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Beadlam Roman Villa Assessment of the Landscape Setting Aerial Investigation & Mapping Report

Dave Knight and Andrew J Roberts

Discovery, Innovation and Science in the Historic Environment



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**BEADLAM ROMAN VILLA
RYEDALE DISTRICT
NORTH YORKSHIRE**

**BEADLAM ROMAN VILLA
Assessment of the Landscape Setting
Aerial Investigation & Mapping Report**

Dave Knight and Andrew J Roberts

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SUMMARY

The site of Beadlam Roman Villa, which includes building footings and buried remains, is an English Heritage Trust guardianship site and a scheduled monument – National Heritage List for England no. 1011365. Due to its location in the middle of farmland, the villa is currently inaccessible to the public. In 2022, English Heritage Trust, with support from the North York Moor National Park authority -led Ryevitalise Landscape Partnership Scheme, are organising regular guided events and providing online content to enable visitors to engage with the site.

In order to better understand the landscape setting of the villa, Historic England's Aerial Investigation and Mapping team undertook a survey of 20sq km surrounding the site. Aerial photographs from the Historic England Archive, the local authority Historic Environment Records and the A L Pacitto collection as well as Environment Agency lidar data were analysed. Additionally, an Unmanned Aircraft System (UAS) survey was also undertaken of the scheduled area incorporating the villa. Archaeological features visible on these aerial sources were mapped to produce a spatially accurate archaeological map.

The aerial mapping survey transcribed and recorded numerous archaeological features visible as earthworks, cropmarks, soilmarks and structures. These remains ranged in date from the later prehistoric period to the Second World War. The earliest sites recorded were several small Bronze Age round barrow cemeteries and the latest related to ancillary accommodation camps for RAF Wombledon. There was no direct evidence for Roman activity associated with the villa on the aerial sources, but the overall results illustrate a landscape that has undergone great transition over the last several millennia.

CONTRIBUTORS

The interpretation and mapping from archaeological sources and reporting on the archaeological landscape was undertaken by Dave Knight of Historic England's Aerial Investigation and Mapping team. The historic context for the villa was authored by Andrew Roberts, properties historian for the English Heritage Trust. Edits were undertaken by Sally Evans, Aerial Investigation & Mapping Manager (North), Helen Winton, Head of Archaeological Investigation Team and Sally Wilson, Properties Curator (North) for English Heritage Trust. The Project Manager for Historic England's input was Sally Evans.

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ARCHIVE LOCATION

Historic England Archive, The Engine House, Firefly Avenue, Swindon, SN2 2EH

DATE OF SURVEY

The UAS survey was undertaken in December 2021 and the mapping and recording between January and March 2022.

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INTRODUCTION

Background

Beadlam Roman villa is an English Heritage Trust guardianship site and scheduled monument – National Heritage List Entry (NHLE) no. 1011365. Having undergone numerous excavations in the 1960s and 1970s, the north range of the villa was consolidated, and the remains left exposed. However, the site is in the middle of pasture farmland and is currently inaccessible to members of the public. English Heritage Trust, with support from the Ryevitalise Partnership Scheme, are planning to open the site for bookable guided walks (six planned for 2022) and develop online content for the site.

In order to get a better understanding of the villa in its archaeological context, Historic England's Aerial Investigation and Mapping team undertook an assessment of aerial photographs and lidar to map and record the surrounding landscape. The results will inform the interpretation and presentation of Beadlam villa and its setting.

Project Area

The project covered an area measuring 20sq km (Fig 1). Bordering the east side of Helmsley, the survey area also incorporated the present-day settlements of Beadlam, Nawton and Harome. The main arterial road, the A170, extends west-east through the project area. Several B roads intersect this, leading north into the Tabular Hills or south towards the settlements of the Vale of Pickering. The Rivers Rye and Riccall flow southwards through the project area.

The site of the Roman villa sits on the northern edge of National Character Area (NCA) Profile: 26 Vale of Pickering. This is described as a low-lying area with gently undulating topography, defined by rivers and wetlands and artificially drained farmland (Natural England 2015a, 3). The area to the north is within NCA Profile: 25 North York Moors and Cleveland Hills. This area is a diverse environment of sparsely populated upland moorland cut by river valleys. The southern foothills of the North York Moors are the Tabular Hills, which gently slope down to the Vale of Pickering (Natural England 2015b, 3, 7).

The Vale of Pickering, in which Beadlam Roman villa is located, has a superficial geology of Lacustrine Deposits of clay, silt and sand, laid down by the post-glacial Lake Pickering, over a bedrock of mudstones of the Amphill Clay and Kimmeridge Clay Formations. The soils are loamy and clayey and seasonally wet with naturally high groundwater following the River Rye and areas around Harome. The geology to the north of the A170 comprises bands of Oolitic limestone of the Malton Oolite and Coral Rag Members, and sandstone of the Middle Calcareous Grit Member. The resulting soils are loamy and free draining (www.bgs.ac.uk; www.landis.org.uk).

