and often had a dewpond alongside. Examples include Mileoak Barn formerly in Southwick parish, now Brighton and Hove (Fig. 43). This is not shown on the1842 tithe map but is on the 1875 Ordnance Survey map which shows a 20m by 6m barn along its western side and a dewpond (also not on the tithe map) 7m to the south of the yard, all set within pasture. The dewpond has since been filled in, but the barn appears to survive.

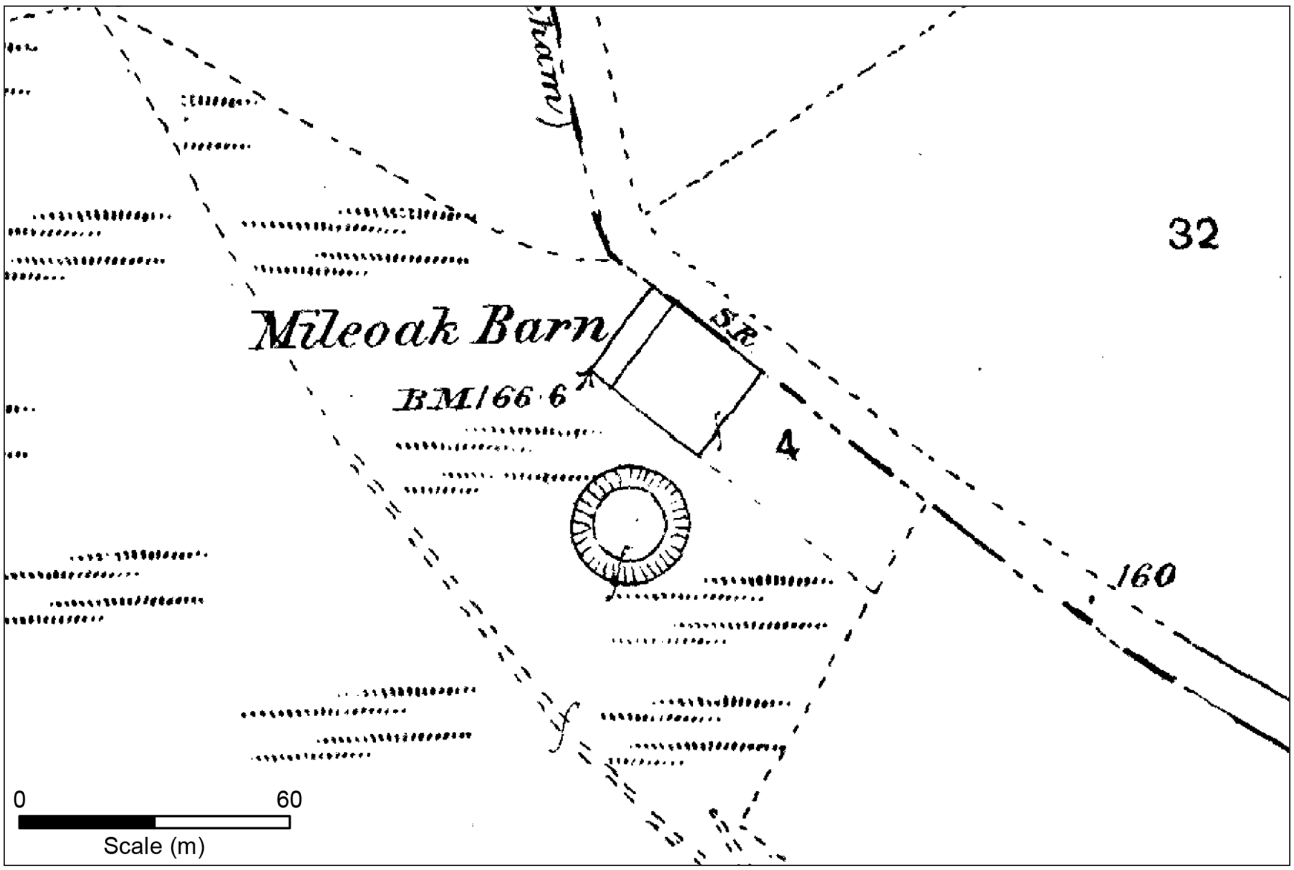

Figure 43: Mileoak Barn and dewpond on 1:2,500 1875 Ordnance Survey Map. © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2023) Licence numbers 000394 and TP0024.

In Patcham (now Brighton and Hove) Hollingbury Barn was situated within downland east of Hollingbury Castle with a dewpond about 25m east of the yard (Fig. 44). Both the barnyard and pond are first shown on the 1842 tithe map. The barn was 20m by 8m and placed along the western end of the yard. The 1874 Ordnance Survey map shows the addition of a shed that ran along the northern and part of the eastern sides of the yard. The barn and yard have since been demolished but the dewpond survives, now within Hollingbury Park Golf Course. In at least one case a pre-existing dewpond may have been the focus for the construction of a barnyard. The 1813 Ordnance Survey map shows a dewpond south-east of Bevendean (formerly Falmer parish). By 1838 the tithe map shows that a barn and yard had been built about 30m from the pond with buildings along the narrower northern end. This in turn appears to have attracted settlement by 1874 and cottages were built to the south and the site named Upper Bevendean. Not all barns had adjacent dewponds, see Dunton's Barn, and New Barn (both Pyecombe – both demolished).

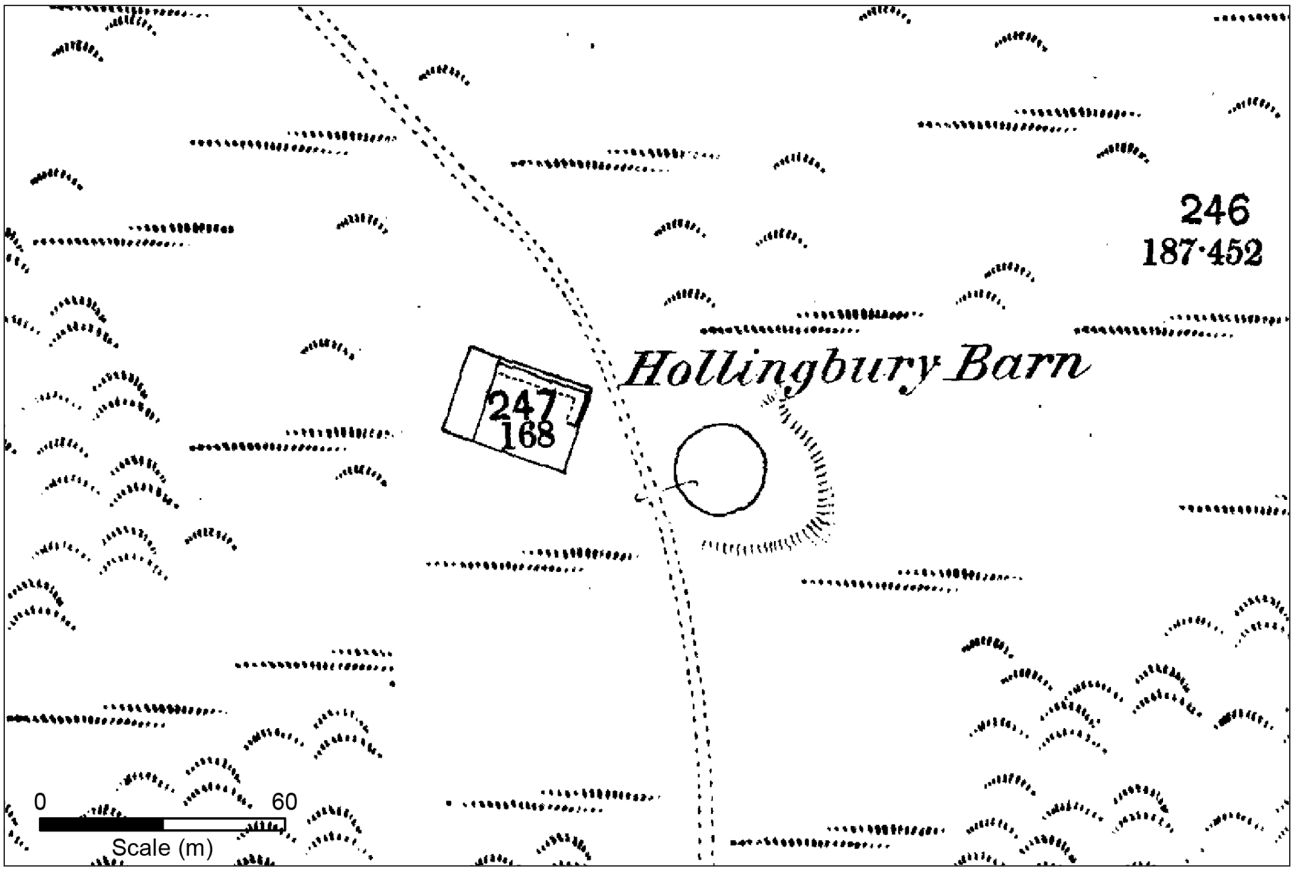

Figure 44: Hollingbury Barn and dewpond 1874. © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2023) Licence numbers 000394 and TP0024.

In all these examples, the downland setting, and the pairing of barnyard and pond suggest they were intended for livestock. Although not identical, they are like the permanent yards known as Standing Folds described in the 1808 edition of the *General View of the Agriculture of* Sussex (Young 1808, 349). These yards were intended to shelter flocks and one standing fold was described as measuring 52m by 18m and able to hold 700 ewes overnight. All around the yard was a shed about 3m wide and another across the middle of the yard open on both sides which held hay for the flock (ibid).

Discussion

None of the large livestock enclosures are depicted on the 18th or early 19th-century maps. The enclosure above Faulkner's Bottom and that above Loose Bottom were eventually depicted on the 1910 Ordnance Survey map, by which time they were named an 'Ancient Earthwork' and an 'Ancient Valley Entrenchment' respectively. Excavated evidence from a sheep enclosure on the Marlborough Downs (Wiltshire) produced pottery form the 13th and 14th centuries (Smith 2005, 194) and although the South Downs enclosures are not securely dated, the larger South Downs enclosures are likely to be medieval in date. Their size and location possibly relate to the pre-enclosure parishes in which they are located. The absence of dewponds suggests a different regime of livestock management and watering when these enclosures were in use, but also that they had fallen out of use before the boom period of dewpond building starting in the 18th century. Two of the enclosures discussed above, at Portslade-by-Sea and the other opposite Varncombe Hill were abandoned and under the plough by the start of the 1840s.

The barnyards appear to be the successors of these large enclosures. Their size suggests smaller flocks reflecting the multiple owners and occupiers (as recorded on the tithe map apportionments) that farmed the South Downs after the parishes were enclosed. The relatively standard design of a rectangular enclosure with barn at one end provided food, shelter and security for the flock or herd, and their use for livestock is emphasised by the pairing of these barns with dewponds.

Navigating the Downs: past routeways and mobility

The traces of many tracks, hollow ways and paths were identified crossing both the Weald and the Downs during the Downs from Above project. These represent fragments of a complex network of routeways from many periods which are remnants of historic human (and stock) movement through this small area of south-eastern England.

A feature of both the North and South Downs are the remains of numerous sinuous incised tracks which cut up the steep chalk escarpment linking the Weald to the chalk high ground and extending across the chalk massif of the Downs to the coastal plain.

The majority of these past routeways are probably medieval or post medieval in date but may well have their origins in the prehistoric or Roman periods. They have formed over time by repeated passage of traffic, and once established, these routes frequently remain in use for long periods, often acting as drainage gullies which deepens them further. When passage becomes difficult along one of these routes, alternative parallel routes may form resulting in numerous braided trackways (English Heritage 2011, 4). On flatter terrains trackways would frequently be provided with side ditches to aid drainage and contain livestock or were defined by adjacent field boundaries or settlement enclosures.

The physical appearance of trackways has remained unchanged through time, so dating is generally difficult unless they occur in association with other datable features such as prehistoric monuments, settlements, or field systems. In landscapes such as the Downs routes established in prehistory following the grain of the land may well have prevailed as the preferred route, subsequent traffic eroding and obliterating earlier traces. Changes in land use, particularly ploughing, will frequently have eroded and masked traces of earlier routes, but fragmented sections may still survive in woodland and uncultivated pockets of land. Other routes have survived as rural lanes, trackways, bridleways, and paths still in use today.

In contrast to the numerous, often sinuous, rural trackways encountered from all periods in history, the primary network of Roman roads was the first planned and engineered routeways in Britain. They were meticulously surveyed and planned to, wherever possible, take the most direct and straight route between important military centres, new and existing settlements, and ports. When faced with more difficult terrain the road builders were forced to follow the grain of the land, and in some case parts of existing pre-invasion routes were used. The network fell into decline in the post-Roman period and new routes were established, largely disregarding the Roman roads. However, some major roads survived, but for the most part only short stretches of road survived fossilised in the modern road network.

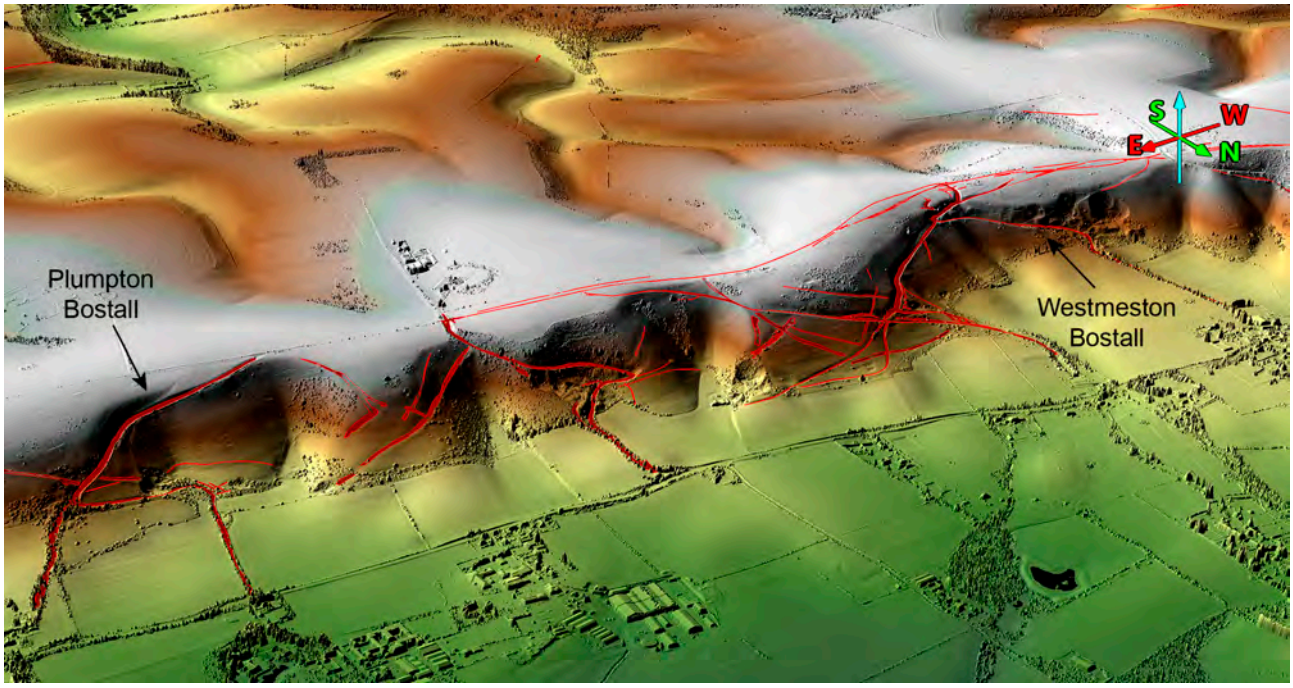

Figure 45: Trackways on the north face of the down between Westmeston Bostall and Plumpton Bostall. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

Later Prehistoric/Roman trackways

As outlined above, dating trackways can be problematic. Most tracks which have been recorded as part of the Downs from Above survey are probably post medieval in date. However, there are a number of fragments of trackway which are associated with later prehistoric settlements, including several middle Bronze Age sites. Other examples are defined by parallel banks or lynchets within later prehistoric or Roman field systems.

One such site is that of a Middle Bronze Age settlement with associated trackways on Plumpton Plain which survives as earthworks clearly visible on lidar images (Fig. 46; *see also* Fig. 22). The settlement is a farmstead with round houses within embanked oval enclosures, linked to each other and the surrounding fields. Three short lengths of bank-defined trackway can be seen – one entering the settlement from the north, a second branch extending south-east to a large sub-circular enclosure, and a third extending westwards from the central enclosures to another large sub-circular enclosure. The tracks extend beyond the settlement to the north (Bell 2020, 222).

Less than 500m to the north-west of this site, at the head of Faulkner's Bottom, are the earthwork remains of a possible later prehistoric or Roman trackway which is aligned NNE-SSW and can be traced for 350m (*see* Fig. 39, top left). The trackway's south-western end appears to respect and curve around an oval embanked enclosure, before continuing south-west as a barely perceptible earthwork visible on the lidar image. To the east are the fragmented remains of a large embanked rectangular enclosure or field on the same axis and possibly associated with the trackway. A large rectangular post medieval stock enclosure overlies the trackway. Other pits and ditches are the remains of Second World War defences and training operations.

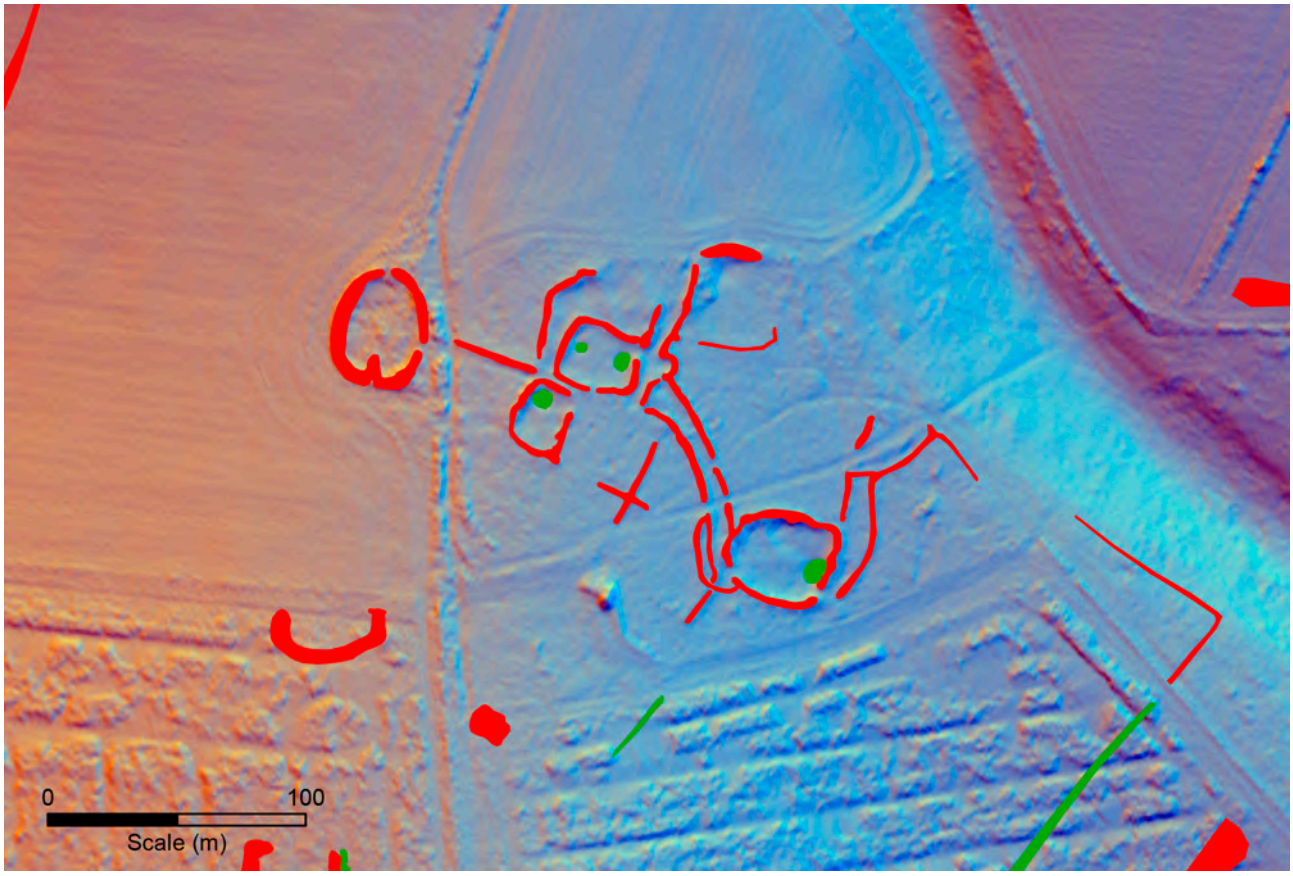

Figure 46: The Middle Bronze Age settlement on Plumpton Plain with sub-circular embanked enclosures linked by bank-defined trackways. Mapped from and overlain on Environment Agency lidar. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

Another probable Iron Age or Roman settlement or farmstead amongst the extensive remains of coaxial embanked fields seen as cropmarks on Picker's Hill (Fig. 47). The site comprises a rectilinear ditched enclosure with an adjacent embanked enclosure, possibly a field or paddock, with a semi-enclosed area between. This may have been a yard into which two sections of trackway converge. The track is defined by parallel banks as it enters the settlement. Further possible fragments of the trackways can be traced over 400m to the NNW and 300m SSE of the heart of site.