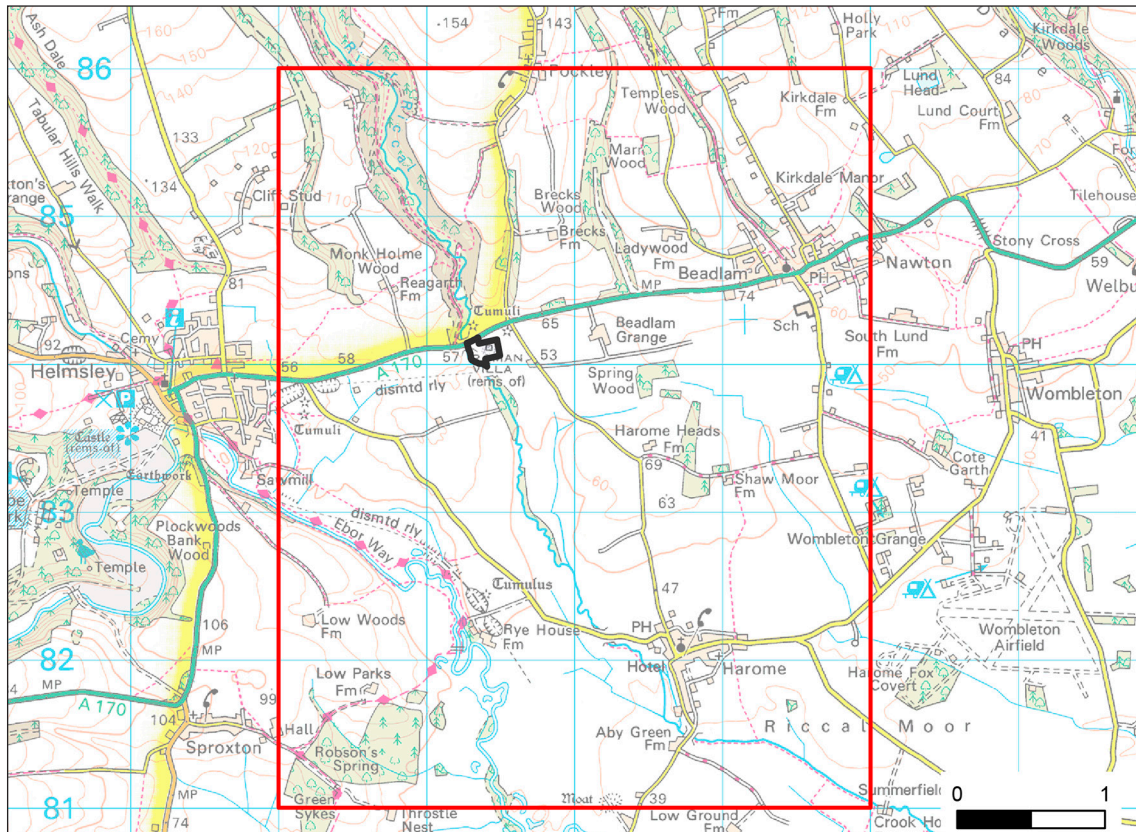


Fig 1: The survey covered 20sq km broadly centring on the scheduled area of Beadlam Roman Villa (outlined in black). Base map © Crown Copyright and database right 2019. All rights reserved. Ordnance Survey Licence number 100019088.

Methods, scope and sources

The primary sources used for mapping included vertical and oblique aerial photographs taken by multiple organisations and individuals over the past 80 years and now held in the Historic England Archive. Recent aerial reconnaissance photographs taken by Historic England’s Aerial Investigation and Mapping team were also assessed.

In addition, the aerial photograph collections held by the North York Moors National Park Authority and the North Yorkshire County Records Office were viewed. These collections include oblique aerial photographs and a small number of vertical photographs. Several images from the oblique aerial photograph collection of A L Pacitto were kindly supplied by Yvonne Boutwood on behalf of the Yorkshire Archaeological and Historical Society (YAHS).

The Cambridgeshire University Collection of Aerial Photography (CUCAP) remains inaccessible, though an online search showed only three oblique images, all at locations with additional coverage held by either the Historic England Archive or one of the local authorities, and a handful of vertical images in the project area.

Ortho-rectified vertical photographs were supplied by Next Perspectives through the Aerial Photography for Great Britain (APGB) agreement.

Publicly available Environment Agency lidar was acquired and visualised as 2D raster images to aid the mapping of earthworks. Ranging from 50cm to 1m in resolution, the lidar covered approximately four-fifths of the project area.

An Unmanned Aircraft System (UAS) mapping flight was undertaken of the scheduled area for Beadlam Roman villa. The vertical imagery from this flight was used to create an orthomosaic vertical image and a digital surface model (DSM) to aid the mapping and for illustrative purposes. Oblique photographs were also captured.

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

BEADLAM ROMAN VILLA

The Discovery

The earth-covered remains of 'old cart-sheds', as the farmer at the time interpreted them, had been recognised by local archaeologists for some time. But it was not until the field was ploughed in the 1960s and surface material collected by A L Pacitto that Roman finds were recognised. This resulted in a trial excavation in 1966 which revealed part of a mosaic floor. Subsequent excavations which culminated in 1978 and a geophysical survey in 1993 revealed three separate ranges around a courtyard with numerous outbuildings.

The excavations were restricted as it was intended from an early point to present the site to the public, so the dating evidence for the site was already scant. The subsequent loss of some of the finds also impeded the complete interpretation of the site (Stead 1971, 178-9; Neal 1996, 1-3). That said, the presence of a bath-suite and the mosaic floor, along with several small finds, suggest that it belonged to a moderately wealthy and educated rural family. Although excavation to any depth was limited, evidence was found for pre-villa occupation and some of the coins retrieved suggest that the site remained in use into the late Roman period (Neal 1996, 40-5).

The setting

The line of the A170 road, follows the boundary between the Tabular Hills (the foothills to the North York Moors) and the Vale of Pickering. Numerous rivers and becks drain from the Hills into the Vale forming confluences with the Rivers Rye or Derwent. One of the lesser of these tributaries is the River Riccal. This narrow river exits the Tabular Hills at Riccal Bridge where it passes under the A170. The villa was sited on a shoulder of better-drained flat land within the arc of a historic meander of the river.

Description and definition of the villa

Periods

The following are based upon Neal 1996: chapters 3 and 4.

Pre-history

Finds of flint tools from 3500-1500BC and two early-bronze age tumuli within 150m of villa buildings.

Iron Age/early Roman

An assumed late-Iron Age or early Roman enclosure ditch partly underlies the villa buildings. A pre-roman trackway runs to the east and a possible Iron Age circular building and enclosure ditches may predate villa. Walled stock compounds certainly predated the villa complex.

Roman

A villa complex consisting of three ranges: the northern and western ranges were winged-corridor houses. The third range consisted of various ancillary buildings presumably for agricultural use.

Modern

The site was known about in 19th and early 20th centuries but dismissed as 'old cart sheds'; the field was used as a camp by Yorkshire regiments during and after the Boer War.

Chronology

The chronology of the complex is not well understood due to the shallow excavation depth and subsequent loss of some of the assemblage. No attempt at closely dating the structure is articulated in the excavation report but based upon coin evidence the villa complex was probably built in c 300 A.D. and was still in use in the late 4th century AD (Neal 1996, 25). This fits a general pattern in Roman Britain where there were comparatively few early villas and the majority were built late, especially in the 4th century AD (Mattingly 2007, chapter 12). The site was clearly used prior to this and the development of pre-existing site with a Roman-style building is a common phenomenon in Roman Britain and within Yorkshire. It may be that there was a longer history of usage during the Iron Age, given the prehistoric features in the wider landscape, but this was not proven by the excavations.

Roman villas in Britain

Ancient Roman sources define a villa as a 'rural house' implicitly owned by somebody with social status. Compared to the large estates of the Mediterranean, the term villa in Britain is applied to any 'rural building of Roman aspect' – ie a rectilinear stone-made structures, with features such as bathhouses, mosaics, and wall paintings (Mattingly 2007, 369-70; Millett 1990, 91-92). By this broad definition, there are an estimated 2000 known villas in Roman Britain, circa 2% of 100,000 known Roman sites. In Britain, use of the term villa ranges from structures of over 1.4ha and 50 rooms to those of 200sq m and fewer than 10 rooms (Mattingly 2007, 370).

Assuming that the north and west ranges are contemporary rather than sequential (*see* Neal 1996: 25), the Beadlam complex can be considered as a small to a medium-sized 'courtyard villa' with fewer than 30 rooms/structures spread across three ranges around a large courtyard. The northern range, the only one currently visible on site, is a winged-corridor house, consisting of a longitudinal corridor at the front, two functional rooms at the centre and parallel suites of three well-appointed rooms at the sides, including one with a mosaic. One evaluation of this building determined that the functional rooms were shared with each suite comprising a distinct standalone unit (Neal 1996, 44; Smith 2012, 56).

Roman settlement patterns in Yorkshire

Of the 258 Roman settlements identified in the Yorkshire region, 213 are considered to be farmsteads and only 20 have been positively identified as villas in a recent synthesis (Allen 2016, 246). Although villas are therefore comparatively rare in Yorkshire, Beadlam is one of a group of 11 potential villas within the Vale of Pickering (Neal 1996, 44). The most relevant major urban centre was Aldborough (*Isurium Brigantum*) – the civitas capital of Brigantes. There were also *coloniae* at York and Lindum; other notable forts and *vici* were at Malton and Doncaster (Allen 2016, 243). The evidence suggests a settlement pattern in Yorkshire that peaked in the second half of the second century with a decline through to the later fourth when settlements numbered one third of those occupied in the late Iron Age (ibid, 248-9).

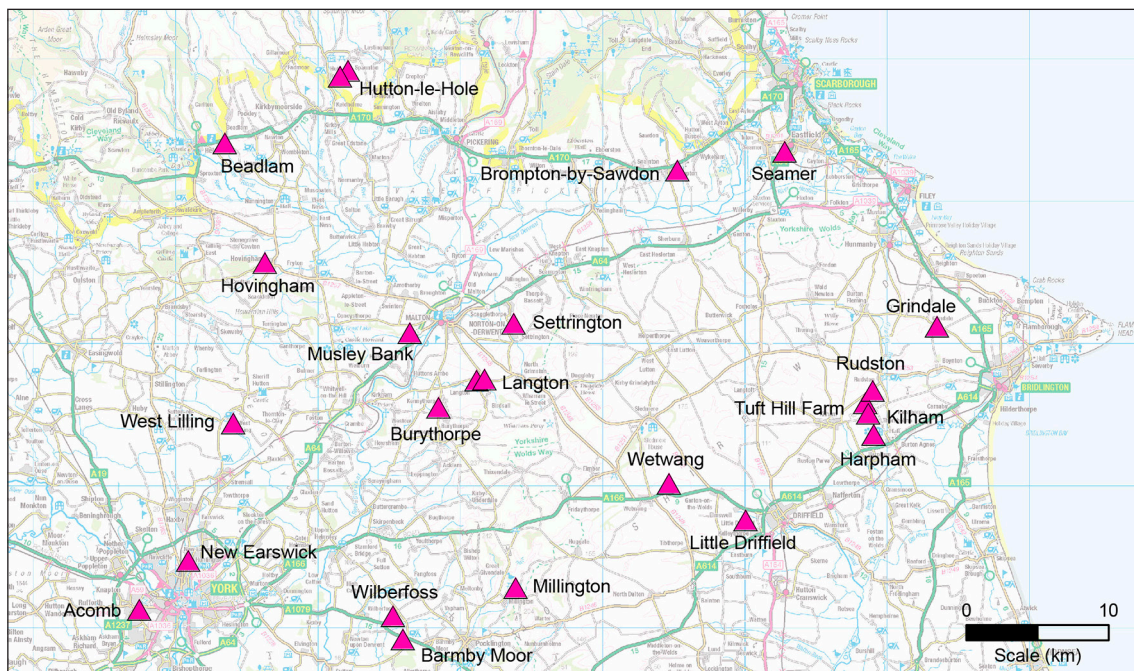


Fig 2: Historic England research records of villa sites identified from excavation, finds or aerial photograph evidence. The distribution differs from Allen's (2016) synthesis but still indicates the large numbers of known sites in the region. Base map © Crown Copyright and database right 2019. All rights reserved. Ordnance Survey Licence number 100019088.

The general picture of rural society for Roman Britain is that it was a well-exploited landscape of arable, pasture, managed woodlands, quarrying and various industrial activities (Millet 2016, 700-3). An estimated 90% of the population of Roman Britain lived in the countryside (Mattingly 2006, 356) and a consistent and large labour supply would have been an important part of the rural economy (Millet 2016, 701). The evidence from Beadlam confirms this general picture, as there is ample accommodation and an estate that may have economically supported a wider community, through industrial and farming activity. Beadlam is one of five villas with evidence of iron smithing in circular structures. These were probably workshops and potentially important elements in the economy of the villas (Allen 2016, 243). Beadlam sits within the densely occupied and exploited landscape of the Vale of Pickering, which has a comparatively high concentration of Roman

sites within Yorkshire. A study of the Vale of Pickering demonstrated the area was well-connected across many miles by a 'linear trackway and enclosure system' of demonstrable Late Iron Age and Roman date (ibid; Millett 2016, 703).

Why build a villa at Beadlam?

Ownership model

Elite romans in Italy and the other southern provinces of the Roman Empire maintained rural villas and town houses and moved between the two. Both were key loci of revenue and a display of wealth. It is certainly possible that in Britain a similar model was pursued by the elite of the civitates. However, the regional administrative units centred on towns such as Aldborough, and the link between town and rural elite is, as yet, unproven in Roman Britain, since specific ownership of villas cannot be established except in very few cases. There are other wealthy owners that could potentially have underwritten and benefitted from specific economic activity on the site, including the imperial family, indigenous elites, retired soldiers or private landowners from elsewhere in, or outside of, the province (Mattingly 2007, 372).

Local and regional economic model

Beadlam could have been key to a regional economy centred upon a regional civitas at Aldborough. Towns spread Roman material culture (eg copious amounts of Roman glassware), which was clearly consumed at Beadlam (Millett and Hodder 1980, 18-9). However, any reciprocal exploitation by villas of the urban markets for produce or industrial goods is uncertain (Millett 2016, 703), and there is no specific evidence for that relationship between Beadlam and Aldborough.

Beadlam was one of a cluster of potential villa sites around Malton – including Langton, Oulston and Hovingham. It has been suggested that the development of military signal stations at Scarborough and Filey, 40km to the east, in the 4th century AD is relevant to the security of the site. It has also been suggested that the military presence at Malton was the significant factor in the construction of villas in this area (Neal 1996, 44). The fort, at Malton, was rebuilt in the 4th century AD and may have housed imperial household cavalry that required provisions (ibid). This relies upon the premise that the villa required the security and market provided by the military to survive. However, the use of the site from the pre-Roman period onwards implies a longer standing economic set-up. The villa's establishment also fits a general pattern of development throughout the province irrespective of specific local factors.

Socio-cultural model

It has been argued that construction of villas reflected changes in trends of elite display resulting in 'ordinary farms monumentalised and made into a show piece' (Millett 2016, 703). These adopted Roman characteristics but had layouts that were particular to Britain and the north-western provinces of the Roman Empire. In keeping with the socio-cultural purpose of villas in the Roman world, their

form in Britain also ‘suggests that receiving, entertaining, and impressing visitors were crucial to its owners’ (ibid). Beadlam villa appears to conform to this socio-cultural model in the morphology, reception spaces, emphatic consumption of Roman material culture, and elements of display (eg the mosaic). Therefore, while the specific impetus to build was presumably a combination of social, cultural and economic factors, the socio-cultural model is most firmly exemplified by the available archaeological evidence. The construction of a villa represents an ‘architectural statement about identity and aspirations’ (ibid) of the owners – ie they are consciously creating a Roman-style home at a great degree of expense.