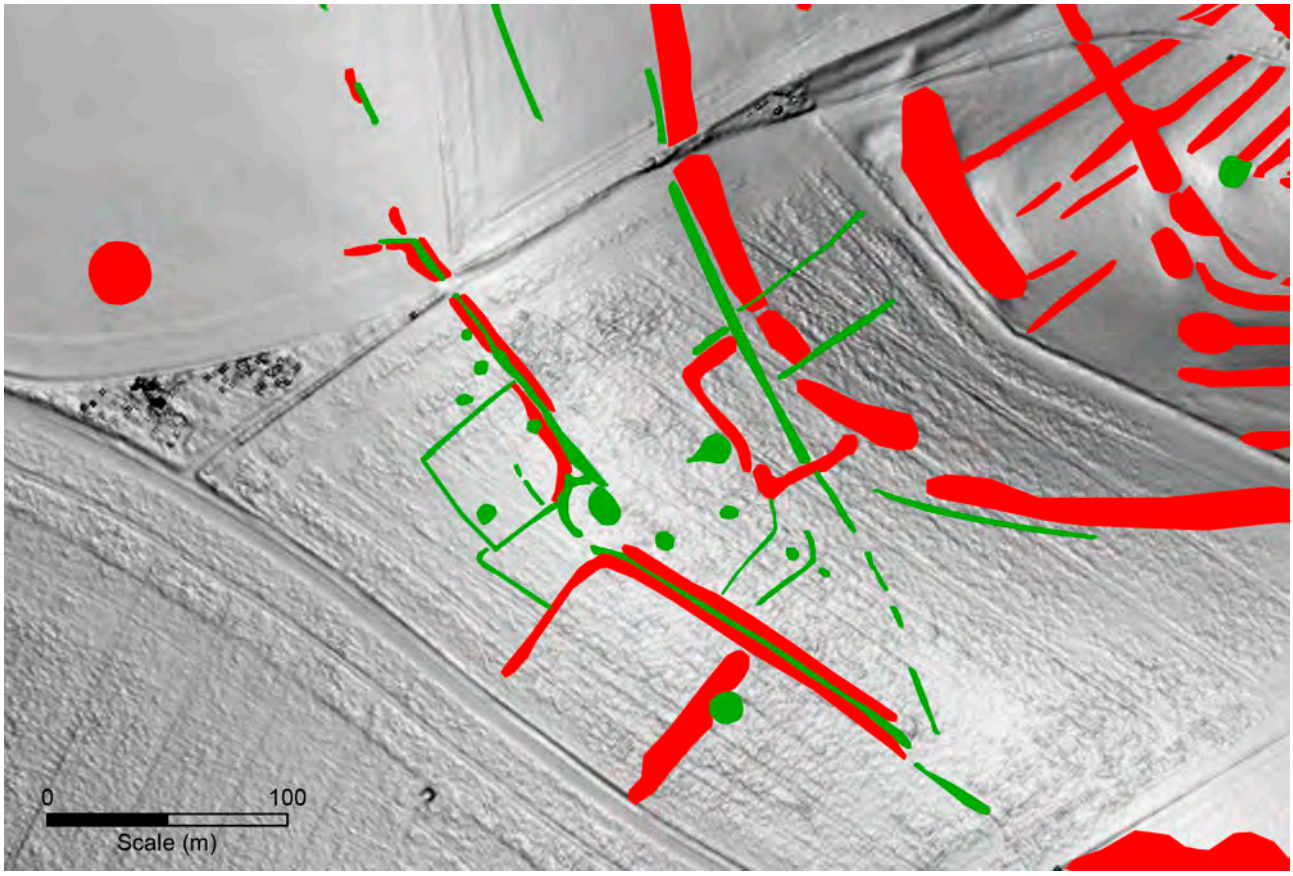

Figure 47: A possible Iron Age or Roman settlement/farmstead with associated trackways on Pickers Hill mapped from aerial photographs set amongst the slight earthwork remains of extensive field systems which have been mapped lidar. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

Ridgeways, cross-dykes and long-distance paths

The current project recorded traces of numerous incised trackways crossing the ridgeway from north to south, and traces of trackway associated with prehistoric and Roman settlements and field systems on the Downs but failed to identify any trace (earthwork or cropmark) of a convincing historic east-west ridgeway route.

Unlike other ridgeway paths, the South Downs Way – which extends along the ridgeway of the northern escarpment from Winchester to Beachy Head – does not appear to be part of a marked historic routeway. The ridgeway profile undulates and is broken by the river valleys of the rivers Adur, Arun, Ouse and Cuckmere which flow from north to south. These rivers were tidal estuaries until at least the medieval period with difficult crossing making a challenging route (Bell 2020, 221). The presence of numerous, late Bronze Age and Iron Age cross-dykes running across the ridgeway at regular intervals would have offered further interruptions to such a ridgeway route when they were in use in prehistory.

An alternative lower route, following the current ‘Underhill Road’ running along the foot of the escarpment, would have been less undulating but would still have had to negotiate the same difficult river crossings. No apparent trace of earlier routes has been identified

by the studies of the region undertaken by the Curwens in the early 20th century (Curwen and Curwen 1923), and neither of these routes were noted and included in the Ordnance Survey (1962) map of Iron Age Britain (ibid. 2020, 221).

There are a number of known cross-dykes between Blackcap and Mount Harry, and lidar and aerial photographs have revealed many of these to be longer features than previously mapped by the Ordnance Survey. This was also observed during the High Woods from Above survey in the western part of the South Downs (Carpenter et al. 2016, 27). In some cases, the earthwork dyke was found to have originally been longer but truncated through later ploughing and the remaining slight earthwork traces only detected by lidar. At other sites the buried remains revealed as cropmarks or soilmarks show the Cross-dyke ditch continues further. Where this is the case it is not clear if the embanked element has simply been removed, or the feature originally continued as a ditch with no bank. It is possible that some of these sites were re-used as trackways. For example, at Ashcombe Bottom a cross-dyke continues through the adjacent modern field to the south-east and then on into the valley where it appears to merge with the current bridleway (Fig. 48).

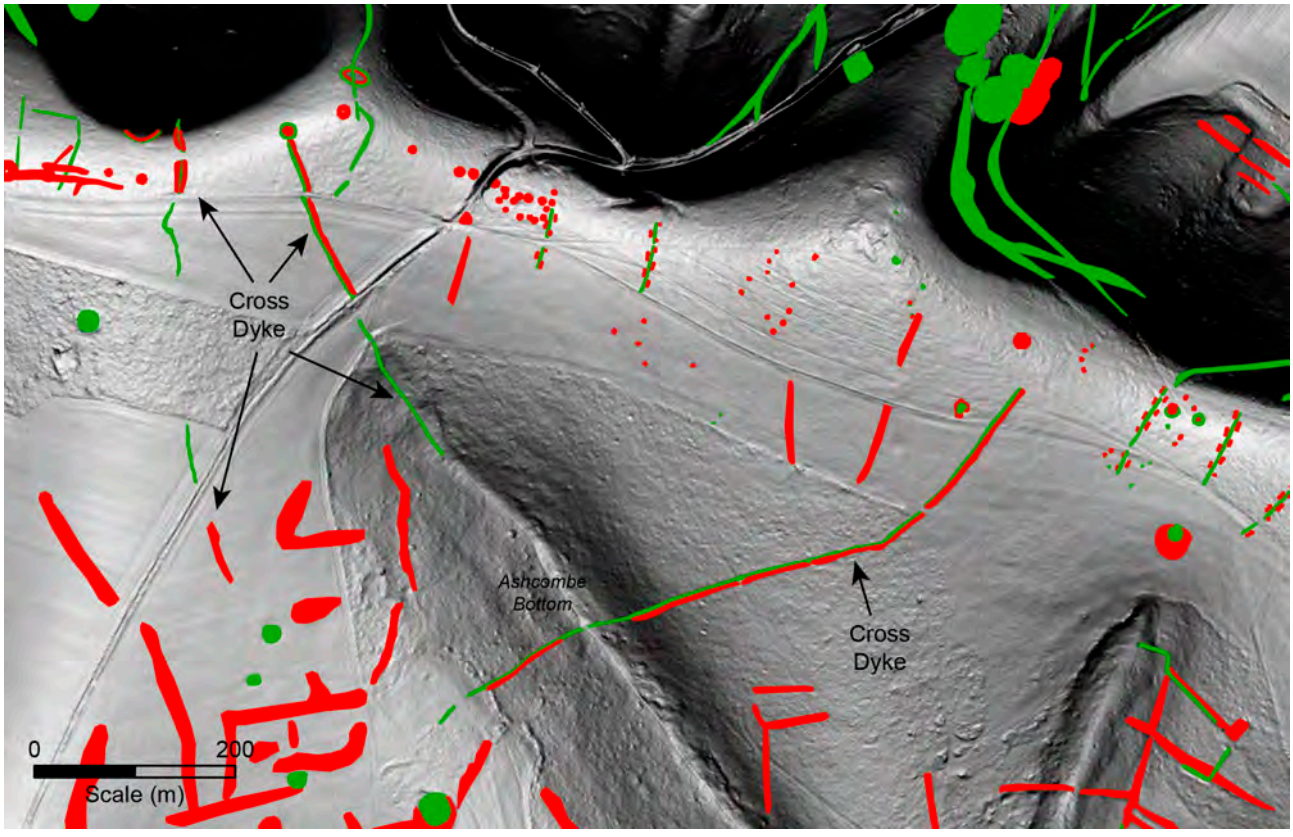

Figure 48: The earthwork remains of two cross-dykes on the ridge at Blackcap with traces of further ditches or trackways extending southwards beyond the earthwork. The western dyke has a sinuous ditch seen as a cropmark, the eastern is visible as a ditch which links with a track and modern bridle way in Ashcombe Bottom. Archaeological mapping © Historic England; LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

Roman roads and their legacy

The success of the Roman Empire was partly founded on its network of arterial and secondary roads linking centres of military or commercial importance. The roads in this region typically extended W-E, linking other coastal centres, or northwards inland to London (*Londinium*) and beyond.

Roman roads were expertly surveyed and engineered, taking the shortest possible route the terrain allowed. Even in the provinces, roads were frequently solidly constructed, featuring a cambered and metalled causeway known as an agger, typically between 4.5 and 7m (and occasionally up to 10m) wide, and flanked by side ditches which provided drainage as well as being a source of the material used to build the road (Margary 1965, 15). The quality of their construction has ensured the survival of many stretches of Roman road to the present day.

Ivan Margary was one of the 20th century's leading authorities on Roman roads. His *Roman Roads in Britain*, first published in 1955, was the first definitive catalogue of all the major and minor Roman roads throughout the country. The maps it contained showed surviving, inferred, and conjectured routes, each of which was allocated a 'Margary number.' Some of these routes were based on earthwork remains or alignments of current roads and boundaries, but others were more speculative. Ivan Margary is also remembered for saving Fishbourne Roman Palace and funding many important archaeological digs around the south coast.

Most of the major routes in this region have been identified to a greater or lesser extent through the work of Margary, though there are significant gaps between certain Roman settlements and other routes are fragmented.

The main arterial routes in the project area included the main N-S road (Margary No.150) which linked London to an unidentified settlement or port on the coast in the vicinity of Brighton and two east-west aligned roads. One (Margary No. 153) extended along the coastal plain from Chichester (*Noviomagus Reginorum*) to Brighton, and another (Margary No. 140) hugged the northern foot of the chalk escarpment between Hardham (Purborough) and Barcombe Mills (Small 2018). Further west (beyond this survey area) is Stane Street (Margary No. 15), which was one of the most important roads in the network, linking Chichester with London. Further east another road linked London to Lewes.

The remains of the Greensand Way

Parts of the northern route from Hardham (Purborough) to Barcombe Mills (Margary No. 140) – also known as the Greensand Way – are fossilised in modern roads such as Horn Lane between the A2037 at Woods Mill and Nutknowle Farm to the west of the A281 (Fig. 49). The lane veers north-east to Woodmancote, but traces of the Roman road can be seen on lidar as slight embankments and cuttings continuing its straight ENE course through the countryside for 3.5km to the A23. A further 420m long stretch of the road is visible as a well-preserved earthwork up to 47m wide where defined by four parallel ditches. This section is partially obscured for a short distance by the present Brighton

Road to the south of Hurstpierpoint. Where the Brighton Road curves northwards the earthworks of the Roman road continue north-east in the direction of Bedlam Street (Fig. 50).

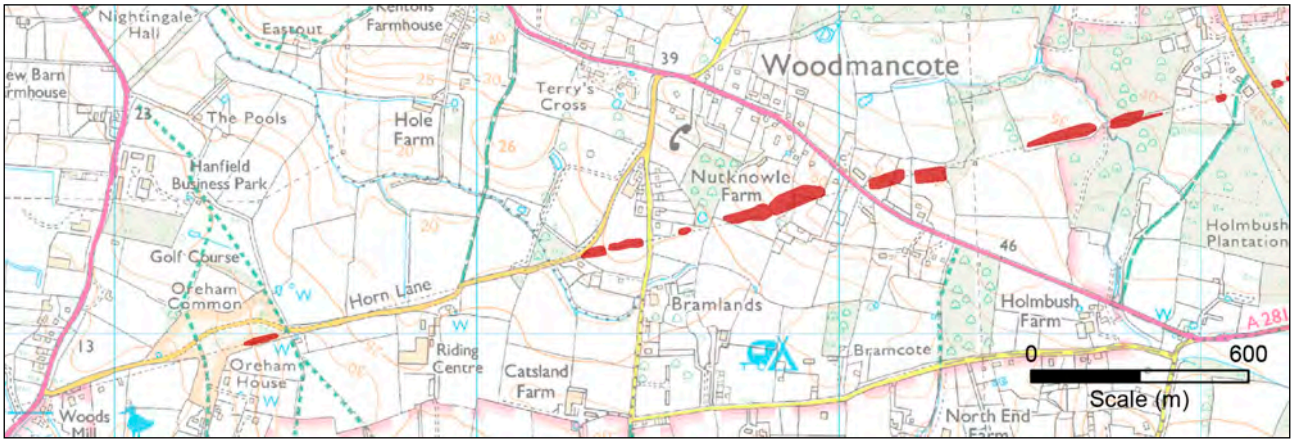

Figure 49: Extract of mapping showing traces of the Roman road (highlighted in red) extending ENE-WSW following Horn Lane and visible as earthwork cuttings to the east of Nutknowle Farm. Base map © Crown Copyright and database right 2023. All rights reserved. Ordnance Survey Licence number 100019088.

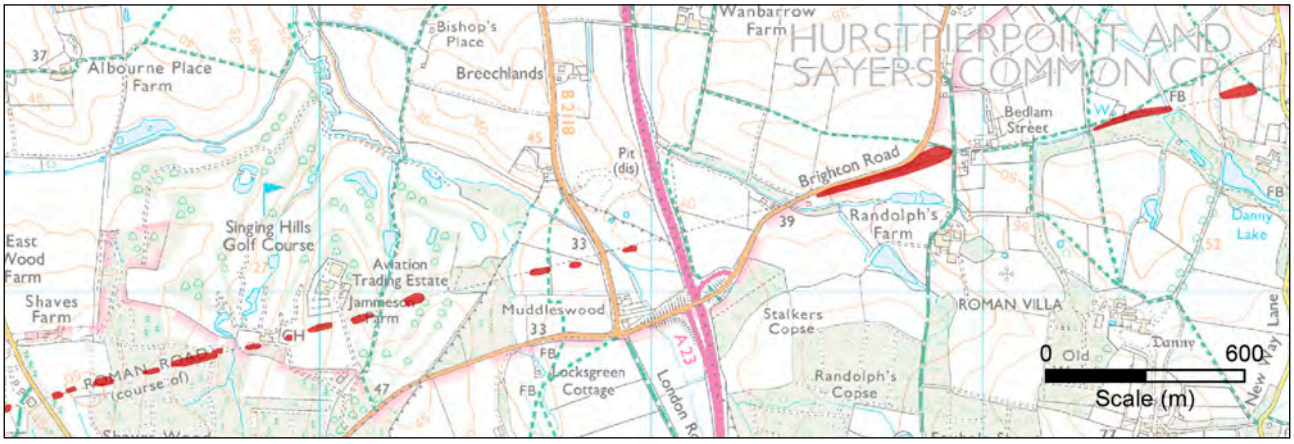

Figure 50: Extract of mapping showing the traces of the Roman road (highlighted in red) extending ENE-WSW. Base map © Crown Copyright and database right 2023. All rights reserved. Ordnance Survey Licence number 100019088.

The course continues as a short stretch of lane to the farm and then as a footpath for 325m where two further short sections of earthwork agger can be seen between Bedlam Street and New Way Lane to the north of Danny Lake. The course of the road changes direction from this point assuming a more E-W alignment through Keymer (now lost beneath the town). The route continues for 450m along a lane between Keymer Ditchling and as a line of field boundaries over 840m long between nurseries at Newtons Farm and the parish boundary to the west of Streat. The course is again visible as the lane marking

the southern side of Plumpton Racecourse, continuing eastwards as a broad ditch for 300m. It is then picked up by a lane south of Hollycroft. The route is broken by the railway cutting, but from this point to Wicham Barn, the agger is visible as several short lengths of bank and ditch, one section with slight traces of a possible contemporary roadside quarry on the southern side of the road (fig 51). Further traces of the road are visible as a hollow way in Folly Wood, but part of this is obscured by a probable post medieval set of tracks.

Figure 51: Extract of mapping showing the traces of the Roman road (highlighted in red) extending W-E past Wickham Barn (with traces of a possible roadside quarry in blue). East of this is the junction with a possible road extending south-west to Beechwood House. Base map © Crown Copyright and database right 2023. All rights reserved. Ordnance Survey Licence number 100019088.

A possible new branch off the Greensand Way (Margary No. 140) at Chiltington

There are slight earthwork traces of a possible newly identified Roman road joining the main route from the south-west to the West of Folly Wood, 180m from the modern A275 (Fig. 52). There is a clear junction with the main E-W Roman road to Beechwood House and the route can be traced for over 850m from this. A projected course aligns on Allington Lane as it passes Allington Farm in the direction of the chalk escarpment where several historic routeways climb up onto the Downs.

Tracing the London to Brighton Road

The main London to Brighton Roman Road (Margary No. 150) crosses the E-W Greensand Way (Margary No. 140) close to Hassocks. From this point the route becomes less clear as it ascends the steep scarp and crosses the Downs to Brighton. There are several suggested routes across the Downs north of Brighton, but no visible evidence of an engineered Roman road has been identified south of Pyecombe. Margary (1965, 96) identified what he believed to be the course of the Roman road climbing up the northern escarpment, visible as a terraced way running parallel to the 17th-century carriage road (now a track). Both are visible on lidar and approximately 670m of the potential Roman road was mapped between Rockrose and Pyecombe where its course may then have

continued as the current main road though Pyecombe village. From this point Margary suggested the road followed the course of a track called the Green Way around West hill and Varncombe Hill and into Varncombe. He then identified a track with traces of a metalled agger, passing Brighton golf Club and crossing over Benfield Hill and Foredown Hill into Portslade (*Portus Adurni*). Identification of a road southward across the Downs has proved difficult to trace, but it has been speculated that a more direct route existed into Brighton following the same course as the railway cutting and the present-day A23 London Road along a dry valley to Patcham or the curving ridgeway to the west (Margary 1965, 96).

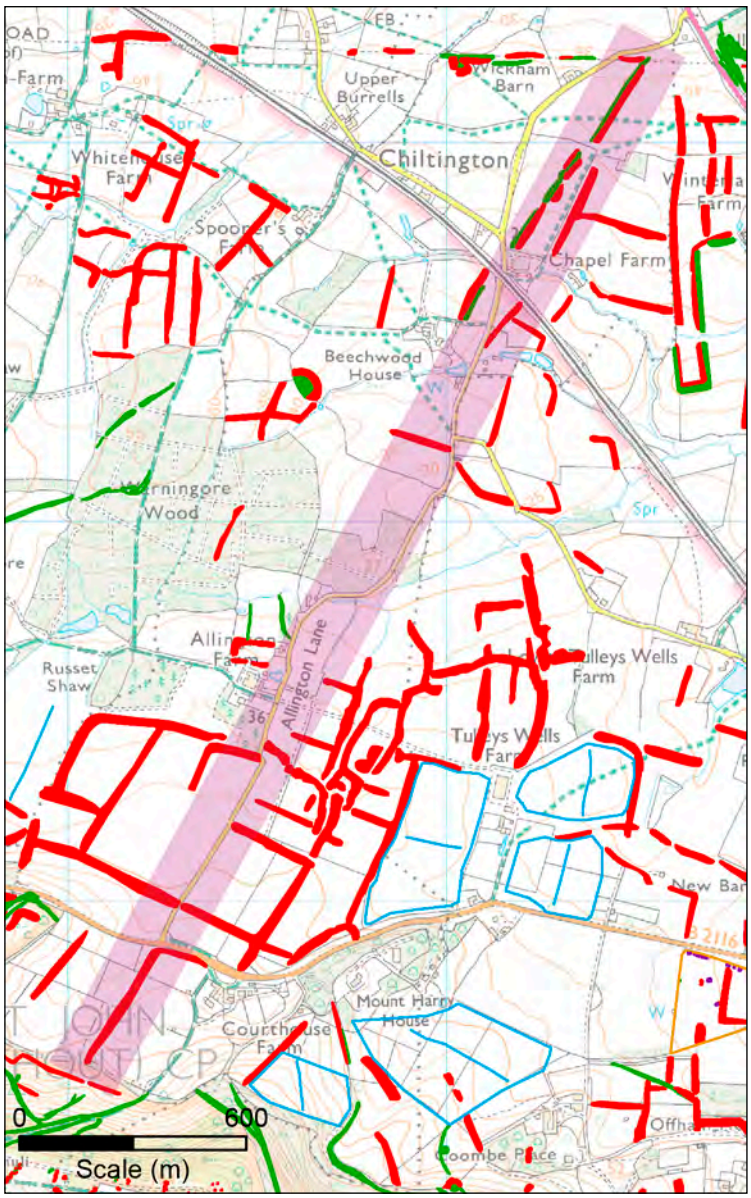

Figure 52: Extract of mapping illustrating the possible remains of a section of Roman Road extending south-west from the known Roman road near Chiltington in the direction of Appleton Lane. Archaeological mapping © Historic England; Base map © Crown Copyright and database right 2023. All rights reserved. Ordnance Survey Licence number 100019088.

Sussex bostalls and droveways

A feature of the northern face of the South Downs and the opposing south face of the North Downs are the deeply incised tracks and paths. In this part of the country, they are known as ‘Bostalls’ – a Sussex name for incised routes, probably drove ways, which lead up the steep northern scarp of the South Downs from the Weald onto the open Downs. These were used to move sheep and other livestock to and from pastures to market, and routes to the coastal region. The name is possibly derived from two Saxon words –*beorg*, meaning hill and *stig* or *stigel*, meaning a rising path (Parish 1875, 20). They are typically deeply worn paths angled across the slope to enable horses and oxen to pull heavy loads up and down the steep escarpment (Brandon 2009, 42).

These routes rise the onto the Downs at regular intervals and many have names such as Plumpton Bostall, Ditchling Bostall, Westmeston Bostall, Middleton Bostall, Steet Bostall, Burnhouse Bostall and Warningore Bostall. This frequency of parallel routes is probably linked to the historic parcelling of land on the Weald and the chalk downlands. In this area of Sussex, the medieval parishes were long linear holdings extending N-S from the settlements and pasture on the Downs down onto the Weald where daughter settlements and fields were located. This ensured equal distribution of the different landscapes and resources shared between adjacent parishes. Routes linking the lowland Weald to the upland Downs became established within each parish through time. A few of these have been surfaced and adopted as roads, but most remain as bridleways and footpaths and frequently they are flanked by subsidiary routes or shortcuts made to avoid an earlier muddy or impassable route. Plumpton Bostall was a bridleway until the Second World War when it was surfaced with concrete to enable tanks and artillery to access the areas of the Downs which were requisitioned for military training between 1942 and early 1947 (Carey 2009).

Several historic named tracks and roads cross the Downs. Some are droves and many are purported to be Roman in origin, radiating out of Brighton in different directions. They are typically fragmentary remnants of routes, surviving partly as tracks, paths and notional routes marked on OS maps. Novington Road is probably a drove, possibly post medieval in date (East Sussex HER MES 38285), which exists as a trackway today. This route extends NE along ridges from Falmer over Balmer Huff and Buckland Bank and descends via a trackway into East Chiltington Parish. The South Downs Way follows the northern section over the Downs.

Jugg’s Road or Jugg’s Bostall is another named route likely to be a drove between Brighton and Lewes. It extends NE from Woodingdean, following Drove Road, becoming a trackway known as Drove Avenue which heads across Newmarket Hill before skirting the northern side of Castle Hill (where it is marked as Jugg’s Road on the OS map) and then descending via Kingstonbridge into Lewes. The road is also purported to be the Brighton to Glindebourne Road (MES489). There are a number of suggestions to the origin of the name Juggs Road, one being that Jug was the nickname of the men of Brighton who used this route to trade fish with Lewes (EPNS 2023).

Industry and Extraction

Historically Sussex is known for several industries founded on an abundance of raw materials which have been exploited since pre-Roman times. In the medieval period the Weald was a centre for ironworking and glassmaking and later for brick and tile making, and chalk extraction and lime burning (Bryant 1979), all of which have left their mark in the landscape to a greater or lesser extent.

Chalk extraction and processing

Chalk has been extracted from the Downs throughout history for building and agricultural improvement on both local and industrial scales. This has left numerous small pits across the landscape and a number of quarries, some of considerable size, along the northern face of the chalk escarpment and the sides of the river valleys such as the Ouse where they have cut through the chalk ridge.

Chalk is made up of calcium carbonate (CaCo3) which when burnt at around 900 degrees Celsius becomes calcium oxide (CaO) known as quicklime. A description by Cato the Elder records the Romans building limekilns 20ft deep and tapering from 3ft at the top to 10ft at the base (West Sussex County Council 1979, 1-2). Adding water to quicklime produces calcium hydroxide or slaked lime which is used as a fertiliser to restore the lime to soil (ibid.). Adding water to quicklime produces calcium hydroxide or slaked lime which is used as a fertiliser to restore the lime to soil (ibid.).

From the Roman period, sand added to slaked lime was the only form of mortar available for building until the invention of Portland Cement in 1824. Chalk has also been used for limewash since the Roman period and, depending on its purity, to whiten paints in more recent times (ibid.).

There was a change in production methods and capacity in response to the growing demand for fertiliser for newly enclosed lands in the 18th and 19th centuries and for other industrial processes and chemical production.

Advances in production came in the 18th century with the invention of the perpetual or draw kiln, a bottle kiln made of stone or brick which could be run continuously. Kilns were often built two or more together, against a hill so they could be fed from the top and the quicklime collected from the bottom via a grate. These large capacity kilns were frequently constructed adjacent to the quarry and ran continually for years (ibid., 5).

Marl pits and small-scale agricultural extraction

Chalk has long been extracted and applied to leached out soils, either in its raw state or burnt to make lime. There are numerous pits and hollows where farmers have dug out the underlying chalk and spread it directly on the fields. This process is known to have been practiced in southern Britain for at least two millennia – Pliny recorded the native Britons spreading unburnt chalk on their fields as a manure called ‘marle’, the effects lasting for 80

years (ibid., 3). Still known today as marl pits, their remains are visible scattered though many downland fields across the country and a large number were mapped during the Downs from Above survey. They are typically placed at intervals across fields. Though mostly infilled, they often remain as slight hollows which are detectable using lidar or appear in ploughed soil as a darker mark where deeper, more organic soil has filled the void, standing out in the surrounding chalky soils (Fig. 53).

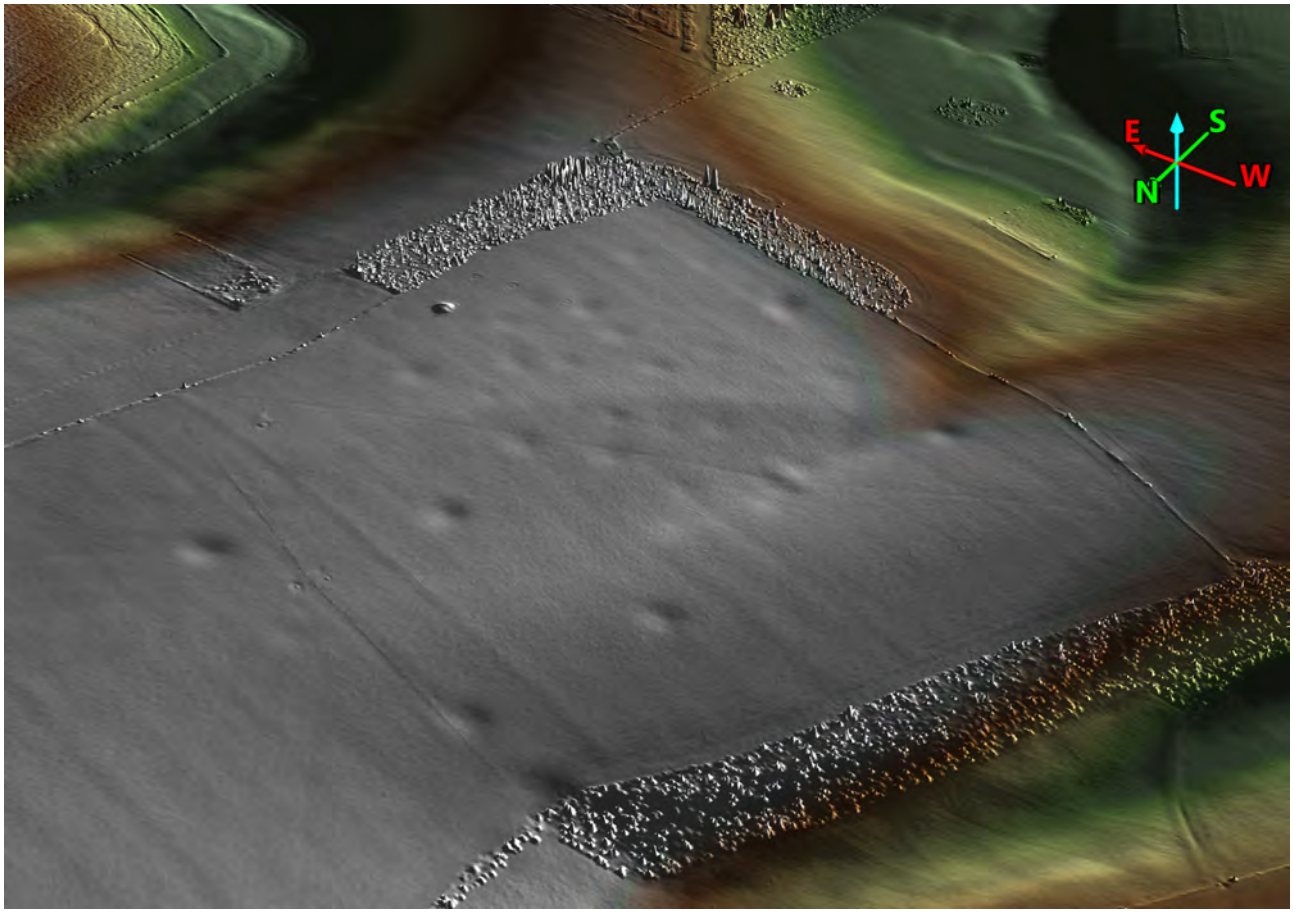

Figure 53: Marl pits visible as earthworks on the southern slopes of Streat Hill. LIDAR DSM 17-JAN-2019 © Historic England. Source Environment Agency.

Small chalk quarries

There are numerous small Chalk pits and quarries on the Downs and they are typically (unlike marl pits in fields) located at field edges or beside tracks. Chalk was extracted on a small scale for local use to spread in its raw state onto the fields or, from at least the medieval period, burnt locally by farmers to make their own lime. This was done in small simple kilns, often little more than a pit in which the chalk was layered with fuel, sometimes coal, which was lit and covered (probably with turfs) to make a clamp which was left for a week or two (ibid., 5). Traces of numerous small undated rural quarries have been mapped from lidar and aerial photographs, often close to farms and in field corners.

Groups of slightly larger quarries are concentrated at the foot of the escarpment and may date from the medieval into the post medieval period. Lime kilns became slightly more sophisticated in the medieval period. Still sunken pits, but often contained by a wall and furnished with draught tunnels. They were fired in the same way with alternating chalk (or imported limestone) and fuel which was covered with turf and left to burn. These quarries reflect the growing demand for lime to improve the soils of the Weald. Many of these small quarries were probably subsumed by the later large-scale post medieval chalk pits.

Large chalk quarries and limekilns

The demand for lime increased with the industrial revolution and the boom in building, railway construction, harbour expansion and a host of industrial processes. Chalk was required in massive quantities and numerous quarries were developed and expanded along the northern edge of the South Downs. Limekilns were built alongside the quarries and the lime burnt in situ and transported as quick lime.

Along the chalk escarpment within the project area there are the remains of numerous large chalk pits with associated limekilns and works that operated on different scales through the 19th and 20th centuries. The larger chalk pits included Novington Pits and kilns, Ditchling Limeworks (*c*.1839-1910), Clayton Limeworks (early 20th century), Offham Chalk Pit (1809-1890) and a host of smaller quarries and works mapped, but not named, on the Ordnance Survey maps.

Offham Chalk Pit

One of the largest chalk pits and works in the area were those at Offham to the north of Lewes which operated from 1809-1890 (Fig. 54). At peak production Offham Chalk Pit was furnished with four lime kilns and lime was transported away by river. The quarry extends over an area of 700m by 300m, cut into the western side of Offham Hill. The site was linked via a sharp 22m long inclined railway (thought to be part of the oldest railway in Sussex) which passed beneath the road, to a wharf on a branch of the Upper Ouse Navigation known as Chalkpit Cut (English Heritage 2000).

Before the 18th century the Ouse was only navigable for transportation below Lewes. The Upper Ouse Navigation Act enabled boats to travel upstream of Lewes. A series of 18 locks and cuts were constructed above Lewes to Sheffield Bridge by 1793 and to Ryelands Bridge by 1812. North of Lewes the Hamsey Cut, a straight 800m long lock-controlled channel with a towpath, avoided the long and convoluted bend in the river. A shorter channel, Chalkpit Cut, was dug to link the river with the wharf at Offham Chalk Pit (Austen et al. 1985, 5), and a second cut known as Pellbrook Cut linked the Wharf at Offham Chalk Pit to the Hamsey Cut.

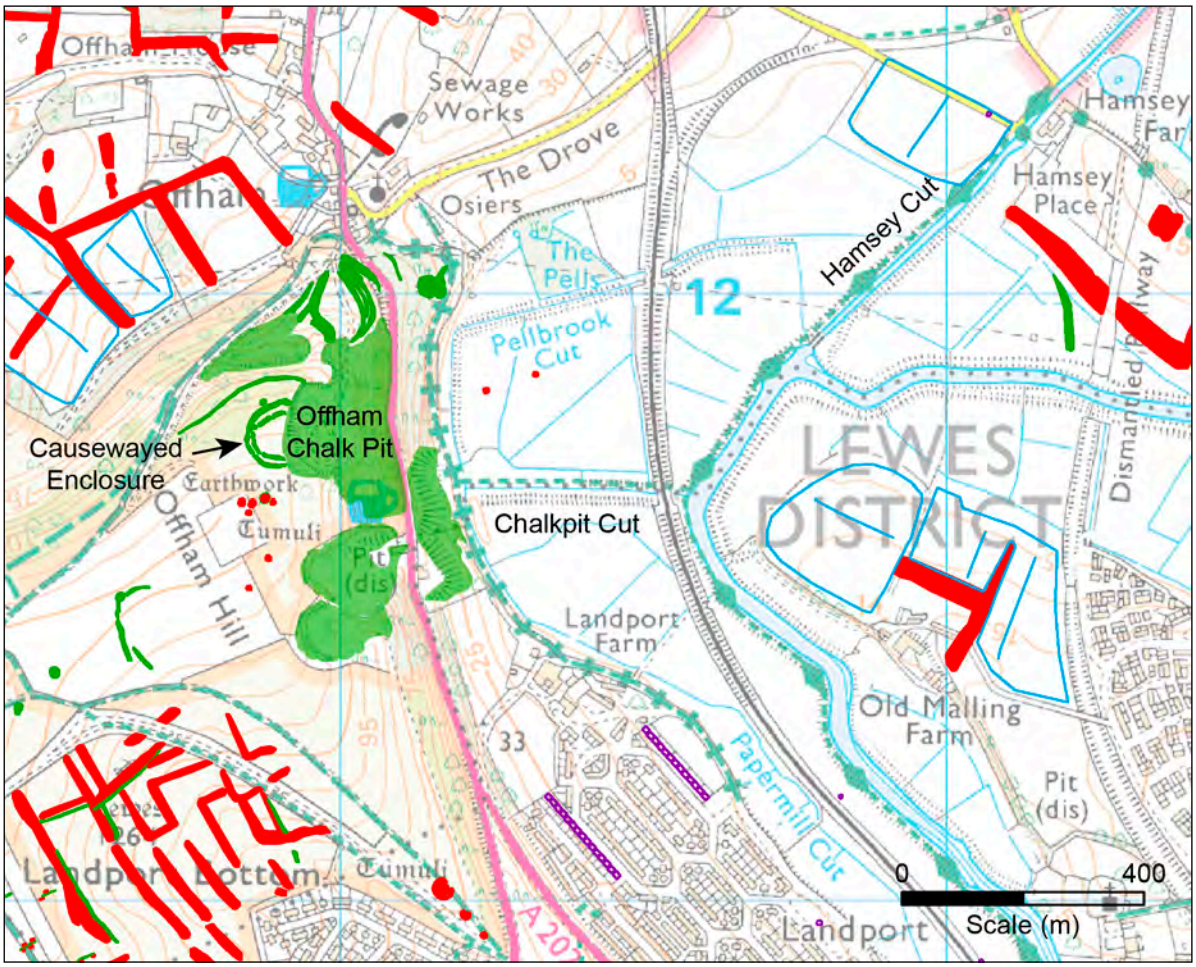

Figure 54: Extract of mapping showing Offham Chalk Pits, surrounding archaeology and the much-altered River Ouse. Archaeological mapping © Historic England; Base map © Crown Copyright and database right 2023. All rights reserved. Ordnance Survey Licence number 100019088.

The chalk workings removed the eastern half of the Neolithic causewayed enclosure on Offham Hill. 19th-century OS maps depict the earthwork remains of the causewayed enclosure, already partially destroyed by the chalk pit. The southern-western part of the enclosure was plough-levelled and buried remains can be detected as a cropmark on aerial photographs, but the earthworks of the northern-western part are in woodland on the edge of the quarry.

Today the Offham Chalk Pit quarries are overgrown with mature trees (Fig. 55). The working areas, trackways and structures such as kilns and the inclined railway have largely been demolished and the remains are difficult to seen on modern aerial photographs and lidar images.

Figure 55: Aerial view of the abandoned and overgrown site of Offham Chalk Pit looking north. 33451_014 12-FEB-18 © Historic England Archive.

Flint mining on the Sussex Downs

For over half a million years flint was probably the most important raw material to be used by hominins within the British Isles (Barber et al. 1999). It is likely the first flint users simply collected flint from abundant deposits exposed at the surface. Flint has been mined in Britain since the Neolithic using shafts dug down as far as 15m through chalk to the desired seam of flint, which was then followed via a network of horizontal galleries (ibid., 38). The largest and best-known Neolithic flint mine is at Grimes Graves in Norfolk which dates to the late Neolithic. In contrast, smaller early Neolithic flint mines have been identified in Sussex, but none were identified in the Downs from Above project area.

Flint was prized for prehistoric tool making but was also used as pot-boilers to allow low-fired pots to withstand being placed in the fire when heating water and food. Ground flint was also used to temper coarse pottery. Flint was also prized for fire-lighting as sparks are readily produced when struck against a ferrous material such as iron pyrites or, in later periods iron or steel. It was used for this well into the 19th century in Britain before largely being replaced by the match from 1826 onwards (ibid.). Flintlock firearms were used from the 16th century into the 19th century.

A flint mine on Wolstonbury Hill (Fig. 56) was exploited for the gun flint industry in the late 18th and early 19th centuries, with much of the labour supplied by the inmates of Hurstpierpoint workhouse (Curwen 1930, 239). The extensive nature of the 19th-century extraction may have removed remains of earlier workings on the site.

Figure 56: Wolstonbury Hill photographed in low sunlight highlighting the prehistoric enclosures and the post medieval flint quarries and part of the large chalk quarry (left). 24802_041 29-OCT-2007 © Historic England Archive.

Aerial photographs and lidar images show several areas of small extractive pits, probably for flint, spread across the hilltop within and extending beyond the earthwork ramparts of a late Bronze Age hilltop enclosure at Wolstonbury. Two further smaller areas of pitting, also thought to be associated with flint extraction, are located on the ridge to the south. The south-eastern area of mining cuts through the earthwork remains of a late Bronze Age and Iron Age cross-dyke showing it is later in date (Fig. 57). Further along the same ridge to the south-east of the cross-dyke are more slight earthworks of pitting, also thought to be the plough-levelled remains of post medieval flint extraction. A large post medieval chalk pit – Wolstonbury Hill West Quarry – has also been dug into the western flank of hill.

Figure 57: Post medieval flint extraction on the ridge below Wolstonbury Hill. The image shows pits cut into a prehistoric cross dyke. 24802_030 29-OCT-2007 © Historic England Archive.

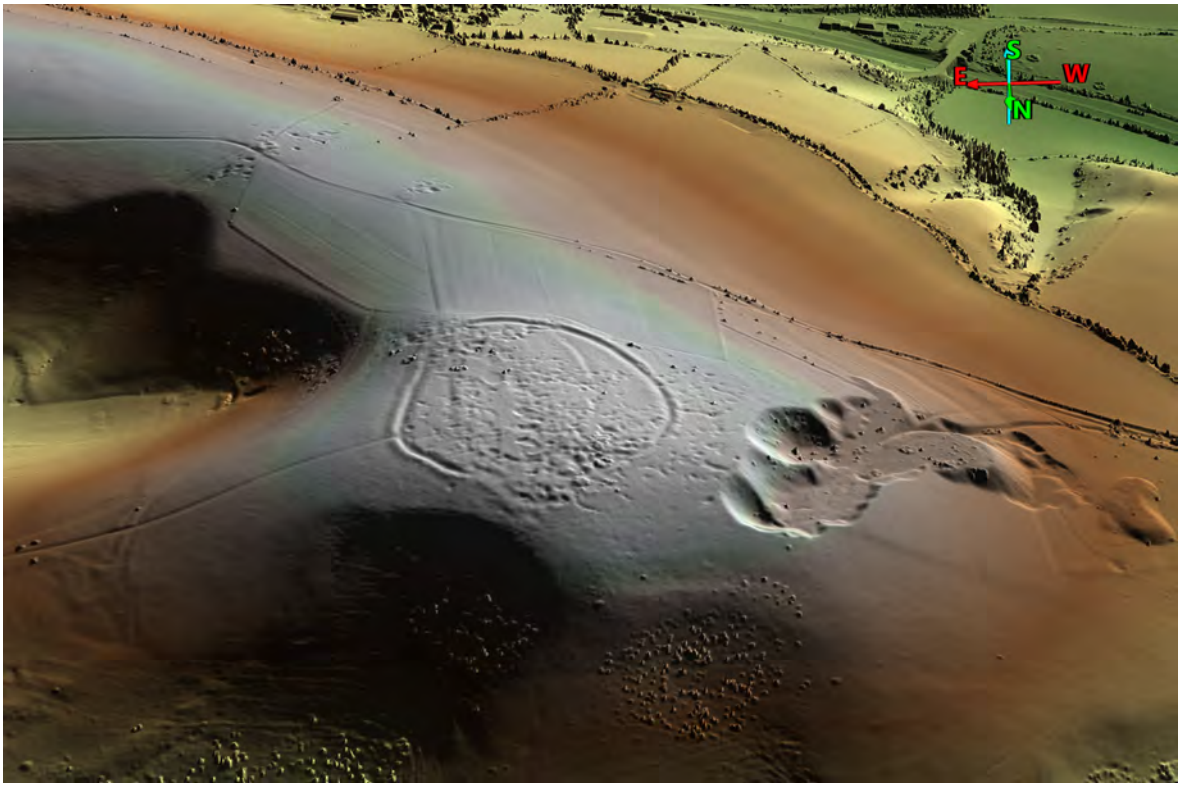

Figure 58: Environment Agency Lidar DTM visualisation (SVF 17-JAN-2019) of Wolstonbury Bronze Age enclosure peppered with post medieval flint mining pits. LIDAR DTM 17-JAN-2019 © Historic England. Source Environment Agency.