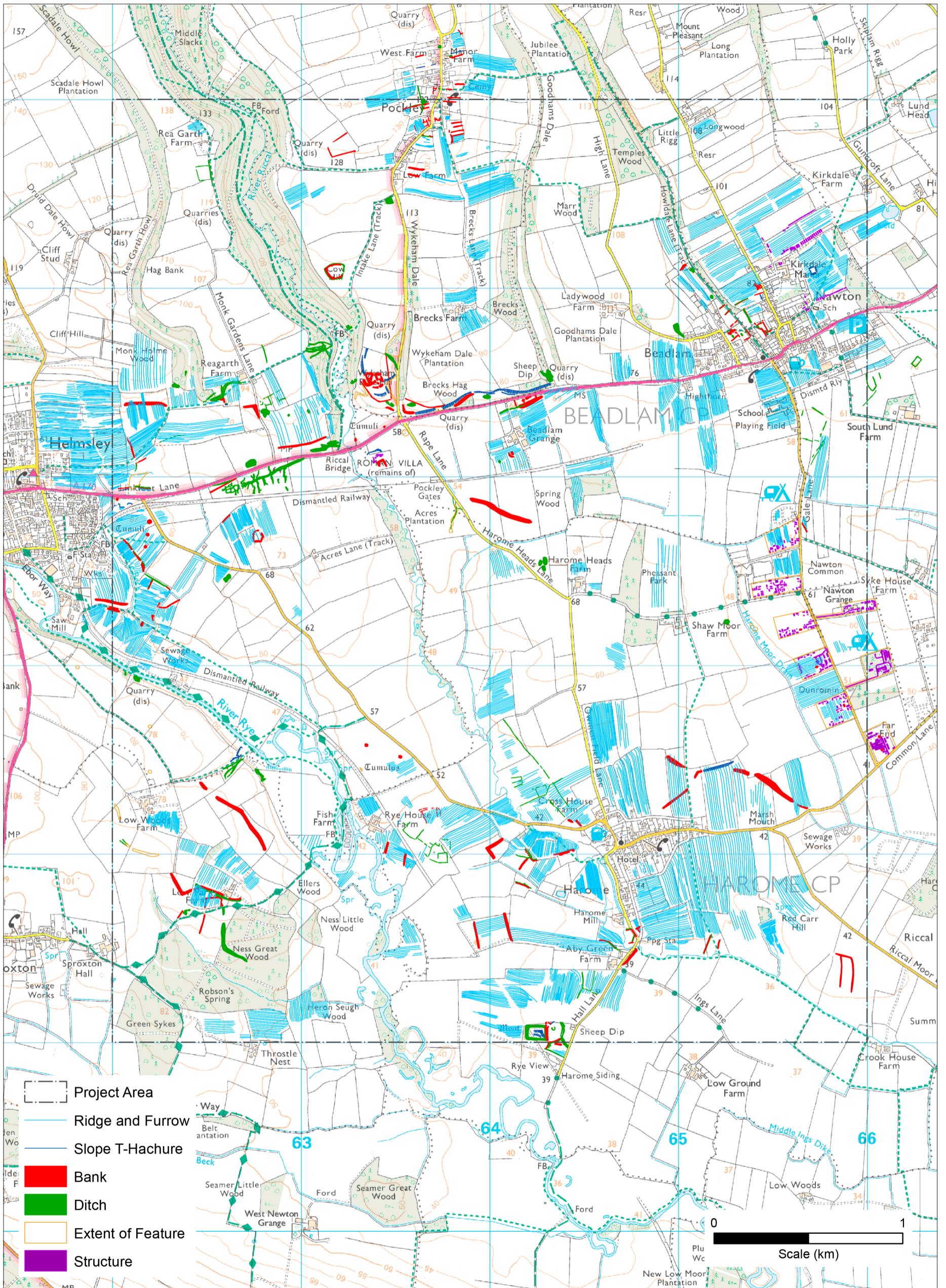


Fig 3: Archaeological features mapped from aerial sources for the Beadlam Roman villa project area. Archaeological mapping © Historic England; Base map © Crown Copyright and database right 2019. All rights reserved. Ordnance Survey Licence number 100019088.

THE ARCHAEOLOGICAL LANDSCAPE

This study concentrates on the immediate environs of the Roman villa. The report is not intended as a full historical and archaeological analysis of the region but instead concentrates on the aerial mapping results in the context of previously studied sites within and near to the project area.

The above-ground archaeology, seen as earthworks in the study area, mainly comprises remains of medieval and post medieval agricultural land use. Much of this remains intact or is known, from aerial photographs, to have survived until recent decades. Some sub-surface remains of ridge and furrow are visible as soil marks. In addition to the medieval period, isolated pockets of later prehistoric or Roman period features are visible as cropmarks. Knowledge of other sub-surface remains is limited because the seasonally wet clayey soils of the lowlands hinder the formation of cropmarks. Where archaeological cropmarks are visible it is on the better draining Tabular Hills but the complex geology beneath also causes cropmarks that can make interpretation difficult. Numerous Bronze Age barrows are also visible, mostly surviving as shallow earthworks. The latest recorded activity are military camps dating to the Second World War (Fig 3).

Sites discussed below are referred to by their Historic England Research Record number. In some cases, these are updated records previously recorded as part of the National Record of the Historic Environment (NRHE). In due course, these records will be transferred to the Local Authority Historic Environment Records (HER). All monument records are available to view via Heritage Gateway – www.heritagegateway.org.uk. Where a scheduled site is discussed, the National Heritage List of England (NHLE) number is also quoted. The list can also be searched online – <https://historicengland.org.uk/listing/the-list>. Where sites corresponded with ones recorded by the HER, the number was included in the attribute data within the digital mapping. The digital mapping, including the attribute data with links to the Heritage Gateway record, can be viewed on the Aerial Archaeology Mapping Explorer – <https://historicengland.org.uk/research/results/aerial-archaeology-mapping-explorer>.

Previous Archaeological Study

There has been little archaeological study around the villa, with only small sites subjected to targeted work in the past, such as Desk Based Assessments in Nawton and Harome and excavations in Pockley and Harome.

The most complete landscape study, which incorporated much of the present project area, was the Howardian Hills Mapping Project, undertaken by the Royal Commission on the Historic Monuments of England (RCHME) between 1992-3 (Carter 1995). This was an aerial photograph-based study and examined many of the same sources used for this study. The current project used additional reconnaissance photography taken since 1993 and lidar data. The RCHME project mapping was manually transcribed and therefore the current digital mapping has better location and spatial accuracy.