Landscape of Leisure

Until the mid-18th to 19th centuries Sussex was a rural backwater served by poor roads, but the coming of the railways opened up the county and coast to the wealthier occupants of the rapidly growing sprawl of nearby London. It became of a place of refuge and recuperation to the middle classes in search of a rural retreat as the health and recreational value of the seaside was being recognised. It gave rise to the development of much of the coast and towns such as Brighton which rapidly became popular, attracting weekenders, holiday makers and commuters (Brandon 2006, 38-40). The first holiday destinations were born, and activities and attractions were developed to amuse those with money and time on their hands. Some activities such as horseracing and golfing have prevailed, but others were short-lived and have left more enigmatic traces in the landscape.

Figure 59: Coloured postcard of Ladies enjoying Devil's Dyke. Historic Postcard published by: The Brighton Palace Series 41 - No. 342. Date unknown. (Author's collection).

Hunting and parkland

Hunting is one of the oldest sports in Britain. Formerly deer hunting for the King and gentry and more latterly fox hunting have featured heavily in the social history of Sussex. Hunting has partly shaped the countryside we see today where hedges, copses and coverts were used for cover. Medieval deer parks associated with grand houses sheltered deer and wild boar and harboured mature trees and woodland (Brandon 2009, 236-7). It also provided a source of employment to rural workers.

The most prominent estate within the survey area is that of Stanmer Park, owned by the Right Honourable Thomas Lord Pelham. The landscape park, gardens and pleasure grounds of Stanmer House were laid out by Nicholas Dubois between 1721 and 1727 on the outskirts of Brighton. Charles Bridgeman advised on tree planting in 1726 and work on the park continued from 1737 until 1799, with further additions to the park continuing throughout the 19th century. Most of the gardens including the arboretum were laid out during a period from the mid-19th to early 20th century. Despite the episodes of landscaping, the slight earthwork remains of extensive later prehistoric/Roman field systems still survive throughout the park.

The estate was used for military training during the Second World War and the entire park was purchased by Brighton Council in 1947. Since then, the park has been used as public open space and the campus of the University of Sussex occupies land on the south-eastern corner of the former park (Historic England: Register of parks and gardens of special historic interest in England). The house is now a pub and restaurant.

Horses and the Downs

Horse racing as we know it became established in the 18th century as a fashionable pastime to the wealthy classes in Regency England, with early Sussex racecourses established at Shermanbury Place, Portslade, Lewes and Brighton (Brandon 2009, 240).

Today there are three racecourses within the project area – Plumpton Racecourse to the north on the Weald, which was established in 1876, and Lewes and Brighton Racecourses, both established in the early 18th century. The locations outside each town took advantage of the freely-draining chalk downland with its benefit of offering reliably firm going for racing in most weathers.

Racing at Lewes was established in the early years of the 18th century on the Downs to the northwest of the town. The course followed an open-ended V-shaped course around the lip of Cuckoo Bottom with the Grandstand and other buildings located on the eastern side. The axis of the course is aligned NNW-SSE with its point (giving a tight bend to the course) to the north.

This was the fourth oldest racecourse in Britain, initially dominated by two-horse races and frequented by royalty and gentry (Fuller 2014). The first record of a race at Lewes was in 1706 and by 1714 the establishment was being run by the family of Lord Pelham of Stanmer Park (Brandon 2009, 240). It had two winning posts, one for 5-furlong races, and another for 6-furlong races which both started at the same point but finished at their individual posts to avoid starting a race on the bend. Despite the irregularities in the course, with a harsh climb to the finishing post in front of the stands, Lewes was once described as ‘one of the finest 4-mile courses in the kingdom’ (Fuller 2014).

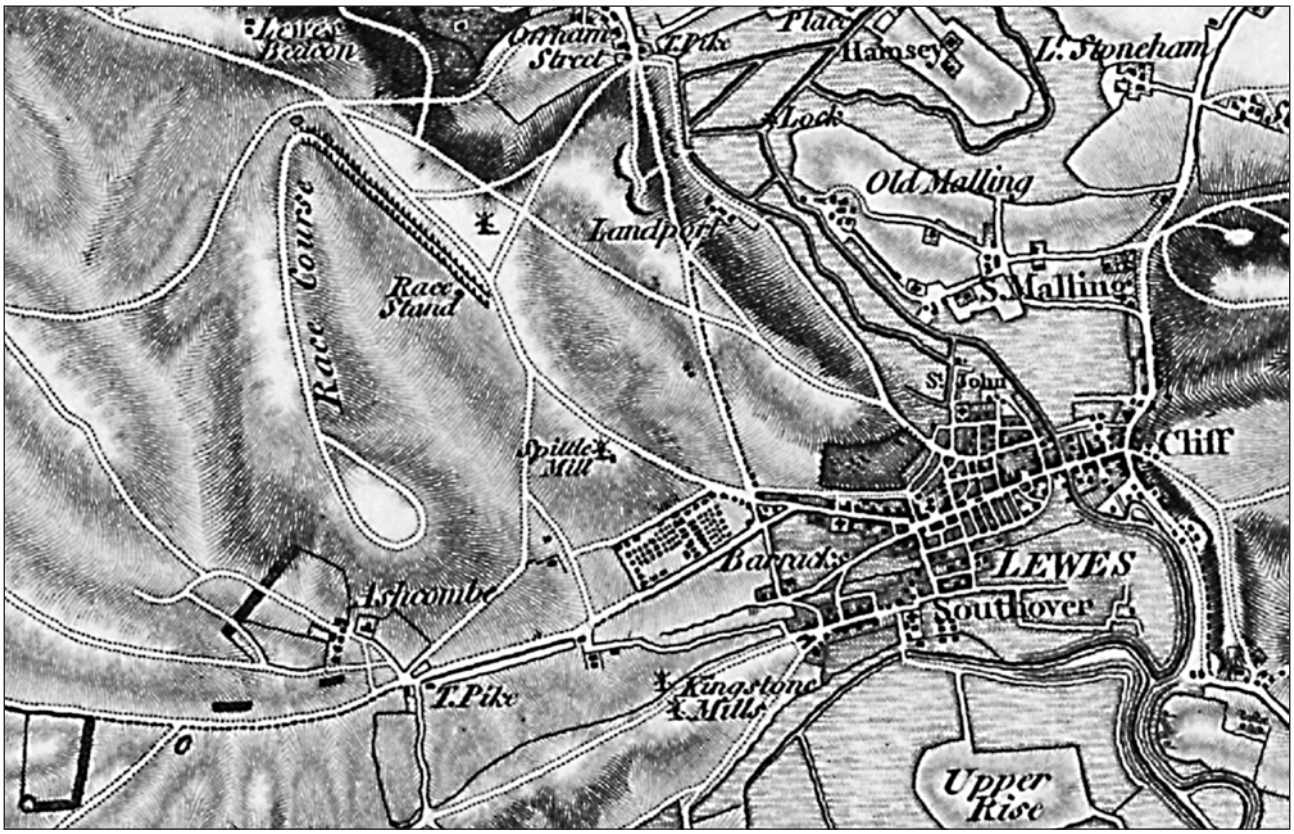

Figure 60: Lewes Racecourse depicted on the OS One Inch map of 1813 to the north west of the town. © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2023) Licence numbers 000394 and TP0024.

Much of Downs around Lewes Racecourse was requisitioned during the Second World war for use as a military training area. Wartime photographs record the extent of this showing a network of tank tracks criss-crossing the entire area and numerous weapons pits and trenches which pepper the landscape. The racecourse was closed for the duration of the war and the site of the stands possibly used by the Army. The gallops were obstructed with anti-aircraft obstructions to deter landing of enemy aircraft on the long straight stretches seen as potential landing strips.

The course reopened after the war and racing was revived, seeing Lester Piggot win his first race there in 1950, but was finally closed on 14 September 1964. The Grandstand buildings are now the home of a racehorse trainer, and the course of the former racecourse is used as gallops. The area partly enclosed by the gallops is cultivated, and there are trees around the inside and outside margins of the course, but pre-war OS maps suggest this was the regime long before the closure of the course. Despite this use as arable land, the slight traces of later prehistoric/ Roman field systems can still be detected on lidar images and aerial photographs within and around the racecourse.

Figure 61: Second World War aircraft obstructions dug into the gallops on the western side of Lewes Racecourse. Detail of RAF/106G/LA/169 FS 2017 09-MAY-1945 Historic England Archive (RAF Photography).

Racing at Brighton was established shortly after Lewes with the first known race taking place in 1713 and the first recorded public race in 1738. Like Lewes, its course is also open-ended, describing an inverted ‘U’ following a ridge around the two dry valleys of Whitehawk Bottom and Sheepcote Valley with the grandstands on the western side. At both Lewes and Brighton races were run in stages with the horses rubbed down in rubbing houses where racehorses were washed and dried during and after races. The rubbing house at Lewes has long-since been removed, but its location at the northern end of the course is recorded on historic OS maps.

Brighton rapidly became more fashionable than Lewes, but by the 1930s racing as a pastime ceased to be as attractive and had gone socially downhill and considered a ‘low sport’, frequented by gangs who threatened the bookmakers (ibid.).

Figure 62: Aerial view of the remains of Lewes Racecourse. Next Perspectives APGB Imagery TQ3810-TQ3911 20-MAY-2015 © Bluesky International/Getmapping PLC.

Brighton racecourse lies on top of the remains of a Neolithic causewayed enclosure, an example of one of the oldest man-made features know to the British Isles and thought to be important places where people gathered. Lewes Racecourse is located just within 1km of a second causewayed enclosure on Offham Hill.

Plumpton Racecourse is located to the north of the Downs on the Weald. This was a much later venue than Lewes and Brighton and was initially established as the first enclosed hare coursing meeting by Thomas Henry Case in 1876. Horse racing was only introduced to the site in 1884. The first horse race took place on 11 February 1884 and meets have continued ever since (Plumpton Racecourse 2023).

Figure 63: Aerial view of Brighton Racecourse at Whitehawk on the outskirts of Brighton as it was in the 1930s. In the foreground are the earthwork remains of a Neolithic causewayed enclosure EPW041369 1930s © Historic England Archive. Aerofilms Collection.

Ladies Mile Victorian Gallops

Evidence of less formal riding activities were also recorded during the Downs from Above project. Ladies Mile on the outskirts of Patcham was a popular route in the 19th century for ladies to ride out onto the Downs following the old drove road from Patcham to Stanmer along a narrow ridge of downland. The southern half of the ridge has been developed since the war, but the northern part is an important pocket of uncultivated grassland preserved as a nature reserve. This has prevented ploughing of a small part of the later prehistoric/Roman field systems and trackways within this strip of land which are recorded as crisp earthworks on RAF vertical aerial photographs taken in 1946. As seen at Lewes Racecourse, anti-aircraft obstructions were dug at intervals across the length of the gallops during the Second World War (Fig. 64).

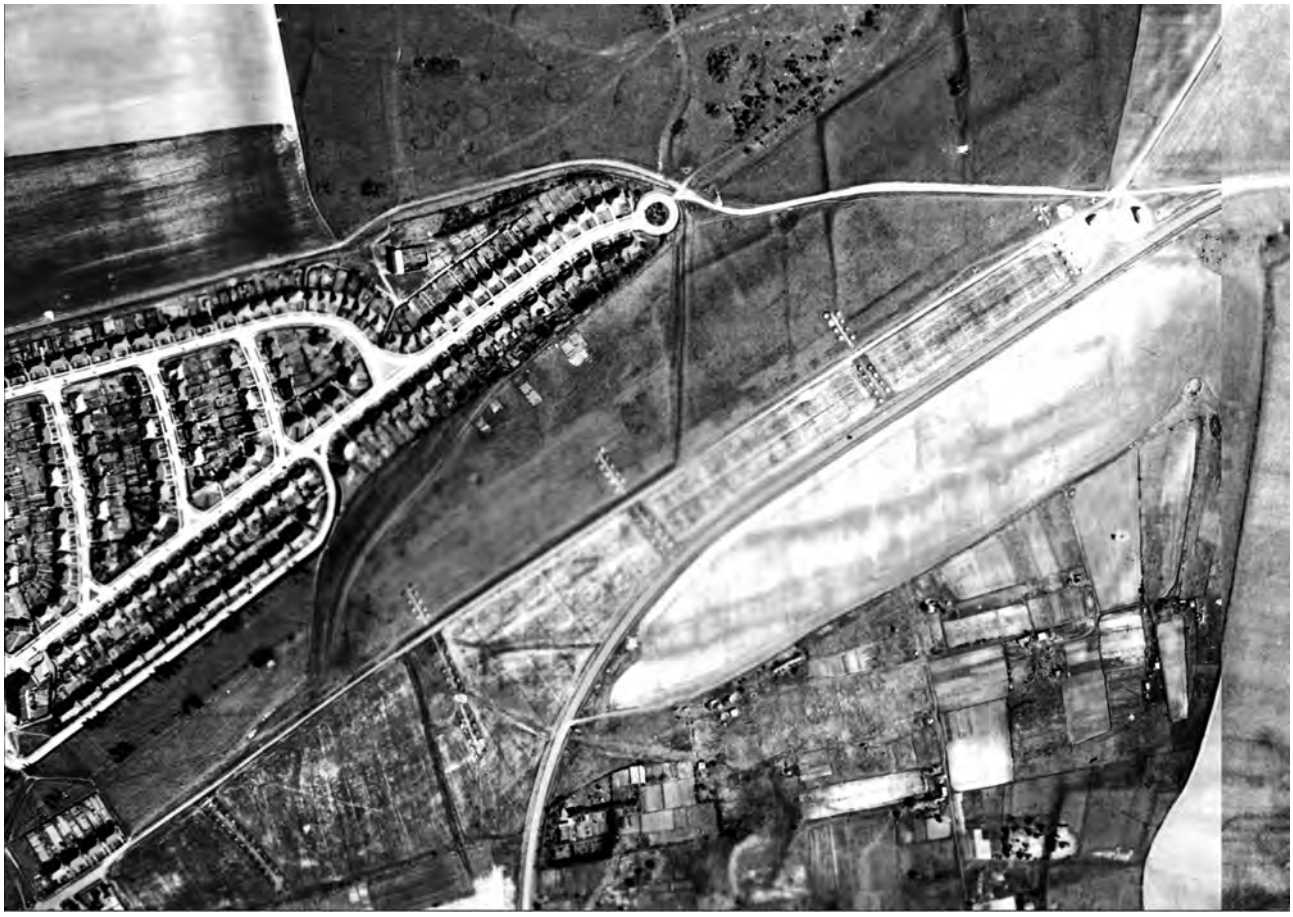

Figure 64: Ladies Mile gallops at Patcham on the outskirts of Brighton interrupted by a line of Second World War anti-aircraft obstructions. A well-preserved field system extends across the site of the nature reserve on the northern part of the ridge. Detail of RAF/3G/TUD/UK/157 V 5106 19-APR-1946 Historic England Archive (RAF Photography).

Devil's Dyke and all the fun of the fair

An Iron Age hillfort is located on a commanding ridge overlooking the Weald to the north and flanked to the south-east by a deep steep-sided dry valley known as the Devil's Dyke. The hilltop has been a draw for millennia and is still attracting visitors. Today the site, is a popular destination where people walk, cycle, fly kites and picnic while enjoying the wide-open views of the Downs. However, Devil's Dyke today, is quite different from the attraction which drew visitors in their droves, reaching the peak of its popularity in the late 19th century.

The hub of this site was the Dyke Hotel built around 1831 (and improved in 1835) within the ramparts of the hillfort. It offered refreshments, acting as a focus for day trippers from Brighton and Hove who walked, rode, or were brought by pony and trap up the Devil's Dyke Road. In 1890 the entire Devils Dyke estate was put up for auction (*Nottingham Evening Post*, 3 May 1890) and sold by Messrs. Ridley, Ledger and Hollis to a private individual (*Mid Sussex Times, Haywards Heath,* 14 July 1891). The purchaser, a Mr H. J Hubbard, set about creating an adventure park (National Trust 2023). There are tales of

royal visits made by King William IV and Queen Adelaide driving by carriage from Devils Dyke and of a young Queen Victoria riding up on horseback while staying at the Brighton Pavilion (ibid.).

The site was developed throughout the late 19th and early 20th centuries, and the hotel and surrounding ridge became the site of an adventure park with fairground attractions occupying much of the interior of Devil's Dyke hillfort. In its heyday the site boasted amongst its attractions: two bandstands, lawns, tea pavilions, a 7-ton replica Naval gun and even a zoo. There were a series of fairground adventure rides, including a rollercoaster, a 'bicycle railway' with adapted bicycles suspended on a fixed circular rail, and an aerial ropeway where thrill-seekers traversed the Devil's Dyke in a metal cage suspended from a wire strung between two metal pylons on either side of the valley (Fig. 65).

Figure 65: Edwardian postcard of the Devil's Dyke looking NE from the railway station to the aerial ropeway suspended between two towers on either side of the Devil's Dyke valley. The white wooden buildings of the ropeway station are visible up-hill (left) of the pylon. Note the hay sheaves are being dried in stooks within the fort. (Author's collection).

The attractions at Devil's Dyke were recorded in the Brighton Gazette and Sussex Telegraph Thursday 17 May 1894, in an article titled: 'Bank Holiday in Brighton'

> At Devil's Dyke a round of amusements were provided, including switchback railway, swings, a rifle gallery, cameral obscurer, fortune telling and during the day also pilot balloons, measuring 40 feet in circumference, were despatched into the azure space. A band discoursed music, and numbers visited the picturesque spot by rail and road.

Figure 66: Coloured postcard of the Devil's Dyke Hotel and some the static attractions and amusements such as swing-boats and a large wooden cannon. Possibly dated 1905. (Author's collection).

The complex was entered from the Devil's Dyke Road from Brighton to the south-east, as routes from the north were difficult and more circuitous. The Brighton and Dyke Railway Company constructed a dedicated spur of the main Brighton to Portsmouth railway (Mitchell and Smith 1983). This was by no means a simple construction as the line needed to negotiate a gradient of 1 in 40 and required a series of deep cuttings and high embankments to maintain a graded track bed. It opened in September 1887 transporting visitors from Dyke Junction in Brighton (now Aldrington Station) to Dyke Station in around 20 minutes (Povey 2023). A halt was added in 1891 at the Devil's Dyke Golf Club just short of the top. There was also provision made for transporting small l of coal and agricultural feed to a small goods yard at Dyke Station and occasionally transporting hay into Brighton from the surrounding farms on the return journey (Mitchell and Smith 1983).

On a more practical level the railway provided a vital lifeline to the farmers and villages around Devil's Dyke, offering a reliable link, particularly during the winter months (Povey 2023).

As the Devil's Dyke became more popular with day trippers more innovative and modern means of transportation (and entertainment) were sought. In the 1897 a funicular railway was constructed from the foot of the hill below the Devil's Dyke hillfort to enable access to and from tea houses in Poynings.

Its opening was reported in the Pall Mall Gazette on 26 July 1879:

> A steep-grade railway was most satisfactorily opened by Sir Henry Howarth, who standing on the edge of the awful precipice, delivered what, under the circumstances, may be described as a recklessly cheerful address to his fellows in danger. Far below could be seen a crowd of the habitual dwellers in the bottomless region wanting to see the first souls descend to them by means of the new-fangled mechanism, which in future is to lead men from the light to the valley of the shadows at 2d or 3d a time. Fortunately, the lift elevates as many souls as it thrusts down. The railway stands like a house-decorator's ladder against the face of the Dyke…The cars- there are two capable of carrying twelve passengers and one attendant...

A month later a magazine article of 14 August 1897 reported:

> A railway of a novel character has been constructed …it is only 840 feet long and claims to be the shortest public railway in this country. Two cars are used for the service, one ascending while the other descends…A three-minutes' exciting ride suffices to convey the car from the hill to the terminus at the bottom (Black and White 1897).

The funicular railway was an ambitious project which appears to have lasted just over a decade before being put out of business by motor buses. It closed in about 1908 and was removed in 1909 (Brighton Museum).

The railway was also finally put out of business by the competition from the motor buses which offered a more comfortable journey delivering visitors to the front of the hotel, dispensing with the short stiff walk from the railway station. The last train ran on 31 December 1938 (ibid.).

The remains of the track bed and site of the station – now incorporated into Devil's Dyke Farm – are recorded on aerial photographs and lidar. A 2.8km section of the northern half of the railway winds up-hill through open countryside. Since closure, the lower 2.4km has been developed for housing, but the course of the railway is fossilised in the layout of the roads though the housing estates of Hangleton following Poplar Avenue, Elm Drive and Amherst Crescent just short of Aldrington Station on the surviving main line. Part of the

upper section has been revived as Dyke Railway Trail which extends from Hangleton Way to the Brighton and Hove Golf Club where it meets the Monarchs Way long distance path. Beyond this point the track it is overgrown and used as a farm track.