More recently, a Ryevitalise Landscape Partnership volunteer-led study used Environment Agency lidar as part of a desk-based assessment of the area around Helmsley (Frodsham 2021). Targets identified by volunteers were added to the HER. Much of the Bedlam survey area falls within the Ryevitalise Study Area 2 and where sites were identified by both studies they are referred to in the text below.

Funerary activity

As with most aerial mapping projects, the earliest features recorded relate to later prehistoric funerary activity. These comprise a number of Bronze Age barrow cemeteries, all sited in the lowlands and with clear associations with watercourses. The best-preserved earthworks are located to the east of Helmsley, 120m south of the junction between Acres Lane and the A170 and adjacent to Spittle Beck (Fig 4). Three round barrows, of varying size, are aligned north-south (58768, scheduled as NHLE 32691). On Figure 4 the northern two barrows are visible either side of a modern drain (centre of frame) and the southernmost is sited under a modern hedge-line and is barely visible on aerial photographs but can be discerned on lidar data.



Fig 4: A south facing aerial photograph showing the location of three Bronze Age round barrows, surrounded by medieval and later ridge and furrow, to the east of Helmsley (58768). The northern barrows are either side of a modern drain (centre of frame) and the southernmost barrow is hidden by a hedge-line. Detail of NMR 20503_021 17-NOV-2005 © Historic England Archive.

Three further barrows are located a little further downstream, where Spittle Beck joins the River Rye, north of Rye House Farm. Somewhat plough-levelled, the northernmost is the best-defined (58809, scheduled as NHLE 1019595). The western barrow (58812, scheduled as NHLE 1019596) has been truncated by the Gilling and Pickering Branch Railway (now disused). The easternmost barrow is the least well preserved and was previously thought to have been located 30m to the west-south-west (58821) but has been correctly located on the lidar data.

Three barrows are located immediately adjacent to Beadlam Roman villa on the east bank of the River Riccal (58768). Pockley Gates barrow is located to the east of the villa and is best preserved of the three, though it has been partially levelled by ploughing (NHLE 1019341). A second lies to the north of the A170, located immediately on the bank of a relict meander of the river (NHLE 1019515). Largely truncated by the movement of the river, only a narrow length of bank remains. The third barrow is unscheduled and almost completely plough levelled and truncated by the modern road.

The study identified three further probable round barrows surviving as low earthwork mounds to the south of Helmsley (1629395, 1629396 and 1629397). These are located on raised ground over a distance of 660m overlooking the River Rye (Fig 5).

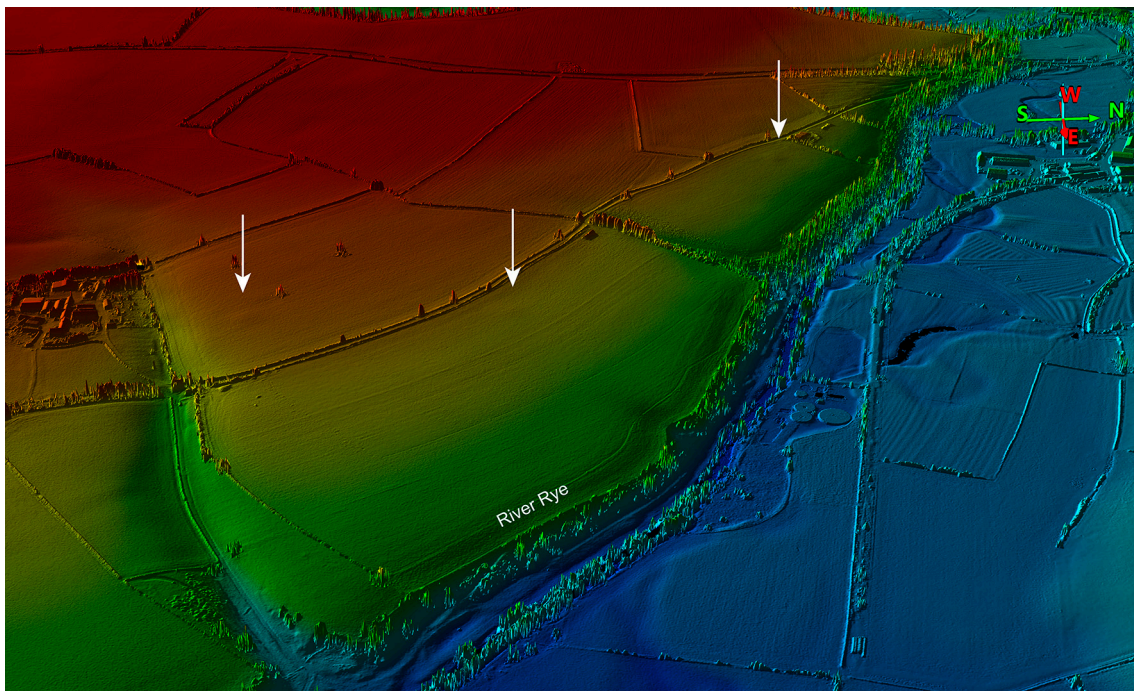


Fig 5: Three probable round barrows newly identified as low earthwork mounds on lidar. They are adjacent to the River Rye – the relationship between funerary monuments and water courses being evident in the region. LIDAR Digital Surface Model composite 2017 © Historic England; source Environment Agency.

Routeways

An important but unresolved question is how people travelled to and from Beadlam in the late Iron Age and Roman periods. There is a what appears to be a sinuous trackway 450m to the south-east (1629416). However, the dubious nature of the cropmark indicating this feature makes it very uncertain as to whether it belongs to the Iron Age/Roman periods or is even archaeological at all. Further afield, there is another possible trackway south of Low Woods Farm on the western edge of the project area (1629455). Similarly, this site, also seen as a cropmark, is possibly non-archaeological.

The only other possible routeway was noted as an intermittent cropmark between Nawton and Nawton Common (1629458 and 1476144), 2.2km to the east of the villa. It is orientated south-west to north-east and may continue to the north of South Lund Farm (Fig 6). Three enclosures were also noted near the trackway, two being parallel with it. Intriguingly, the south-west end of the trackways appears to align on a kink in Gale Lane indicating that the lane could potentially be on the alignment of a much earlier route.