Today, apart from the much-altered hotel and visitor car parks, the Iron Age hillfort and adjacent ridge and the Devil's Dyke are once again empty grassland. In front of the hotel is a large concrete commemorative seat designed by John Leopold Denman and installed on 30 May 1929 to commemorate the gifting of 190 acres of downland purchased for public use for the sum of £9,000 in an initiative led by Herbert Carden, Mayor of Brighton (ArtUK 2023).

Figure 67: Aerial view of the Dyke Hotel with the commemorative seat visible to the left. Note the four visitor motor buses and three cars in the hotel car park. EPW041379 01-MAY-1933 © Historic England Archive. Aerofilms Collection.

Of the once bustling hub of public attractions, only slight traces remain as enigmatic earthworks and isolated blocks of concrete. Within the fort enclosure the most prominent feature is the circular embanked platform 50m in diameter located on the northern side of hillfort enclosure which is all that remains of the Victorian bicycle railway.

Figure 68: View of the current Dyke Hotel and part of the ramparts of the hillfort cut by numerous paths and commemorative bench in the foreground. The former funicular foundation cutting can be seen in the shadowed area top left. 24801_011 29-OCT-2007 © Historic England Archive.

Immediately north-west of this are the remains of the funicular railway foundations, which are visible in the hillfort ramparts, and the straight earthwork cutting for the track which descends the steep slope to the north. The rail track and the top and bottom station buildings have long-since gone. A second fainter linear cutting or ditch to the east of the funicular cutting appears to be one of the two paths which developed on either side of the track and are recorded on photographs taken while the railway was still in use.

Remains of the aerial ropeway survive on the south side of the hillfort where there are the concrete footings of the two metal towers and the station building. The footings for the northern tower lie just within the hillfort ramparts and the southern tower on the steep slope on the opposite side of the Devil's Dyke valley. Approximately 40m above the north tower a slight depression marks the site of the ropeway's north station building, seen as a white building on the historic postcard (Fig. 65). There are also traces of the path leading down from the centre of the fort to the ropeway station building.

The main site of the Victorian fairground was located immediately north-east of the hotel, which is now partially wooded. Faint traces of earthworks visible on the lidar could be associated with the fairground attractions, but could relate to First World War weapons testing, though bomb testing took place over the valley at Devil's Dyke. During the Second World War it was a defended location and military installation, and the site was peppered with weapons pits and barbed wire obstructions.

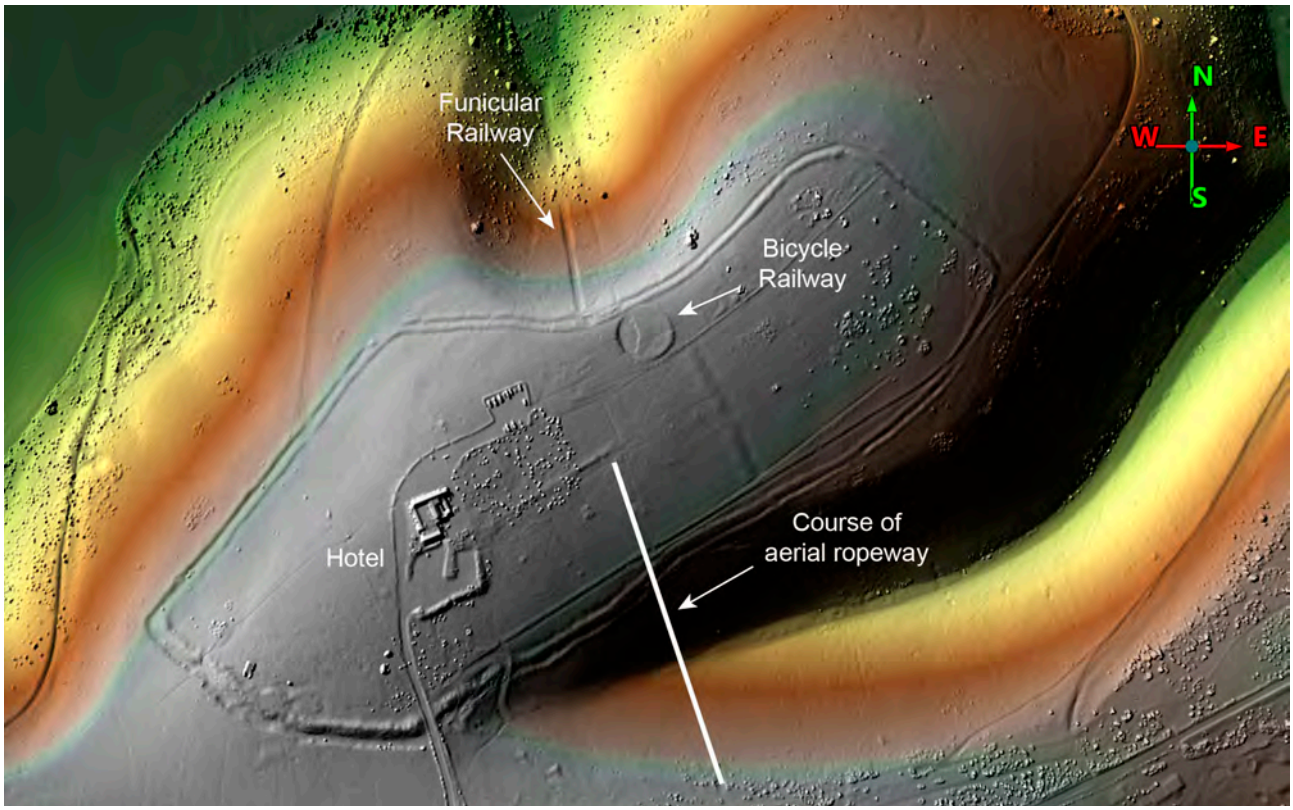

Figure 69: Lidar image of Devil's Dyke Hillfort showing slight earthwork traces of the Victorian playground. LIDAR DSM 17-JAN-2019 © Historic England; source Environment Agency.

Figure 70: View of Devil's Dyke hillfort from the north with the hotel and carpark within. The site of the station and part of the railway line can be seen in the far distance. The Golf Course occupies a large area to the south (top left). 24801_008 29-OCT-2007© Historic England Archive.

Golf courses

Golf took off as a popular sport of the rich and elite towards the end of the 19th century, fulfilling the growing passion for outdoor exercise

Initially a pastime of men, it rapidly became popular with women and the Sussex County Ladies Golf Association was formed at Lewes in 1900. There are several long-established golf courses around Brighton and, in common with horse racing, the free-draining character of chalk downland benefits golf courses, enabling play all year round.

The first three courses in the country were established in Sussex in 1887 at Royal Eastbourne, Brighton and Hove, and Seaford. From then on numbers rapidly multiplied, taking in areas of former farmland around the towns and then spreading into the Downs with up-market housing built around the courses.

Brighton and Hove Golf Club, a 9-hole course was founded in 1887 on the downs south of the Devil's Dyke Road. On the eastern side of Brighton, the East Brighton Golf Club was founded a few years later in 1893 to the south-east of the Brighton Racecourse.

The Devil's Dyke Golf Course was established in 1906 and is located on the south side of the Devil's Dyke valley and hillfort. The site benefited from the development of the area with a dedicated halt for the club established on the Devil's Dyke Railway.

Hollingbury course was opened in 1908, closer to the centre of Brighton. At the heart of the course is Hollingbury Castle. Shortly after this West Hove Club, an 18-hole course, was founded in 1910 immediately west of the smaller Brighton and Hove Golf Club. In contrast with other courses the Waterhall Golf Club located on the Downs north-west of the A27 was a municipal golf course owned by the Brighton and Hove Council. The course was administered by the Leisure Services Division but has now closed and is part of a rewilding initiative with the intention of restoring the chalk grassland (The Living Coast 2021, Brighton & Hove City Council 2022).

It is not entirely clear if play continued at all the golf courses in the area through the First and Second World Wars, but there is evidence that the army requisitioned the Devil's Dyke Golf Course for troop training during the Second World War when large tracts of the Downs around Brighton and Lewes were requisitioned for a military training area. The extensive scarring from the intensive troop activity is evident on wartime photography of the barely recognisable Devil's Dyke Golf Club (Fig. 71).

Figure 71: Two aerial views of Devil's Dyke Golf Club. Left image taken in May 1945 bearing the scars of military training activities from vehicle tracks, artillery scarring, entrenchment and barbed wire obstructions. Right image taken in April 2021. RAF/106G/LA313 3043 17-MAY-1945 Historic England Archive (RAF Photography), and Next Perspectives APGB Imagery TQ2509-TQ2711 22-APR-2021 © Bluesky International/Getmapping PLC.

Landscape of War

When Arthur Goodchild came to Shoreham in 1914 as part of the first influx of many thousands of troops who would be stationed there during the First World War, the downland was a place of tranquillity:

> There are market garden farms about here, and cows and sheep on the hills. There are no hedges about the hills, only a few wire fences. (goodchilds.org)

This peace was soon shattered by the trampling of thousands of men across the hills and the digging of large networks of practice trenches; the rest of the Downs remained largely untouched. The camps were removed following the war and the earthwork foundations, along with the trenches, were left as the open grassland returned to livestock grazing.

However, following the outbreak of the Second World War, large areas of the open grassland were claimed for arable agriculture, and by 1942 the military presence on the Downs led to roads being closed and farms evacuated, with the chalk upland becoming the training ground and staging post for the D-Day invasions in 1944. The Downs were slowly relinquished by the army before the end of the war as the threat of invasion lessened, but by 1947, with rationing ongoing, agricultural exploitation and intensive farming once again started, changing the nature of the Downs for good (Brandon 1999, 181-5).

The South Downs had a long relationship with the Army, both in and out of wartime. Recent studies using aerial resources on neighbouring downland and coastal areas revealed a complex and rich history of training soldiers and for defence. The High Woods from Above project mapped an array of military activity from the First World War onwards, including lumber camps, prisoner of war camps and airfields, including the iconic RAF Tangmere which played a pivotal role in the Battle of Britain (Carpenter et al. 2016). Mapping of the coastal area as part of the South East Rapid Coastal Zone Assessment Survey (Dickson et al., 2012) revealed vast defences stretching the entire length of the coastline south of the Downs. As one of the primary targets for invasion during the Second World War, the beaches were littered with anti-tank cubes, scaffolding and barbed wire. These were further enhanced by minefields, pillboxes, gun batteries, as well as larger infrastructure such as airfields and camps. Whilst the specialist study of Seaford Camp allows an insight to a site that mirrored the camp at Shoreham during the First World War (Skinner 2011).

Fencibles and volunteers

The relationship between the Downs and the Army pre-dates the 20th century. There were militia and volunteer units in existence from at least the 1790s in the bordering towns of Lewes and Brighton. Preston Barracks for example, just outside the project area, was in use from 1793 until around 2000. Early military training events were rarely documented,

unless in local newspapers, but there is little doubt that these units would have undertaken exercises on the open grassland. Newspaper articles throughout the latter half of the 19th century and the early 20th century refer to army manoeuvres across various parts of the South Downs – mostly between Brighton and Eastbourne. One of the largest exercises to take place was 'The Battle of Wolstonbury Hill' in March 1883. A combined force of artillery, infantry and yeomanry undertook a large-scale mock battle along the slopes of the hill, with 'the old British Trench serving as emplacements for the guns' (*The Sussex Express, Surrey Standard, Weald of Kent Mail Hants and County Advertiser* 27 Mar. 1883, 4).

Traces of the activities of the Rifle Volunteer Corps (the forerunners to the present Territorial Army) from the second half of the 19th century are seen at Mile Oak Rifle Range, nestled into the slopes of Whitelot Bottom below Thundersbarrow Hill. The range was opened in 1900 for the 1st Volunteer Battalion of the Sussex Regiment (formerly the 1st Sussex Rifle Volunteer Corps, based at Brighton), and was used by military volunteers and civilian shooting clubs (Middleton 2022). Vertical aerial photographs from the late 1940s show it was in use during the Second World War, as they record several range markers with recent disturbance. The target butts are now under scrub woodland, but the earthworks remain at least partly intact, visible on 2019 lidar. The range markers have been levelled – most of the firing range site being turned over to cereal crop cultivation.

Figure 72: Wolstonbury Hill rifle range was established during the latter half of the 19th century and saw continued use until and throughout the Second World War. Detail of RAF/106G/UK/559 RP 3066 29-JUL-1945 Historic England Archive (RAF Photography).

A similar rifle range was established in a depression on the east side of Wolstonbury Hill, with the target butt constructed into the hillside (Fig. 72). Marked up to 700 yards on the 1879 Ordnance Survey map, this range was probably established by a local Rifle Volunteer unit at some point after 1860. Aerial photographs show it was in use during the Second World War as the firing range appears to have been altered and adapted with numerous weapons pits as well as barbed wire obstructions. It seems unlikely the latter formed a point of defence being in a dip, so were most likely for training purposes or established to form a compound. The range was reputedly used by the Home Guard, with mortar practice taking place on the hill (Brown 2006). The range is depicted on current OS maps, though appears to have been disused for a number of decades.

Another rifle range was established in Sheepcote Valley, east of Whitehawk. This range was also illustrated on the 1874 Ordnance Survey map, in this instance labelled as 'Volunteer Rifle Ranges'. There were three butts and firing positions marked up to 800 yards. The range may have gone out of use at some point before 1911 and the site was soon afterwards used as a tip. The butts remained visible on historic aerial photographs but have since been levelled.

Lord Kitchener's Boys

Field Marshall Earl Herbert Kitchener was made the Secretary of State for War on 5 August 1914, one day into the war, and immediately announced his intention to expand the Army to 70 divisions. By the end of 1914, over one million volunteers had enlisted, becoming the 'New Army'. The 24th Division was formed in September at Shoreham, comprising battalions from eastern England (Middlebrook 2000, 39-41, 61).

At Slonk Hill, to the north of Shoreham-on-Sea, tented encampments of volunteer units were a common sight throughout the Edwardian period, often using the nearby firing range at Mile Oak for training. This military activity was intermittent but in a single day in September 1914, 'train after train' containing thousands of men pulled up into Shoreham Station, much to the shock of the local residents. The weather was atrocious so many local residents housed the soldiers overnight, and a vast tented encampment was established in Buckingam Park and Oxen Fields. Thousands more troops arrived over the following days and the construction of a hutted camp began in earnest on Slonk Hill (Cheale 1921, 259-60).

Arthur and Edmund (Ned) Goodchild, two brothers who served in the 9th Battalion, Suffolk Regiment stationed at Shoreham, frequently wrote home to their mother, offering an invaluable insight into the lives of the troops as the camp was being constructed. Much of the following paragraphs outlines their observations, and excerpts are quoted here with the kind permission of Henry Finch, author of the '*The Goodchilds of Grundisburgh: Four brothers in the First World War*' (goodchilds.org).

When the troops first arrived at Shoreham in September 1914 they encamped on Slonk Hill, but were then moved to Buckingham Park to allow the construction of the hutted camp to commence. Arthur (October 1914):

> The huts they are building for us will soon be ready. Some will be ready in a week but some won't be ready for a month. They have carted nearly all the timber. There were 9 or 10 traction engines going for nearly a fortnight, Sundays and all, so were the carpenters at work on Sunday, there are fifty or sixty horses still carting wood and about 300 men employed on the building. It's being done by a contractor from London.

The wet weather made for terrible living conditions. Rainwater would pour through the tents and the ground turned to slippery mud, so thick wooden boards were brought in to line the floors, but even these had to be lifted and aired due to mould. Many rumours circulated amongst the troops that they would be leaving Shoreham soon, or that they would soon be in the huts, whilst others stated that the newly constructed huts were already condemned. Whatever the truth, the construction of the camp dragged on – partly by the carpenters going on strike – but by the end of November many of the huts were up and the camp roads were being built, in some cases, as Ned states, by the troops themselves. Arthur (3rd December 1914):

> I am very pleased to say we are out of the rotten tents and into the huts, they are a lot better. There's plenty of room in them and they are dry and clean. They are 20 yards long and 7 yds wide. There is supposed to be 40 men in each but there are 36 in mine. We have 3 boards of two stands each so we are about 5 inches off the floor, and we are going to have straw mattresses and table in a day or two. We have got seats, we had to go and fetch them ourselves today and I expect we shall get the tables tomorrow … There is a stove in each hut, so we shall be warm when the weather gets colder, but we shan't want fires yet for the weather is not very cold at present.

However, by January Arthur had already been moved out of the huts as they required repairs and was billeted in Brighton.

> The reason why we are to be billeted is because the huts are draughty and the rain come in at the windows and under the doors. They are going to put match boarding inside our huts while we are away and finish them altogether so I expect we shall be out of them about a month.

However, even following the repairs, Ned commented that they remained the same and the Suffolks were eventually billeted throughout Brighton.

The locals of Shoreham noted that in those early days, there was a holiday-like air of enthusiasm amongst the young men. The Shoreham residents clearly developed a close

attachment to the young optimistic soldiers. After the Division left the camp for Aldershot en route to France in June 1915, their subsequent terrible fate at the Battle of Loos had a profound impact on local residents (Cheale 1921, 260-1).

The hutted encampment at Shoreham bordered the north side of the town, surrounding Buckingham Park to the west, north and east. It was constructed as a series of blocks which housed individual battalions, with some shared amenities. As the Goodchild brothers illustrated in their letters, it took some time for the camp to become functional, and even by the time both brothers had left, there were still clearly many issues and it must not have been terribly homely in the winter months. A wartime copy of a plan of the camp on Slonk Hill survives (Fig. 73). The plan was drawn in 1917 when the camp would have been at the height of activity. The accuracy of the layout has been confirmed by the earthwork remains still visible on the 1940s aerial photographs.

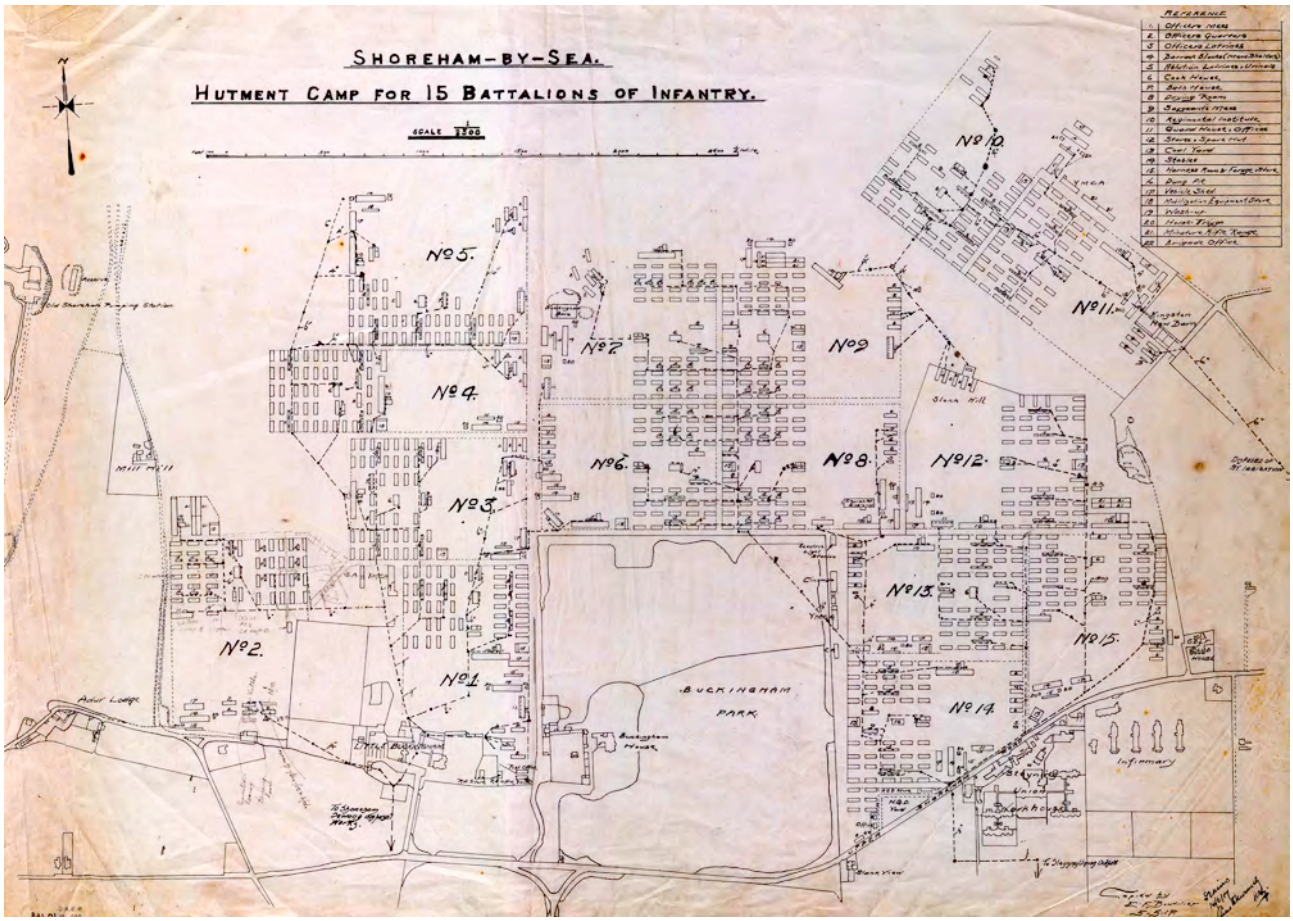

Figure 73: A copy of a plan of Shoreham Camp, dated May 1917. *WSRO ref Add Mss 10168*.

There was open chalk grassland to the north, where there were ‘no hedges about the hills, only a few wire fences’ as Arthur Goodchild wrote. The vast open spaces allowed for military manoeuvres and training exercises.

The Goodchild brothers make some mention of the training that took place at Shoreham in their letters home to their mother. Arthur, 3rd November 1914:

> This morning we had to jump over some poles laid 7 feet apart and we have to run and walk as quick as we can, walk on our toes and do all sorts of physical things.

These early days of training appear to have been relatively ad hoc. Ned referred to ‘running up and down them hills at Shoreham’. Mock attacks on other battalions occurred near Southwick and Portslade, presumably taking place in open countryside – there is no evidence for practice trenching in either of these areas.

Recent studies of the First World War camps on Cannock Chase in Staffordshire revealed the intensity of training that was taking place, largely undocumented but recorded on historic aerial photographs or still visible as extant earthworks (Carpenter et al. 2018). Similar evidence can be seen to the north of Shoreham on historic photographs. However, little survives as earthworks today as most of the grassland was turned over to intensive arable farming following the Second World War.

As was found at Cannock Chase, each camp block may have had its own area to construct training earthworks. This is illustrated by numerous practice trenches in and around the huts. These include an assault course west of camps 4 and 5, practice trenches between rows of huts in camp 7 and an elaborate network of trenches between camps 8 and 12, believed to have been constructed during the First World War, but probably reused and remodelled during Second World War.

The bulk of practice earthworks were, however, dug to the north of the camp. These comprised more assault courses and extensive practice trench networks. The most imposing was on the southern slope of Thundersbarrow Hill, where two opposing sides of trenches, including front line, support line and communication trenches, were constructed over a length of nearly 300m (Fig. 74).

Arthur Goodchild wrote on 13th November:

> We went trench digging last Wednesday and have been again this morning. It takes a long time to dig a trench here, for when we get down a foot we come to solid chalk, and we have to pick it up. We go about three miles inland to dig the trenches, and when we got there this morning it rained pouring.

They were again digging trenches on 27 November. Some of Arthur’s measurements of distances in his letters are changeable and his description of digging through chalk clearly denotes that they were on the Downs, so it is likely that the trenches he refers to were those at Thundersbarrow, some 1.3km to the north of the camp.

Figure 74: Practice trenches on Thundersbarrow Hill. Detail of RAF/3G/TUD/UK/157 V 5095 19-APR-1946 Historic England Archive (RAF Photography).

In the early stages of the war, shooting practice was undertaken either at Steyning or at Portslade (described in Arthur's letters as both two and nine miles away – but probably meaning Mile Oak, which was approximately 1.8km to the north-east). Eventually, four large firing ranges were established to the south and south-east of New Erringham Farm. The target butts were arrayed along the northern slopes of Slonk Hill and the longest in Mossy Bottom with visible firing lines laid out at 200 yards (183m), 300 yards (274m) and 600 yards (549m) to the south of the butts. The farm was presumably requisitioned due the proximity to the butts and live firing.

Over the following years, the camp would evolve and accommodate many thousands more troops from all over the United Kingdom and Commonwealth. Cheale noted particularly how the mood of the town changed gradually throughout the war, and the stark difference between the visit of King George V in 1916 and again in March 1918 when the war was very close to being lost (Cheale 1921, 262). As early as January 1915, many wounded began turning up in the neighbouring towns and the seriousness of the war began to take hold.

Shoreham camp was demolished immediately after the First World War, but as the Downs largely remained open grassland, the earthworks of the building footings, practice trenches, assault courses and firing ranges were left. And by the 1940s, when the first widespread aerial photographic coverage was taken, many of these earthworks remained intact (Fig. 75). Urban creep had levelled some of the southern camp areas, but much of the camp layout is clearly visible on vertical aerial photographs. Many of the training earthworks were reinstated during the Second World War, including trenches and the firing ranges, for both training and defensive purposes.

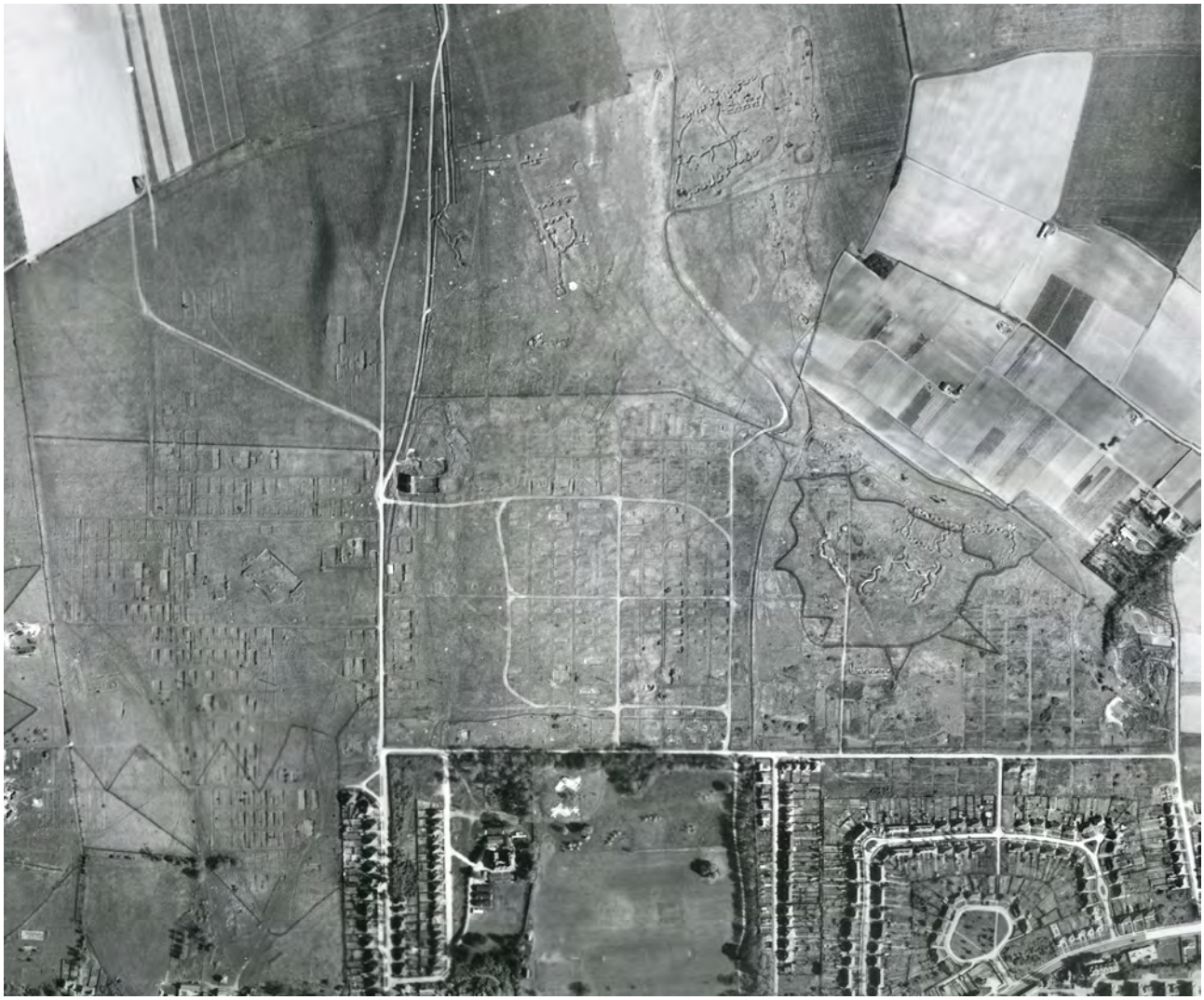

Figure 75: The remains of the First World War training camp at Shoreham remained visible as earthworks in the 1940s. The area was turned into a defensive strong-point during the Second World War. RAF/3G/TUD/UK/157 V 5071 19-APR-1946 Historic England Archive (RAF Photography).

Within a decade or two of the end of the Second World War, these earthworks were almost entirely levelled, either through urban development encroaching from the south or by the grassland being turned over to arable use. The only traces that remain are the extremely shallow and amorphous undulations where the trenches and firing range butts once stood, most visible on lidar. A careful eye might also be able to trace the outlines of a handful of hut footings in the field between the A27 and the Happy Valley Equestrian Centre – all that appears to remain of a camp that was designed to hold over 15,000 soldiers.

Weapons testing

As the First World War progressed, technology advanced considerably. The evolution of artillery and aerial bombs meant that testing facilities were required up and down the country – in marginal land away from populated areas. Devil's Dyke was chosen for such a purpose in 1918, when the Brighton Bomb Testing Station was established. Construction began in June 1918, but it wasn't completed until three days before the armistice.

The testing site worked on the basis of two rail/trolley tracks on the high ground either side of the Devil's Dyke ravine, between which a ropeway would have extended (Fig. 76). The bombs were suspended from this rope and released into the valley below. Martin Snow, who published his findings in the Sussex Industrial Archaeology Society Newsletter (2010, 12-15), successfully located the lines of the trolley tracks on historic aerial photographs.

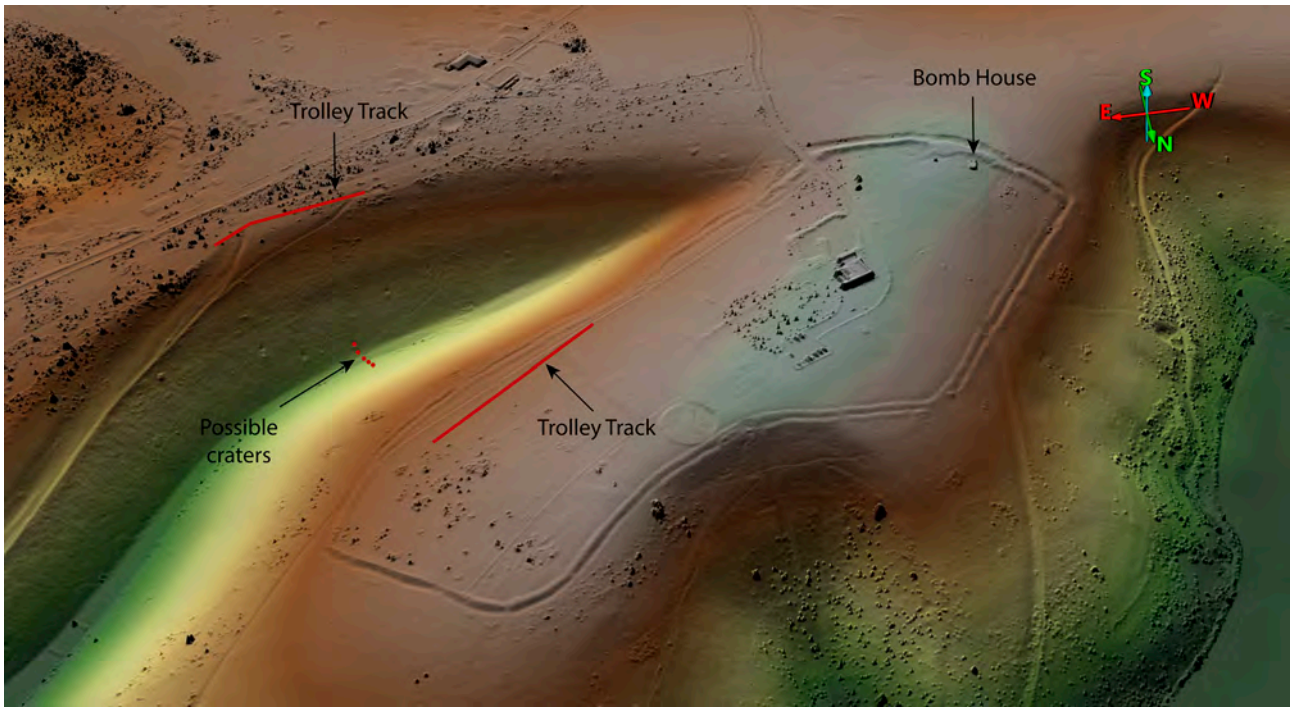

Figure 76: The location of the rail trolley tracks which suspended a rope over Devil's Dyke in order to test bombs in 1918. LIDAR DSM 17-JAN-2019 © Historic England; source Environment Agency.

The track beds are visible as shallow earthwork ditches today, most easily seen on the lidar. They are approximately 150m in length. The track on the north side of the ravine sits within the hillfort, extending south-west to north-east. That on the south side extends west to east, but then kinks to the north-east for the final 50m. There is a platform at the west end of this track that may have been the site of a building or might have been the observation dugout. Both tracks are at approximately 190m above sea level at their western ends and 186m at the east end.

At the western end of the plateau, some 430m west of the north track bed, is a ruined building termed the ‘bomb house’ (Snow 2010, 13; Fig. 77). The exact function of this building remains a mystery, but it was almost certainly constructed as part of the testing facility. The building has no roof and has been largely infilled, possibly during the Second World War.

Figure 77: The ‘Bomb House’ was constructed on the plateau, inside the hillfort. The exact function is uncertain, though it was likely a part of the bomb testing facility. September 2022 © Historic England.

Although the documentary evidence does not state whether the site ever became operational, a line of five circular hollows at the base of the ravine, directly between the two trolley tracks, suggests that some limited testing did take place. Based on the line of the craters, the projected line of the ropeway would have been at 189m Above Ordnance Datum on the south side of the ravine and 186m on the north – suggesting that gravity would have carried the bombs from south to north. There would have been a drop of over 70m (not including the sag from the weight of the bomb on the ropeway).

Defended localities

After the First World War, the South Downs largely returned to grassland. When the Second World War began in 1939, large areas of the open chalk downland were turned over to arable farming, but very soon afterwards were requisitioned by the military. After which much of the downland became the focus of intense military training and defence, and large areas were closed off to the public. Aerial photographs taken from the mid to late 1940s provide an important contemporary snapshot of the wartime landscape.

The threat of invasion in 1940 was high as 'Operation Sea Lion' – the German codename for the invasion plan of Britain – identified Brighton and the neighbouring coastline as potential landing areas. The proximity of this coastline to the chalk downs meant that the rolling hills would be the first natural obstacles to be encountered following a successful landing. The high ground gave the defender the advantage of excellent views over the Downs to the south and the Weald to the north. Several defended localities were established on the Downs, mostly concentrated on the highest ground along the northern ridge line including those at Devil's Dyke, Truleigh Hill, Ditchling Beacon and Mount Harry (Fig. 78).

The hillfort at Devil's Dyke formed a focal point for the defences. A series of large barbed wire enclosures stretched across the western half of the prehistoric earthworks, no doubt intending to use the ramparts to aid in the defence, and then extended to the south and south-east over the golf course. It was probably at this point that the 'bomb house', which is thought to be part of the First World War bomb testing facility (*see* Fig. 77), was partly infilled to allow it to be used a firing position – the top of the walls being at standing height on the inside.

Ditchling Beacon had a series of dispersed barbed wire enclosures with several gun emplacements and weapons pits. There is a dense concentration of weapons pits at Mount Harry, but no evidence for barbed wire on the available aerial photographs. As with other sites, the aerial photographs provide a snapshot of these sites at intervals before and immediately after the war. Therefore it is possible that elements of some sites were removed or altered earlier in the war, before the aerial photographs were taken.

A large installation was established to the north of Pyecombe, stretching along the southern slope of Wolstonbury Hill and straddling the main north road from Brighton (the current A273) and the Clayton railway tunnel at Pyecombe (Fig. 79). This also comprised large enclosures of barbed wire and the defended locality covered an area measuring nearly 42ha. It included several well-constructed gun emplacements for anti-tank guns or heavier artillery, numerous weapons pits and trenches, and a possible pillbox. The site had a small camp hidden in woodland, perhaps indicating it was permanently manned. The barbed wire was removed shortly after the war, and the earthworks were gradually ploughed level. The earthwork platforms of some of the camp buildings remain in woodland and were identified on lidar.

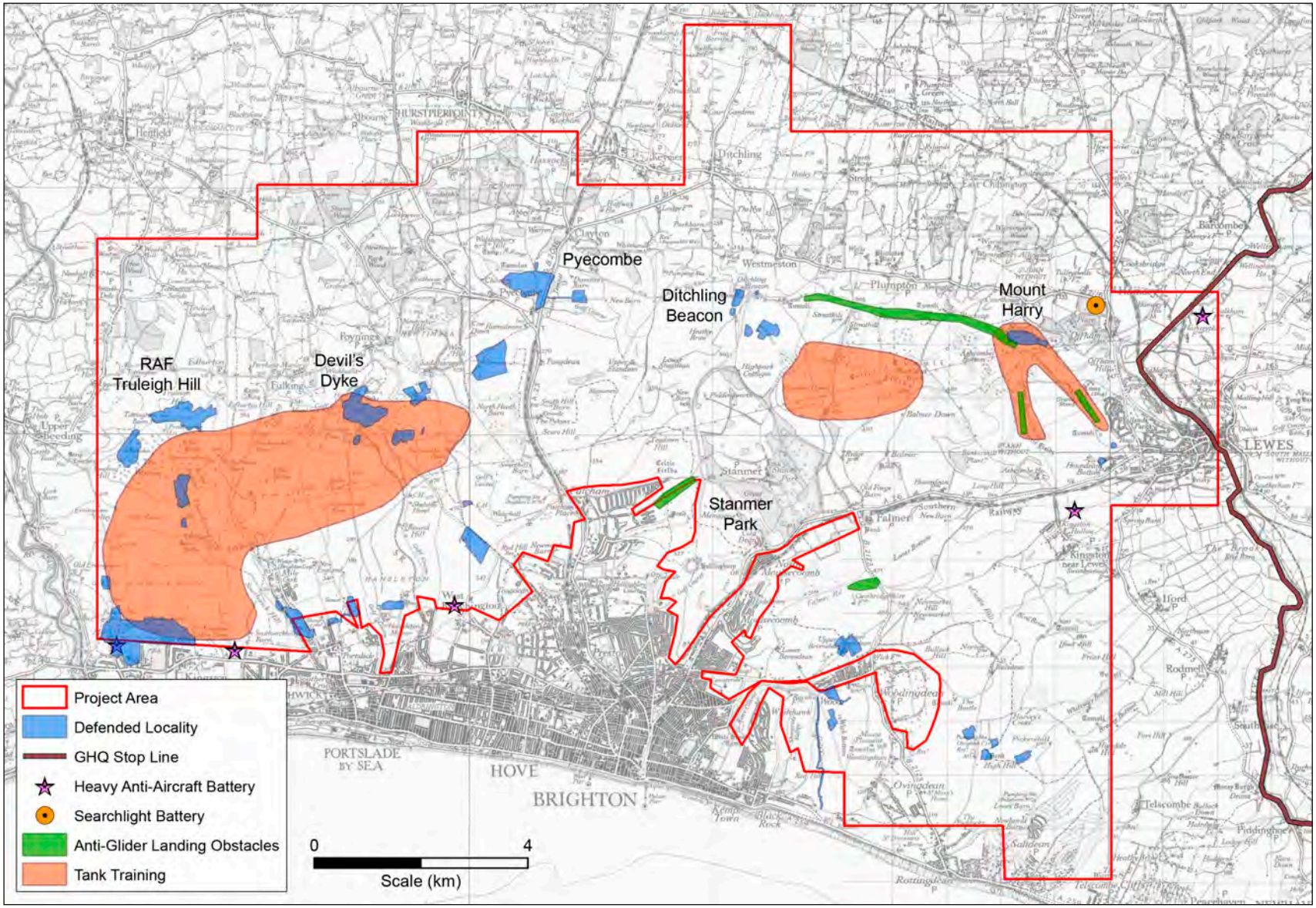

Figure 78: Locations of the primary defences and other military activity visible on aerial photographs during the Second World War. The base map is the one inch to one mile scale Ordnance Survey map, revised in 1939-1940. Map reproduced with the permission of the National Library of Scotland.

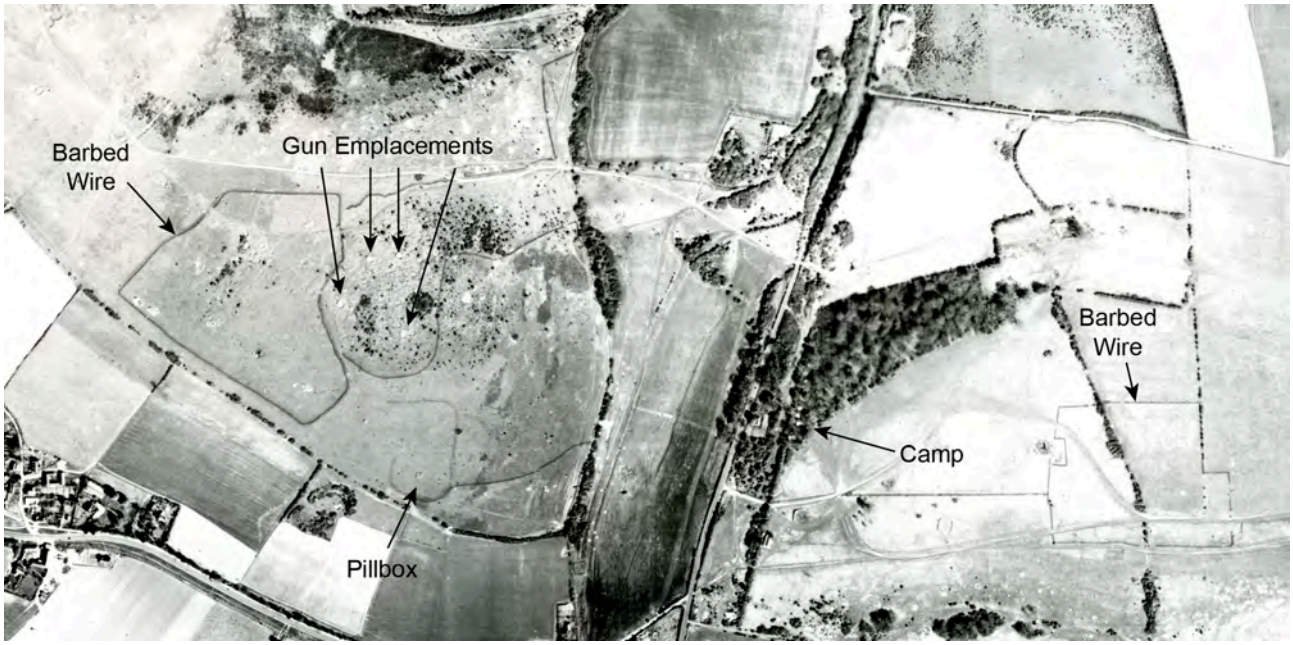

Figure 79: The cutting for the road and railway at Pyecombe was one of the most heavily defended points on this part of the South Downs. RAF/3G/TUD/UK/157 V 5206-7 19-APR-1946 Historic England Archive (RAF Photography).