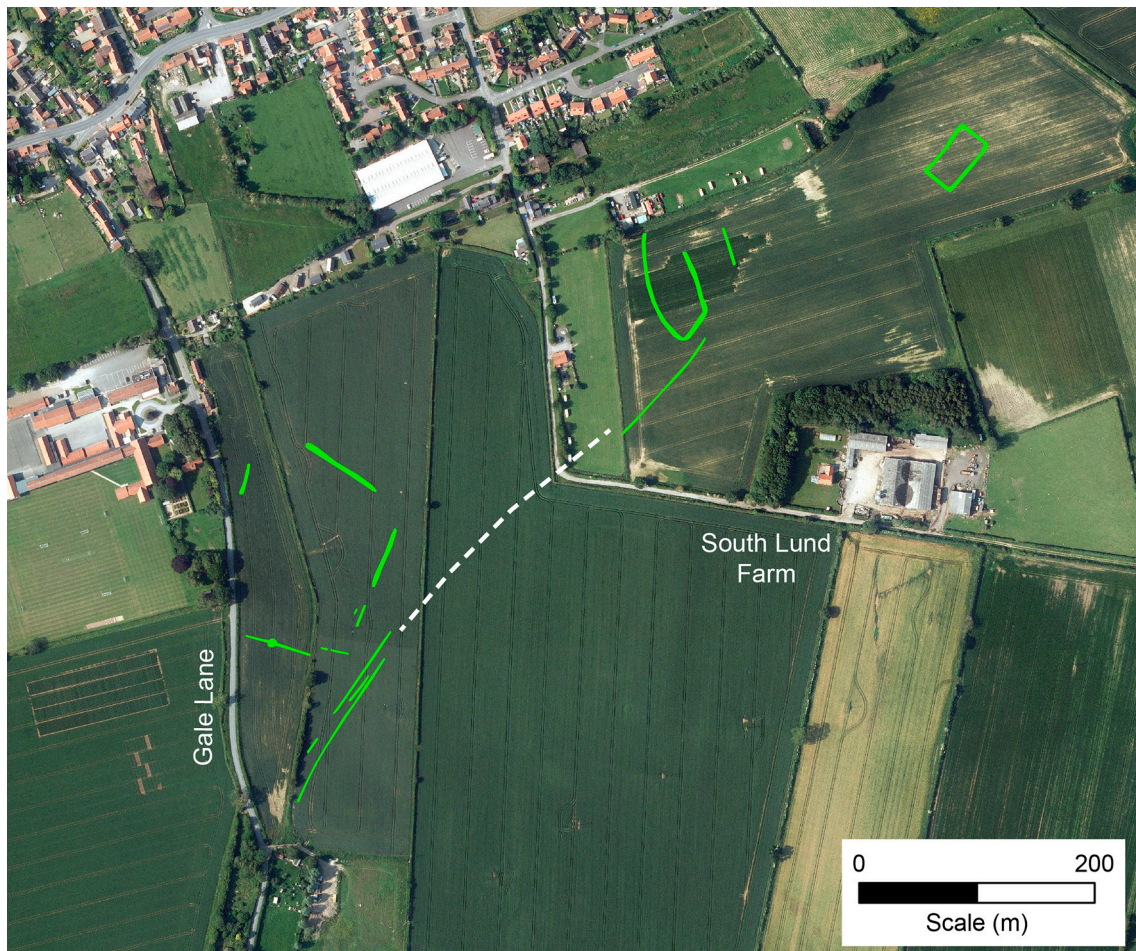


Fig 6: A trackway or probable Iron Age or Roman origin is visible as cropmarks to the south of Nawton. Archaeological mapping © Historic England; Next Perspectives APGB Imagery SE6583-6684 24-JUN-2020 © Bluesky International/Getmapping PLC.

There is more evidence for routeways from later periods in the aerial mapping results, with earthwork examples noted along the line of the A170, close to the villa. A broad medieval or later hollow way extends towards the River Riccal from the south-west (just to the north of Riccal Bridge), on either side of the A170 (1629407; Fig 7). A series of sinuous perpendicular channels extend to the north and south, which might be natural water runoff. It is not clear whether the hollow way predates the route of the modern road, ie is an earlier alignment, or intersected it. The very irregular appearance of the earthworks suggest that it was probably a droveway leading livestock to the river. An examination of the earthworks on the ground revealed no evidence of the hollow way continuing to the east of the river, so it may have led to a watering location and not a crossing point.

The western end of the trackway is less certain and the earthworks are truncated by the line of the Gilling and Pickering Branch Railway. The survival of medieval and post medieval cultivation as earthworks to the west and south appear to suggest that the droveway may have curved west and back to the current alignment of the A170, and this relationship was lost through the construction of the railway.

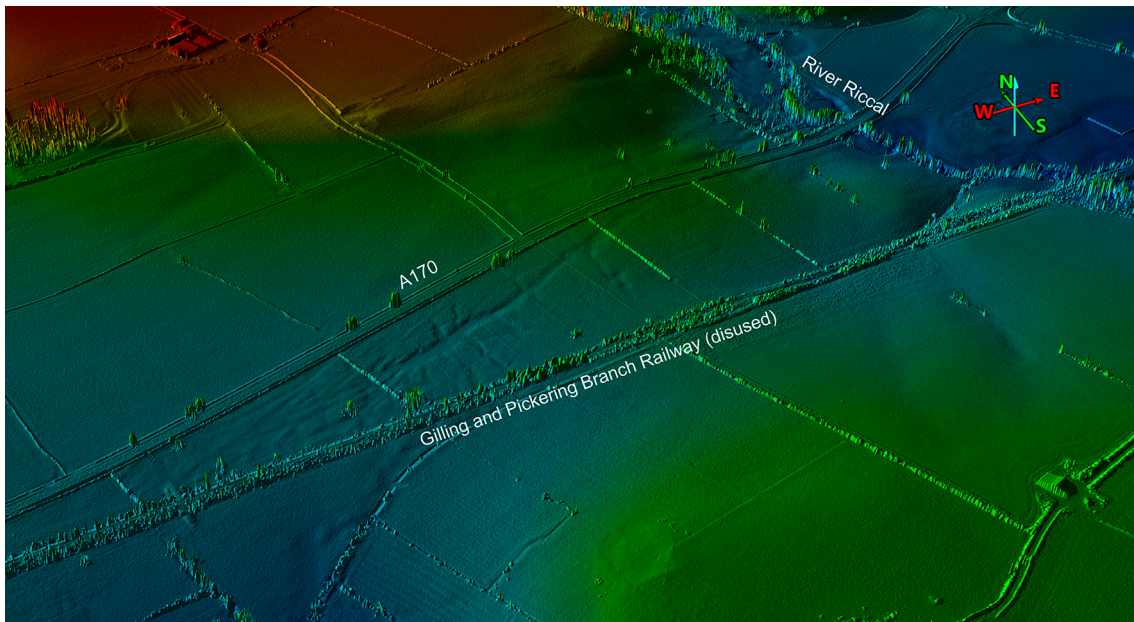


Fig 7: A medieval hollow way (1629407), now between the railway and road, extends towards the River Riccal. It is thought to have been used to drove livestock to a watering point. The western end has been removed by the old railway. LIDAR Digital Surface Model composite 2017 © Historic England; source Environment Agency.

Less than 400m to the west, there is another amorphous group of earthworks, including probable braided hollow ways (908695). Again, the sinuous nature of these earthworks might relate to some natural water runoff. The first edition Ordnance Survey map for this area, published in 1893, shows three pumps in the vicinity, which suggests the presence of a spring line. Most of these earthworks were difficult to define as they were heavily ploughed in the 1990s before the lidar survey and when recorded on historic aerial photographs were largely in bad light or shadow. However, the amorphous nature of the visible earthworks might also suggest extensive livestock movement. These might be associated with earthworks

on the opposite side of the A170, where building footings are visible alongside further amorphous earthworks (58784).