Truleigh Hill was the most heavily defended point in this central area of the Downs because it was the location of a Chain Home Low Radar Station. It became operational in July 1940 and was one of a series of radar stations capable of detecting low-flying aircraft. The site was expanded and developed throughout the war and remained in use until 1958 and was demolished in 1965 (Taylor 2020, 4, 77).

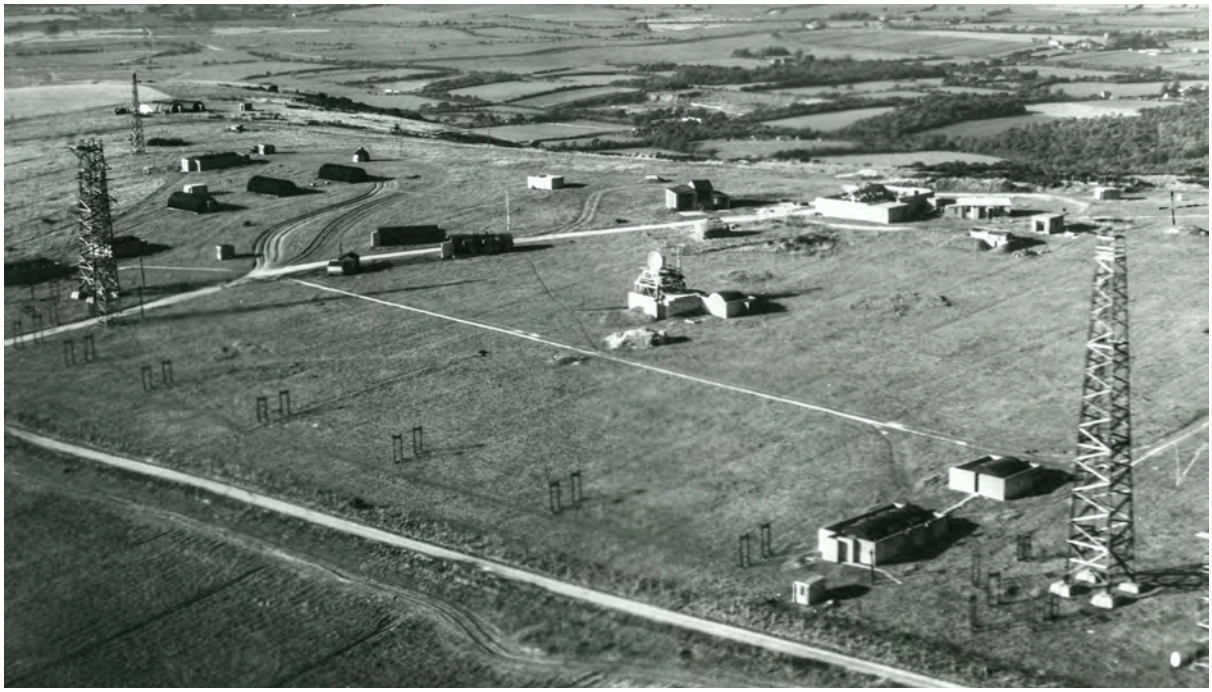

Figure 80: RAF Truleigh Hill was established as a Chain Home Low radar station at the beginning of the Second World War. It remained in use in the Cold War. RAF 30087/PO-0026 31-OCT-1949 Historic England Archive (RAF Photography).

1940s RAF vertical aerial photographs show the defended area at Truleigh at its maximum extent. The complex of transmitter towers, receiver block, accommodation huts were within a barbed wire compound. This was surrounded by at least six pillboxes, each within their own barbed wire enclosure. There were gun emplacements to the north-east, north-west and south-east, either for anti-aircraft guns or heavy artillery. Additional barbed wire defences stretched to the east and west, and numerous weapons pits, trenches and a possible further pillbox were located in and around these (Fig. 81).

Figure 81: RAF Truleigh was defended by a network of barbed wire, pillboxes and gun emplacements. Archaeological mapping © Historic England; Aerial Photograph TQ2210 22-APR-2021 © Bluesky International/Getmapping PLC.

Truleigh Hill remained in use following the war, this time to counter the Soviet threat during the Cold War. By the 1950s most of the peripheral defences had disappeared and the defences were largely replaced by normal wire fences – only the Type 51 radar being surrounded by a dense barbed wire perimeter (Fig. 82). As a result of constant remodelling and the closure of the site in 1958, only a pillbox and a transmitter block blast wall remain extant from the original wartime layout. There is also a blast wall on the site of the standby set house, but the footprint appears to be slightly different to that visible on 1940s aerial photographs, so is presumed to belong to the post-war configuration.

Figure 82: RAF Truleigh Hill as it appeared in 1955. The wartime defensive perimeter had been removed, as were numerous ancillary structures. RAF/82/1121 F22 136 21-MAR-1955 Historic England Archive (RAF Photography).

The aerial photographs used in the project showed additional smaller defended locations across the downland which were previously unrecorded in the historic environment record. These mainly comprised intermittent lengths and enclosures of barbed wire with weapons pits. It is likely that the fragmentary nature of most of these barbed wire defences, excluding Pyecombe and Truleigh Hill, indicates that they were abandoned, and in some cases possibly partly removed when the threat of invasion lessened earlier in the war, before the source aerial photographs were taken. These points of defence were mostly located along arterial roads and trackways leading north across the Downs, at Beeding Hill, Saddlescombe, Thundersbarrow Hill, Mill Hill, Portslade and Hangleton, Pond Brow, Westdene, Woodingdean, Casterbridge Farm, Court Farm House, Upper Bevendean and Baisdean. An extensive length of barbed wire extended over 2km along the east side of the Sheepcote Valley to the east of Brighton. This was probably intended as a lesser stop line.

Part of the First World War training area on Slonk Hill was reused during the Second World War. A network of barbed wire enclosures stretched from the east bank of the River Adur

to Slonk Hill Farm, extending along field boundaries and along the backs of domestic gardens. The focal point appears to have been immediately west of the farm, where complex rows of barbed wire encircled the remains of the Shoreham Camp First World War practice trenches. These trenches were possibly re-dug and remodelled, no doubt intended as a strong point or redoubt in the event of invasion.

On the eastern edge of the Downs, the River Ouse formed part of the GHQ (General Headquarters) Stop Line from Newhaven to Penshurst. Established in 1940, this line of heavy defences was designed to slow down enemy movements inland and towards London. Only a tiny fragment of this stop line falls within the project area, in and around Lewes, which was a key road and rail crossing point of the river (Butler 2007, 121-2). The main defence was a string of pillboxes along the west bank of the river and part of the Keymer and Lewes Branch Railway. There was a concentration at Hamsey and a pillbox and gun emplacement near the junction of Brighton Road and Spital Road. A series of anti-tank blocks were erected near the west corner of where the Tesco superstore is now. These were intended to hamper tanks getting to the (now removed) Lewes to Uckfield railway line to cross the river. There was an additional gun emplacement surrounded by barbed wire on the south-east corner of the racecourse, as well as numerous anti-aircraft obstructions alongside the east gallops. Only some of the defences, both military and civil, are recorded on aerial photographs, and many more were noted by Butler (ibid., 122-4) but they do provide an important record of the layout at certain points in time.

There was a Heavy Anti-Aircraft battery on the east bank of the river, opposite Hamsey, another at Kingston Hollow and a searchlight battery north of Offham. These were probably in operation throughout the war for the defence of Lewes and neighbouring towns.

Extensive anti-aircraft obstructions were constructed along the northern ridgeline of the Downs to the east of Ditchling Beacon for a distance of over 3.5km. Together with the defended localities, these formed a perimeter defence network around Brighton, Hove and Shoreham-by-Sea. Additional anti-aircraft obstructions were constructed at Patcham and Falmer Hill.

Further defences, both civil and military, were scattered throughout the project area, but as the project area focussed on the chalk downland, the denser concentrations that clustered in and around the urban areas largely fell outside of it. Sites of interest that were noted include heavy anti-aircraft batteries at Mill Hill, east of Slonk Hill Farm and at West Blatchington (now the junction of Beeding Avenue and Steyning Avenue).

Training on the Downs

The effects of intensive military training are recorded on aerial photographs across the Downs. The range of features identifiable, such as isolated weapons pits, trenches, firing ranges or mass vehicle movement, show that 1940s aerial photographs provide a unique record of these ephemeral events.

Some of the most intensive training was not mapped in detail because it covered vast areas of the open grassland and comprised numerous overlapping armoured vehicle tracks and thousands of weapons pits and shell craters. The main focus of this activity seemed to be south and south-west of Devil's Dyke and to the west of the project area, projecting east from Erringham Farm, across Mossy Bottom and Thundersbarrow Hill. Many of these short-lived ground disturbances show up as moderately fresh on late war photography and probably relate to extensive manoeuvres on the build-up to D-Day in June 1944.

Evidence of live firing was seen at Erringham Farm which was surrounded by numerous weapons pits and seems to have been used as a practice target for both rifle and mortar fire. The farmhouse is in ruins on photography taken in the late 1940s and was presumably one of the many homes requisitioned by the military during the war. Balmer Farm suffered a similar fate (*see* Fig. 26).

Armoured vehicles based in Stanmer Park conducted extensive training indicated by vehicle tracks and shell holes to the south of Devil's Dyke, across the golf course, Ewe Bottom and Pond Brow (Fig. 83). They used a turning point to the south of Saddlescombe where they appear to have fired at a series of targets set into the west slope of Varncombe Hill. The turning circle became so incised that it remained visible as a cropmark on 1970s vertical photographs. The pockmarked ground around the golf course appears to be an accumulation of shell holes from live-firing, as well as weapons pits and remnants of gun emplacements from several defended localities that spread across this area.

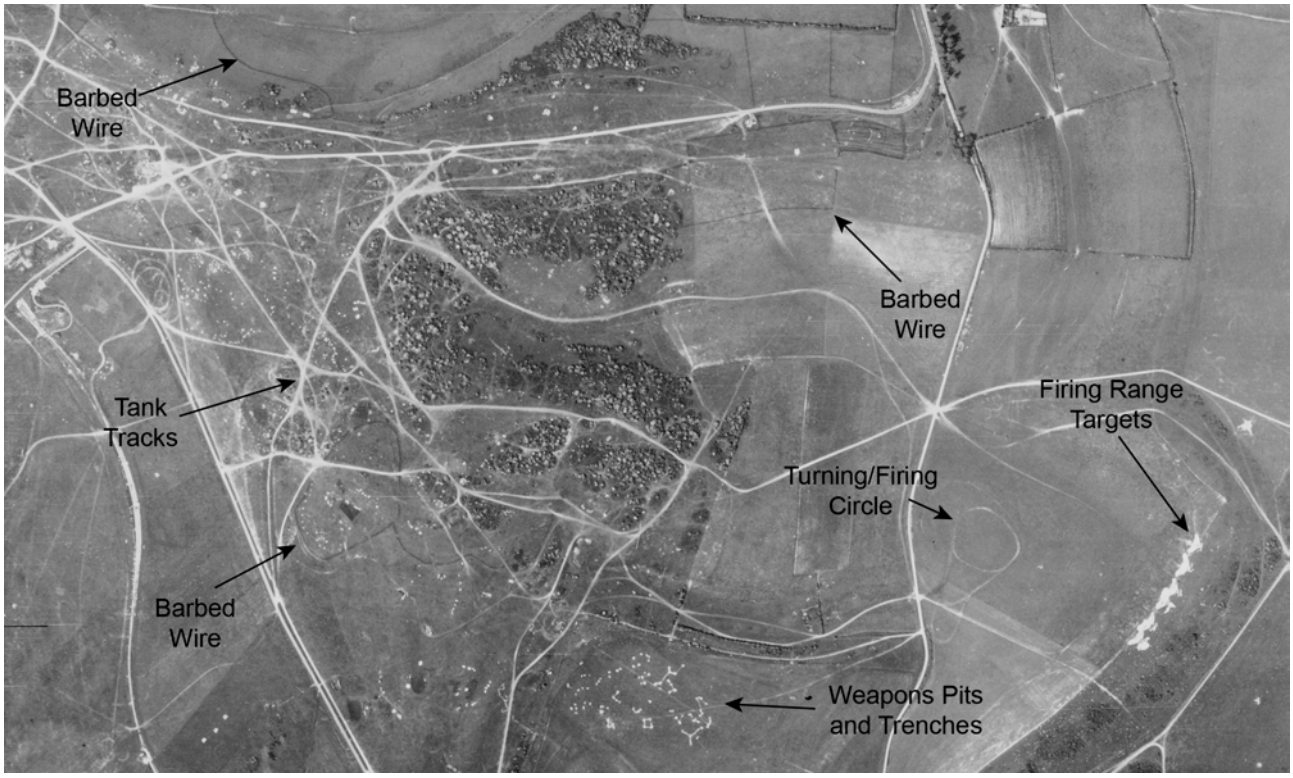

Figure 83: Extensive armoured vehicle and infantry training to the south of Devil's Dyke. Note how the defensive barbed wire from early-war defended localities has been largely abandoned. RAF/106G/LA/313 RS 3042 17-MAY-1945 Historic England Archive (RAF Photography).

The Chattri Indian War Memorial on Holt Hill is thought to have been damaged during the Second World War. The memorial was erected in 1921 in honour of Indian soldiers who died of wounds whilst hospitalised in Brighton during the First World War and were cremated on the hills near the site of the memorial. Both Arthur and Ned Goodchild (*see* Lord Kitchener's Boys chapter above) made reference to the large number of wounded Indian soldiers in early 1915 who were billeted or hospitalised in Brighton. Ned remarked that 'they carry all the dead onto the hills to be burnt as it is their religion'.

Despite being out-of-bounds to training, the memorial was badly damaged by weapons fire during the Second World War and allied troops were blamed. However, Peter Hibbs (2023) makes a sound argument that the damage might have been inflicted by an enemy aircraft, due to the angle at which some of the shots must have been fired and the potential high velocity of some of the rounds. The damage to the south side of the monument was most extensive, though some was received to the north-west also. Although by no means conclusive, it is worth noting that several weapons pits are visible on aerial photographs taken in 1945 (since levelled) on the slopes of Poor Brow – the hill opposite the memorial to the south-east. Additionally, a weapons pit is also sited immediately north-west of the monument. Both would have allowed an open field of fire towards the monument, and could potentially explain the damage inflicted (Fig. 84).

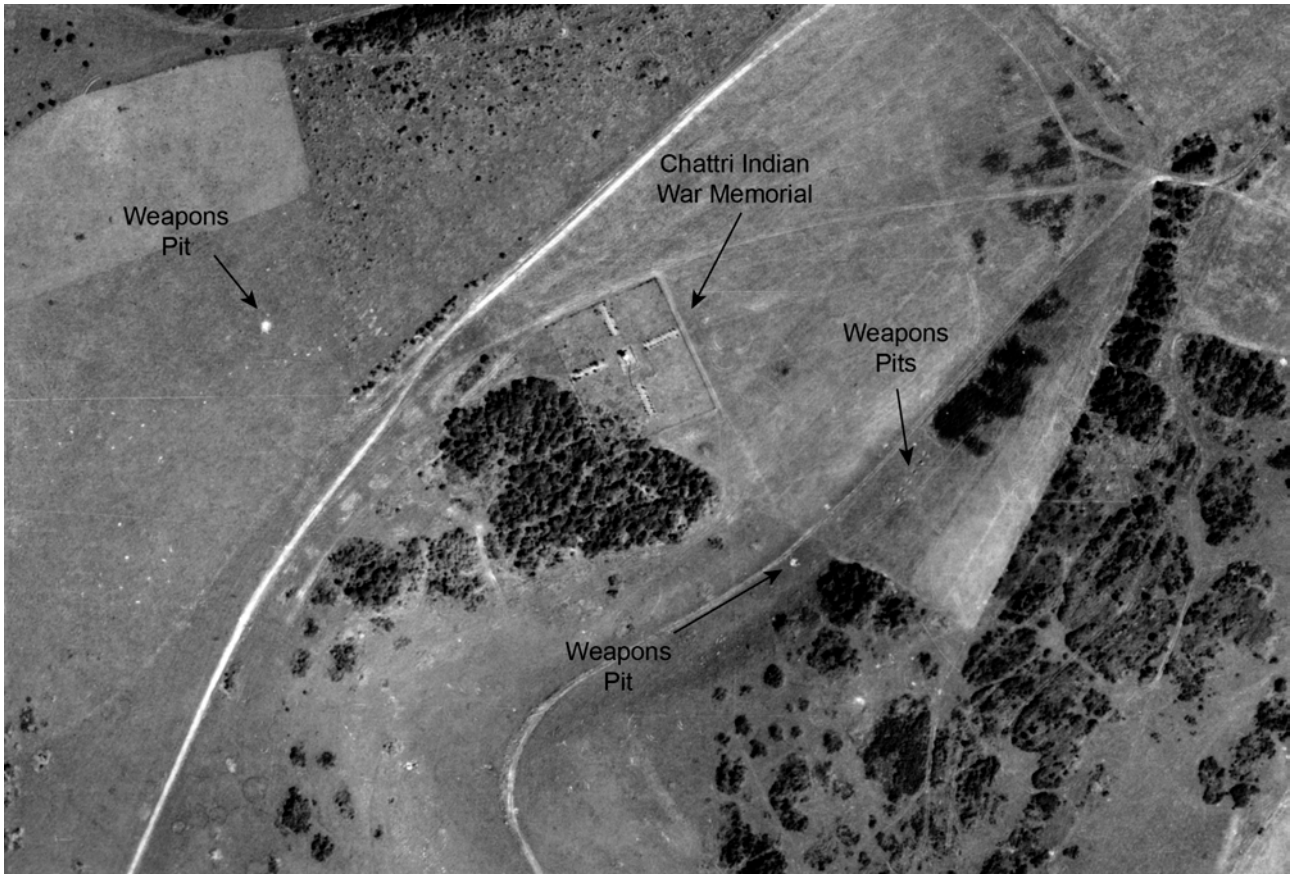

Figure 84: Second World War training weapons pits in relation to the Chattri Indian War Memorial. Detail of RAF/106G/UK/559 RP 3003 29-JUL-1945 Historic England Archive (RAF Photography).

The civil impact

When the Army took over, public access to large parts of the Downs was prohibited, but the impacts of the war on the civilian population were far more wide ranging. The proximity of the south coast to occupied France meant that it was vulnerable from invasion or as a nearby target for bombing. There was need for civil defence and those visible on aerial photographs include air raid shelters and emergency water supplies. Late war and post-war photography often capture these ephemeral features before they were demolished. Most of the built-up areas of Brighton, Hove and Shoreham-by-Sea lay outside the current project area and few defences were noted on the peripheral edges as the land rose on to the Downs – as the emphasis in the unpopulated areas was on military defence.

Lewes was never a major target for the Luftwaffe, with no industries of note, but it did have civil defences recorded on aerial photographs. Several earthwork air raid shelters were located on the western edge of the town and on the sports ground to the west of the centre. Emergency water tanks for firefighting were dotted around the town.

Figure 85: Bomb damage in the centre of Lewes (highlighted in red). Note the anti-tank blocks to prevent the enemy from crossing the river via the railway bridge. The main road bridge across the river (bottom right) was wired with explosives. Detail of RAF/106G/UK/538 RP 3120 24-JUL-1945 Historic England Archive (RAF Photography).

The railway in Lewes was targeted by German bombers on a number of occasions and evidence from aerial photographs shows that a number of houses along St. John Street, Lancaster Street, North Street and West Street were destroyed or had to be demolished as a result of bomb damage (Fig. 85). Local newspapers of the time did not disclose where bomb damage was sustained, but the Sussex Express regularly reported on bombs being dropped in the area, any civilian casualties, as well as Air Raid Patrol meetings and training for tackling incendiary bombs. There was even a call for the people of Lewes to 'go about your normal occupations' due to the lack of people attending church due to fear of air raids (*Sussex Express & County Herald* 26 July 1940, 1).

As people became displaced from their bomb-damaged properties there was an urgent national need for housing. One solution was rapid construction of prefabricated homes – commonly known as 'prefabs' – constructed under the auspices of the 1944 Temporary Housing Act (Blanchet and Zhuravlyova 2018, 30). Starting in the latter phases of the war and continuing into peacetime, prefabs sprang up across urban areas. The Bevendean estate, on the outskirts of Brighton, was typical (Fig. 86). The houses were erected alongside pre-existing roads that were laid out for housing estates that were paused when war broke out. The regular rows of newly-constructed housing stretched along Heath Hill Avenue. Additional temporary housing was also identified from aerial photographs in Whitehawk and in Lewes – along Winterbourne Lane, Churchill Road and Crisp Road.

Figure 86: Prefabricated housing was constructed in Bevendean at the end of the war. They remained inhabited for over a decade. Detail of RAF/CPE/UK/1768 RP 4228 07-OCT-1946 Historic England Archive (RAF Photography).

The legacy

The aftermath of the war would leave the chalk downland forever changed. The scars of tank tracks and weapons pits would mostly fade in time, but the change from pasture to arable cultivation in many parts of the Downs was permanent. The northern ridgeline was the only area that remained largely untouched by intensive arable farming in the post war period and it is here that we see some of the most extensive earthwork remains, from the later prehistoric to the Second World War.

Prefabricated houses were gradually demolished and replaced with permanent housing, concrete pillboxes, water tanks and other infrastructure were removed, and barbed wire entanglements were uprooted. Even the remains of the First World War camp at Shoreham and the practice trenches were eventually put under the plough (Fig. 87).