Hollow ways were seen as earthworks at Reagarth Farm (1629445). These extend to the south-west of the farm and may have originally skirted along the edge of cultivation plots, roughly following the route of the current right-of-way, towards the earthworks discussed above adjacent to the A170 (908695 and 58784).

It would appear that there was extensive stock movement happening to the east of Helmsley, whether these relate to a droving route into the market town or were simply movement between farms and pasture is uncertain without a wider study.

To the east of the villa, along the north side of the A170, a possible terraced road or track hugs the base of the slope for a distance of over 800m (1629459), roughly parallel to the road. The north embankment of the route appears to be an enhanced natural slope, probably largely formed by the ploughing of the land to the north causing a pronounced drop where the ploughing ended. The level area of the road can be seen clearly at the east end. However, to the west the northern scarp becomes considerably steeper and much of this is masked by scrub tree cover. The bank here appears to run almost to the edge of the current road. This may have been an earlier alignment of the Helmsley to Beadlam road, after which it was straightened to its current course, or might simply have been an alternative route for livestock.



Fig 8: The linear platform (highlighted) with embankment to the north of a probable earlier trackway or road. March 2022 © Historic England. Photographer Dave Knight.

Dating the routeways is difficult. The two tentative and sinuous trackways seen as cropmarks at Low Woods Farm (1629455) and south of the Beadlam Roman villa (1629416) might simply be modern drainage, however both display very shallow hollows running between the two ditches, visible only on lidar. If these are genuine routeways, then although the double ditch as a cropmark is suggestive of an Iron Age or Roman date, the presence of the hollow way surviving as an earthwork might suggest a more recent date, or a continuation of use.

The hollow way to the west of the villa (1629407) could be an earlier alignment of the Helmsley to Beadlam road, though it appears more likely that it was for herding livestock to the River Riccal for watering. The sinuous route along the base of the slope to the east of the villa (1629459) is more likely an earlier alignment of the road, since straightened.

There is circumstantial evidence for the approximate route of the A170 being in use in the early medieval period linking the settlements along it. Their existence prior to the Norman Conquest is suggested by the use of 'ton' in place-names along the road (McDonnell 1963, 70), and the mention of Helmsley, Beadlam, Nawton and Kirkbymoorside in the Domesday Book (Williams and Martin 2003). St Gregory's Minster in Kirkdale, 2km east of the project area, though not referenced in the Domesday Book, contains pre-Norman fabric. Excavation has even suggested a late Roman origin for the site, or at least the use of Roman masonry from nearby (Rahtz and Watts 2021, 6, 284-9).

Although there is no direct archaeological evidence, it is possible that the A170 route has pre-medieval origins. Topographically, the route makes sense, being an easily navigable line along the southern base of the uplands, excepting the river/beck crossings (some of which are dry in summer or still fordable when not in spate). There is an unsubstantiated record for a gravelled road, possibly Roman, immediately south-east of Beadlam villa (NRHE 908682), but the origin of the record is uncertain and there is no evidence on aerial sources.

Enclosures and early settlement

A number of enclosures were identified and mapped from both aerial photographs and lidar data. The most extensive site is located on the east bank of the River Rye adjacent to Rye House Farm, west of Harome. This complex (1629456) comprises a series of Iron Age/Roman rectilinear enclosures intermittently visible as cropmarks (Fig 9). The complexity of the site suggests it is likely to be a settlement with associated land parcels for stock or crops. The nucleus for the settlement might have been a square enclosure in the south of the complex, which measures 50m across. Numerous ditches extend to the north and form larger enclosures. To the north of the complex a section of trackway and enclosure appear lighter suggesting compacted subsurface features. It is uncertain whether these features are truly embanked or displaying an unusual cropmark reversal (Wilson 1982, 55).



Fig 9: A probable settlement and field system complex of Iron Age or Roman date east of Rye House Farm. The 'positive' cropmarks mapped in red are likely ditched features seen as a reversed cropmark. Archaeological mapping © Historic England; Next Perspectives APGB Imagery SE3681-2 24-JUN-2020 © Bluesky International/Getmapping PLC.

Other enclosures to the south of the A170 and of a likely similar date were seen as cropmarks south of Nawton. These were discussed in the context of their relationships to trackways above (see Fig 6). The largest (1629458) is partially visible and could be part of a wider field system. Those to the east (1476144) are smaller, one almost a perfect rectangle. Although presumed to be broadly Iron Age/Roman in date, their function is uncertain.

Moving north of the A170, the nearest site which might have some contemporaneity with the villa is a probable settlement south-east of Reagarth Farm (1003035). Visible as poor-quality cropmarks in a field with extensive geological cropmarks, this site comprises a rectangular ditched enclosure with abutting linear ditches that

appear to form part of a wider field system. A small circular enclosure is visible immediately adjacent, and with a diameter measuring 16m could be a large round house ring ditch. However, it could be a Bronze Age funerary monument unrelated to the enclosure.

A similar rectilinear enclosure is visible as cropmarks south of the similarly named Rea Garth Farm (1369619), some 1.2km north of that discussed above. Again, geological marks make the identification of any archaeological cropmarks difficult, however, there are no obvious features associated with this enclosure.

Another enclosure is visible a little to the north, on the east side of the River Riccal valley (1629358; Fig 10). Located on the prominent south-facing edge of Cow Hill, the trapezoidal enclosure has an external ditch with a possible entrance gap in the east facing side. The faint light cropmark of a broad internal bank might suggest it is a defended enclosure, most likely Iron Age in date though a Bronze Age origin could also be considered.



Fig 10: A south-west facing view of a later prehistoric enclosure on Cow Hill displaying an outer ditch with internal bank, possibly suggesting a defensive origin. ALP 2769/2 26-JUN-1975 © A.L. Pacitto Collection, YAHS

A triple-ditched curvilinear cropmark enclosure was mapped to the south-west of Reagarth Farm by the Howardian Hills Mapping Project (NRHE 1024392). If a genuine feature, the unusual morphology of this enclosure might suggest a Bronze Age or Iron Age date, but there was no sign of it on any of the photographs or lidar assessed as part of this project. It is possible the unknown photograph from which

it was originally mapped is now missing, or it might be a misinterpretation of geological features or sinuous hollow ways also noted in the area.

One of the most intriguing sites mapped by the project is located a short distance to the south of Cow Hill, on Wykeham Dale Hill (1629403; Fig 11). This site was also identified through the Ryevitalise Lidar Landscape Project as a possible late prehistoric or Roman settlement (Frodsham 2021, 22 and fig 12). This site is perhaps best described as a compartmentalised embanked enclosure. Visible only as extremely shallow earthworks on lidar alone, defining this site is difficult. It might have started out as a D-shaped enclosure with subsequent additions. There appear to be two routeways exiting the enclosure to the east down the slope. Making a V-shape, both appear to be slightly terraced into the slope (though neither are easily discernible on the ground). One heads north-east, presumably to a route along the bottom of Wykeham Dale and the other south-east towards the junction between Wykeham Dale and the A170. The field in which the earthworks are located is currently under pasture but was being ploughed within the confines of a boundary bank (also visible as an earthwork) on aerial photographs between the 1940s and the 1970s. There is another route snaking down the slope to the south-west of the enclosure. These earthworks are much more pronounced than those of the enclosure and therefore considered more recent in date.