The effect was such, that only a small proportion of the remains survive from either war despite the many thousands of soldiers who trampled over the hills; the tanks that cut deep ruts into the chalk; the tall butts used for live firing exercises. However, a keen eye might spy a shallow weapons pit dug into the ramparts of Devils Dyke, or a rectangular platform that once housed a Nissan hut in woodland.

Figure 87: As the grassland to the north of Shoreham-by-Sea gradually gave way to arable farming, the earthwork remains of the First World War training camp were levelled. RAF/541/535 RP 3029 30-MAY-1950 Historic England Archive (RAF Photography).

The South Downs and Further Work

The Downs from Above project identified a range of archaeological sites dating from the Neolithic to the Second World War. Earthwork preservation is in places good, but some sites no longer exist above ground or have been much reduced. The Downs from Above mapping collates information on all these sites, whether they are exceptional or ordinary, in good or in poor condition, and helps to demonstrate how they all contribute to the character of the South Downs.

The archaeological sites across the South Downs help link local communities with past people or events. They can further enhance people's attachment to the South Downs and their satisfaction from being associated with this special and historic landscape. This can help create a sense of place that provides meaning for those who draw part of their identity from it or have emotional links to this area.

The suggestions for further work below will enable local volunteers to engage with the archaeology of the South Downs in a variety of ways and further our understanding of this landscape. The historic environment can also play an important role in a person's health and wellbeing, whether by visiting a site or becoming more involved with heritage through volunteering (Reilly, Nolan, and Monckton n.d.). Many of the features identified during this project offer the opportunity for documentary research to be carried out. This provides another way that local volunteers can engage with the archaeology of their area and is also an opportunity for those who are unable to take part in fieldwork to be involved with the project.

Other suggestions for further work could involve fieldwork and offers volunteers the opportunity to explore and investigate the South Downs and its archaeology. Some of the archaeological sites on the South Downs also relate to the natural environment and the post medieval dewponds are a good example of this. Edward Martin's early 20th-century dewpond research included some observations on the wildlife associated with some of the ponds and he noted the presence of newts, freshwater snails and dragonflies (Martin 1915, 203, 205). The condition and environmental health of dewponds could form another strand of future fieldwork based on the Downs from Above mapping. Some of these ponds, although dry, may be candidates for restoration, others no longer exist and some, while indexed as earthworks survive only as slight depressions. More details on the state of preservation are recorded in the data attached to the mapped features and the project GIS could serve as a basic habitat opportunity map to support future work on the dewponds.

Fields and settlement

Several settlement sites were identified across the South Downs. Most of these are thought to be Iron Age or Roman in date and further work could explore the relationship between these settlements and the surrounding field systems. They can be related to the previously identified settlement sites and provide a more accurate picture of the settlement patten across the Downs. The identification of buried remains from cropmarks also provides targets for any future fieldwork.

As well as the relationship between settlements and their fields, the mapping allows the relationship between features from different periods to be studied. Further work could address the question of how do the Middle Bronze Age, Iron Age and Roman fields relate to earlier features in the landscape such as Neolithic and Early Bronze Age barrows and Late bronze Age/Early Iron Age cross dykes. Earlier features can be avoided, ignored, or incorporated into later works. In the same way, have these ancient fields influenced later boundaries or other features in the landscape?

There are apparent gaps in the later prehistoric and Roman field systems and some of these may be the result of later ploughing. A better understanding of the areas of medieval and post medieval ploughing through documentary and map research may help explain some of these gaps in the distribution of ancient fields.

Dewponds and livestock enclosures

Although many dewponds survive as earthworks and are recorded as such by this project, the degree of earthwork survival varies. While some ponds are in use, others have almost completely been levelled and only survive as a slight depression in arable or pasture. There is scope for field visits to any ponds accessible to the public to allow more detailed recording to take place. Observations could include condition, whether the pond holds any water, any evidence of materials used – concrete being an obvious example.

The project was based on aerial evidence, so any ponds levelled or built over before the earliest aerial photographs (taken in the 1940s) were not included in the mapping. Further work could include a review of the 19th-century OS maps covering the areas that had been built over by the 1940s as Brighton and Hove expanded. Edward Martin's pioneering study of dewponds includes an Appendix of Sussex ponds where he recorded location, shape, size, amount of water, number of weeds etc. (Martin 1915, 202-206). His observations could be compared with the present state of any surviving ponds. A more detailed documentary study in relation to land use and land ownership may also help in better understanding the age and distribution of these ponds.

The 19th-century field barns associated with the dewponds are a further area of research although they were outside the scope of the aerial mapping. South Downs farmsteads are the subject of a Farmstead and Landscape Statement (Lake 2020) but there may still be scope for further work looking at farm buildings, enclosures and ponds on the Downs which would meet one of the objectives of the South East Research agenda (Barber 2019, 53).

Funerary monuments

There has been surprisingly little recent study undertaken of the funerary monuments on the Downs. Although Grinsell's work in the 1930s was exceptional for its time, and there have been numerous excavations over the decades, these studies did not utilise the suite of modern analytical techniques that are now available.

Most of the best surviving monuments are protected through scheduling. However, in numerous instances, additional detail and further barrows have been noted outside the scheduled areas. In some cases, it may be appropriate to consider whether monuments would meet the criteria for an amendment of the designation.

Other barrows are so plough-levelled there may be damage to the subsurface deposits. The newly discovered possible barrow cemetery at Devil's Dyke however might allow a unique opportunity to study an earthwork barrow grouping in more detail. Primarily, geophysical survey could be employed to try and ascertain the full extent of the site, as well as detailed terrain modelling using drone-mounted lidar or Structure from Motion. This site would provide a superb example for volunteer training, engaging the use of multiple forms of archaeological practice. This research could help inform future management of the site.

Kingston barrows, an early medieval barrow cemetery, is scheduled and those earthworks that survive the best are in an area of arable reversion. However, lidar clearly depicts many more undulations, albeit much denuded, outside the scheduled area to the south, east and north-east (*see* Fig. 13). This site would benefit from further investigation, perhaps geophysical survey, to establish whether these additional earthworks might relate to the cemetery, or whether they relate to either periglacial processes or flint mining.

Wartime memories

The diaries of Ned and Arthur Goodchild allow an invaluable insight into their experiences at Shoreham during the First World War. These were just two of the many thousands who passed through the towns and camp. Further documentary research into personal memoires, battalion diaries and letters of both British and Commonwealth troops could help build a clearer picture of the diversity of the personnel and the training that took place on the Downs during the war. This would help understand who dug the practice trenches, what they were used for, and the personal stories of those soldiers after they were deployed on active service. Research could also help understand the effect of the military presence on the civilian population who billeted, fed and befriended many a Tommy.

The passing in recent years of the last surviving individuals who trained and fought in the First World War has shown the value of timely recording of spoken memories. The Second World War had an enormous impact on the South Downs, through military and farming activity. The result played a significant role in developing the character of the Downs into what we see today. Volunteer groups local to the area are perfectly located and acquainted with people of the Second World War generation to carry out a study of such memories for posterity.

A possible Roman road off the Greensand Way

The slight earthwork traces of a straight linear ditch flanked by a bank (on its eastern side) has been identified on lidar images extending north-east for over 850m north-east from Beechwood House at TQ 3904 1453 to remains of the agger of the Roman road known as the Greensand Way at TQ 3954 1522, 180m west of the modern A275 (Fig. 52). Where Allington Lane curves gently to the west and south, this feature appears to take a more direct course, meeting at Chapel Farm and passing beneath the railway line. Beyond the railway line the ditch and its flanking bank (now on the west of the ditch) can be traced for a further 150m to Beechwood House. Allington Lane continues SSW on a slightly sinuous course to Allington Farm where it assumes a straighter course to the foot of the Downs. The linear feature is on the same alignment and if extended would meet the course of Allington Lane as it passes Allington Farm. This may represent the remains of a possible spur of Roman road forming a junction with the Greensand Way – Margary No. 140 and extending onto the Downs. This site would benefit from further investigation to ascertain whether it is in fact the remains of a road of Roman or later date, and if so, can it be dated and traced any further between Beechwood House and Allington Farm through targeted geophysical survey and excavation. Further work could explore and expand our knowledge of these historic connections on the Downs and improve our understanding of the relationship between these routes and settlements and their influence on the present-day routeways.

Archaeology beneath Brighton and Hove

The Downs from Above project area excluded the built-up area that now makes up the City of Brighton and Hove as well as towns such as Woodingdean, and Rottingdean. However, archaeological finds from the city help to understand the archaeology of this now urban area and show the potential for further discoveries to be made.

Some of the open areas of downland shown in the 1940s aerial photographs have since been built over. House building at Moulsecoomb, Coldean, and Bevendean (some of which had been halted by the war) were underway from the late 1940s. Other post-war development extended Brighton and Hove northwards as far as the A27.

Several features mapped from the historic aerial photographs have since been built over. To the east of Brighton small areas of prehistoric or Roman field systems were built over in the post war housing developments. Second World War defences were situated on downland are now built over in Hangleton, and Portslade. Houses now cover the locations of Heavy Anti-Aircraft batteries in West Blatchington and Shoreham-by-Sea. Houses also occupy part the First World War camp in Shoreham-by-Sea.

Numerous archaeological finds across Brighton and Hove made over the last 200 years or so help to better understand the history of this part of the Downs and highlight the potential for further finds. Some were found in gardens and include several Roman coins while other artefacts were recovered during building work and include a Bronze Age axe, a Bronze Age burial and a palaeolithic hand axe.

Several Bronze Age barrows are known to have existed within Brighton and Hove. The finds from Bronze Age barrows, including a large barrow called Bunkers Mound were made in the early 1800s. To the west, was the Hove Tumulus – a Bronze Age barrow situated near Salisbury Road that was destroyed in 1856-7. The barrow contained several items including an amber cup now in the Brighton Museum & Art Gallery

Other finds appear to indicate extensive sites. Three sets of finds made in Portslade-by-Sea in 1898, 1927 and 1949 near the junction of St Andrew's Road and Church Road suggest the presence of an Anglo-Saxon cemetery. Any further discoveries will help to determine the extent of this cemetery and further our understanding of this site.

Some sites are only known through documentary sources and future work may help to better understand them. An 18th century militia camp extended over approximately 600m between Brighton and Hove. Although this would have been occupied for only a few days small finds in the vicinity may help in determining its extent and location.

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Appendix 1

Scope

The scope of the mapping adhered to Historic England's Aerial Investigation & Mapping Standards. It included all archaeological features visible as earthworks, structures, soilmarks and cropmarks, including features visible as earthworks on historic photographs which have since been levelled. Chronologically, these ranged in date from the Neolithic to the 21st century.

Cropmarks, parchmarks and soilmarks

All sub-surface archaeological remains visible as cropmarks, parchmarks or soilmarks were mapped and recorded.

Earthworks

All archaeological earthworks were mapped and recorded. This included features visible as earthworks on early photographs which have since been levelled. Archaeological earthworks depicted on OS maps were also mapped if visible on aerial sources.

Buildings and structures

The foundations of ruined buildings visible as cropmarks, soilmarks, parchmarks, earthworks or stonework were mapped and recorded. Standing roofed or unroofed buildings were not normally mapped. The exceptions were in specific archaeological contexts such as industrial and military complexes, or when associated with other cropmark and earthwork features.

Ridge and furrow

Medieval and post medieval ridge and furrow was mapped and recorded, regardless of preservation. The extents of each area of ridge and furrow were defined by a polygon and a single line used to indicate the direction and form of ploughing.

Post medieval field boundaries

Post medieval field boundaries (upstanding or levelled) that were not depicted on current OS maps were mapped and recorded. This included boundaries that were depicted on historic OS or tithe maps.

Parkland, landscape parks, gardens and country houses

Vestigial manmade elements of landscape parks and gardens were mapped and recorded. Those elements of the park that are still in use such as formal gardens and tracks were not recorded.

Industrial features and extraction

All extraction, irrespective of size, was mapped and recorded. Industrial complexes were mapped as seen. This included any roofed or unroofed structures that are still upstanding.

20th-century military features

Military features up to and including the Cold War were mapped and recorded. This included any roofed or unroofed structures.

Natural features

Natural features which are geological or geomorphological in origin were not mapped. If there was risk of confusion in contexts with other archaeological features, then the natural features were mentioned in the monument record.

Methods

Sources

Aerial photographs

All readily available vertical and oblique aerial photographs were assessed. These principally comprised print and digital material from the following sources:

- The Historic England Archive.
- Aerial Photography for Great Britain (APGB) orthophotographs.
- Google Earth.

An assessment was made of the aerial photographs held at The Keep, East Sussex. The majority were duplicates of photography held by the Historic England Archive. A sub-set of the collection was not ready accessible and therefore not viewed. The West Sussex collection was also not readily accessible.

Lidar

Environment Agency lidar data were downloaded from the Defra Survey Data Download Platform. The entire project area is covered by the National LIDAR Programme at a resolution of 1m, dating to 2019-2020.

Other sources

In addition to the aerial photographs and lidar, other sources of information were consulted to inform interpretation and understanding of sites. These included:

- Historic Ordnance Survey maps.
- HER data – spatial data and textual monument records. Any other GIS layers (e.g. pre-OS historic maps etc)
- Historic England research records (Warden).

- The National Heritage List for England.
- Tithe maps (Genealogist website accessed through the Historic England Library and the East Sussex County Council online tithe map portal).
- British Geological Survey (BGS) data (BGS GeoIndex Onshore map viewer).
- Soils data from Soilscapes, a 1:250,000 scale, simplified soils dataset covering England and Wales (BGS UK Soil Observatory map viewer).
- Results from previous archaeological investigations (reports, survey data, journal articles, monographs, SE Research Framework).

Assessment and mapping

All available aerial photographs were viewed under magnification and in stereo where possible. Digital photographs were viewed on screen.

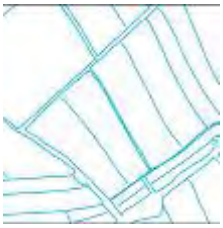
Lidar data were processed using the Relief Visualization Toolbox 2.2.1 (Kokalj and Somrak 2019; Zakšek, Oštir and Kokalj 2011) to produce 2D visualisations as GeoTIFF images. The visualisations were viewed in the GIS. Lidar data were also viewed in 3D in Quick Terrain Reader and Modeler.

Aerial photographs were rectified using Aerial 5.36 software. Control information was be derived from APGB 12.5cm resolution orthophotographs. Height data at 5m resolution was used to improve the accuracy of rectifications. Where good control information is available on the photography and source used for control, the accuracy of rectifications is commonly within ±1m of true ground position. In areas with poor control and/or high topographic variation this error may be larger (Evans 2019, 44–5).

Where good coverage of historical aerial photography allowed, the photogrammetric technique ‘Structure from Motion’ was used to combine and rectify multiple vertical photographs. This was particularly useful for a number of the 1940s RAF flights.

Archaeological features were mapped as line and polygon data within a geodatabase using ArcMap 10.7.1 in accordance with Historic England’s ‘Standards for Aerial Investigation and Mapping Projects’ and Aerial Investigation and Mapping Technical Specification. See Table 1.

Table 1. Mapping layer content and drawing conventions, based on AI&M standards.

Layer name	Layer content	Layer colour	Feature type	
MONUMENT_ POLYGON	Polygon encompassing features within a single NRHE record	Black	Polygon	
BANK	Polygon for features such as banks, platforms, mounds and spoil heaps	Red	Polygon	
DITCH	Polygon for features such as ditches, hollows, pits or hollow ways	Green	Polygon	
EXTENT_OF_ FEATURE	Polygon outlining a feature or group of features such as industrial complexes	Orange	Polygon	
RIDGE_AND_ FURROW_ ALIGNMENT	Polyline depicting the direction of a plot of ridge and furrow	cyan	Polyline	
STRUCTURE	Polygon for built features including stone, concrete, metal and wood	Purple	Polygon	
SCARP_ SLOPE_EDGE	Polylines in form of a schematic t-hachure depicting break of slope	Blue	Polyline	

Textual data were recorded in an attribute table as outlined in table 2 below. Monument polygons were created to outline the extent of a single monument.

Table 2: Aerial mapping attribute data.

Attribute	Description	Sample data
WARDEN No	Historic England Research Record Unique Identifier (UID)	79060
HER_No	HER number for those features concorded with existing HER records	MHU1513
PERIOD	Date of feature (EH Thesaurus). Single or dual indexed terms	MEDIEVAL
NARROW_TYPE	Monument Type (EH Thesaurus). Specific monument type for individual features	FISHPOND
BROAD_TYPE	Monument Type (EH Thesaurus). Broader monument type to enable grouping of individual features	CISTERCIAN MONASTERY
EVIDENCE_1	Form of remains (EH Thesaurus) as seen on PHOTO_1	EARTHWORK
PHOTO_1	Source feature was mapped from (aerial photograph or lidar)	NMR RAF/3G/TUD/UK/3 PART I 5097 14-DEC-1945
EVIDENCE_2	Form of remains (EH Thesaurus) as seen on PHOTO_2	LEVELLED EARTHWORK
PHOTO_2	Latest available source (aerial photograph or lidar) to give indication of current state of preservation. Not applicable for cropmark sites	NMR 28225/36 19-OCT-2011
Heritage_Gateway	URL to full monument record on Heritage Gateway	Heritage Gateway web address

Monument recording was undertaken in the Historic England Research Records database (Warden). The records are available via Heritage Gateway (www.heritagegateway.org.uk) Data will be supplied to the HERs. Mapping will be available via the HERs, the Aerial Archaeology Mapping Explorer (https://historicengland.org.uk/research/results/aerial-archaeology-mapping-explorer/), and the project-specific GIS portal.

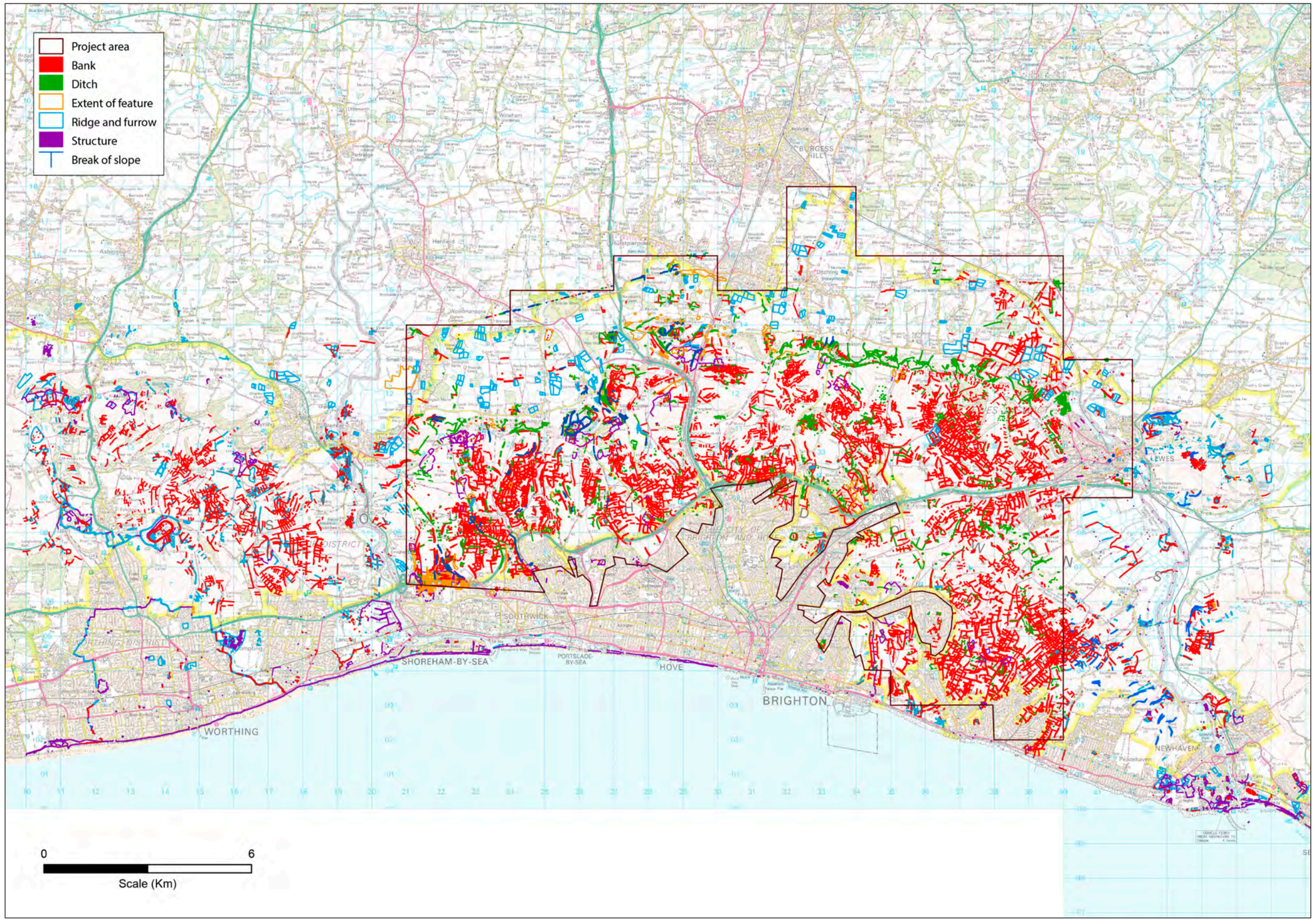


Figure 88: Overview of mapping in context with the wider mapping of the South Downs. The South Downs NMP Pilot Area 1: Worthing to the Weald, mapped the area to the west. The coast to the south was mapped by the South East Rapid Coastal Zone Assessment Survey. The area to the east was included as part of the South Downs Beachy Head to the River Ouse mapping project. Archaeological mapping © Historic England. Base map © Crown copyright and database right 2023. All rights reserved. Ordnance Survey licence number 100019088.



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