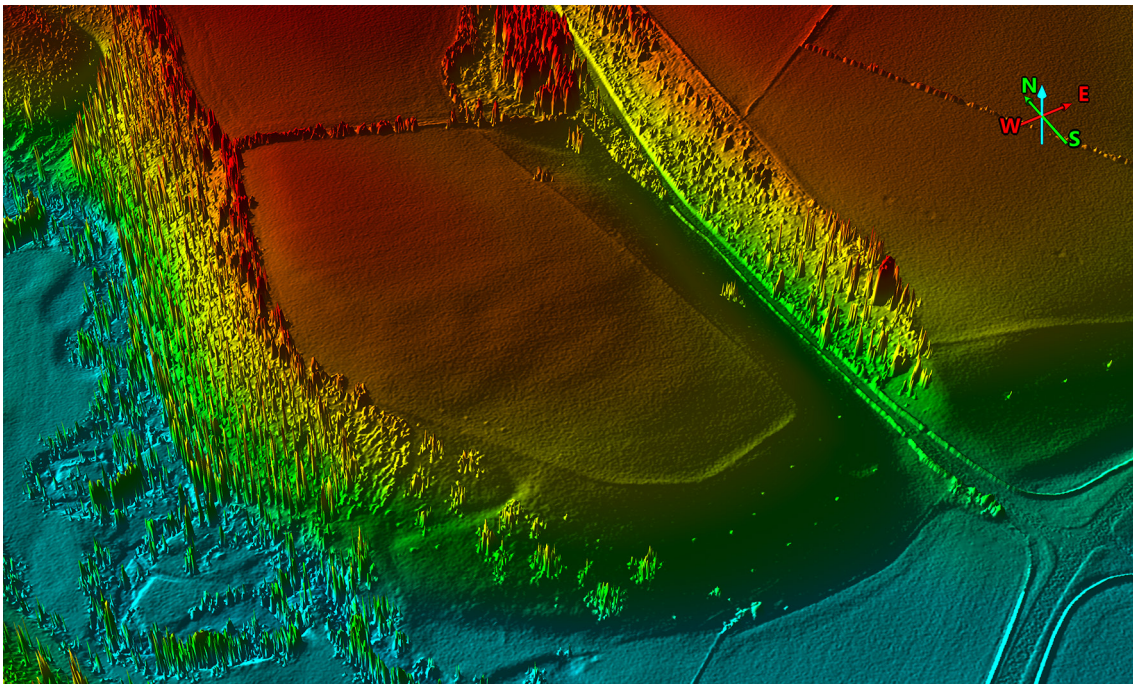


Fig 11: The possible settlement site on Wykeham Dale Hill has been almost completely ploughed level. LIDAR Digital Surface Model composite 2017 © Historic England; source Environment Agency.

Dating the Wykeham Dale Hill enclosure is challenging. The promontory location overlooking the Vale of Pickering is exposed. It is however only a small climb of approximately 20m over a distance of 80m from the current road in Wykeham Dale. Most of the farmsteads or settlements in this area which are thought to have medieval origins are generally in more sheltered locations with moderately level access to main routeways. The levelling of the earthworks on the summit of the field can be explained by the ploughing recorded on historic aerial photographs and before. The earthworks on the lower slopes however were out of the area of ploughing yet similarly denuded, presumably from natural weathering and wear. The form of the site is similar to later prehistoric and Roman enclosed settlements of the Yorkshire Dales and Northumberland and therefore could be of the same date.

However, a medieval date should also be considered. If so, given the unusual location for a farmstead, did it serve a specific function, such as a monastic grange holding? The location does not seem isolated enough to relate to the known sheep and cattle farming sites of the North York Moors that were held by the various ecclesiastical houses, nor is the site mentioned in the extensive lists of Rievaulx properties (McDonnell 1963, 110-5). Another clue might be in the placename – ‘Wykeham Dale’ and ‘Wykeham Dale Hill’ suggesting a settlement or site associated with one. There are several Wykeham’s in the region – some of which are mentioned in the Domesday survey, such as one near Malton and another in the manor of Nunnington (Williams and Martin 2003, 840). There is no mention of a Wykeham in the list of lost early medieval and medieval settlements compiled by McDonnell (1963, 414-5), but the possibility should still be considered.

Lastly, a small pentagonal enclosure was noted 700m to the west of the villa site (1629398), both by this study and also by the Ryevitalise Lidar Landscape Project. Located at the junction of a number of modern field boundaries and overlain by post medieval ridge and furrow, this small enclosure, with maximum visible dimensions measuring 65m by 60m, is unusual in form. Firstly by its shape, and secondly because it survives as an earthwork bank with good definition in an area where most enclosures are plough-levelled. It is located on a very slight natural knoll which could explain it being embanked rather than ditched due to the bedrock being closer to the surface. It appears to be slightly sunken in the centre, possibly with internal features. These are poorly defined and not visible with enough clarity to map but may be sub-circular in form. If this is a settlement enclosure it is likely to be Bronze Age or Iron Age in origin. However, the form of embanked hut circles within an enclosure is more typical of upland environments than in the lowland Vale of Pickering where locations of round houses are generally only known from cropmarks of the gully caused by run-off from the roof. Another suggestion is that the hollow centre is quarrying with the upcast spoil forming an enclosure effect, and the site being much more recent in date.

The villa

The very survival of the villa as an earthwork in a heavily farmed landscape is nothing short of remarkable. Historically, this was probably largely due to its location. The intense farming landscapes of the medieval period appear to have concentrated around the larger settlements; namely Helmsley, Harome, and Beadlam/Nawton. The further away from these settlements, the less extensive the ridge and furrow appears in the archaeological record – though this could be due to the nature of more recent farming techniques having removed evidence of earlier agricultural practices in these areas. Indeed, it was ploughing in 1964 and 1965 that first brought finds to the surface which suggested a Roman date for the site (Neil 1996, 1). Another reason for the survival of the site is that the fields adjacent to the River Riccal, especially to the east where the land is lower-lying, are prone to water logging, and with the exception of a small island on which the villa is located, this land may not have been considered suitable for arable use.



Fig 12: A south facing aerial photograph showing the north and west ranges of the villa during the excavations of 1969. Note the mosaic still in place in the foreground. Following the lifting and preservation of the mosaic, only this building was consolidated for public view. ALPC TP P295 1969 © A.L. Pacitto Collection, YAHS.

The archaeological remains visible on aerial photographs and lidar comprise visible building footings and the earthworks of buried remains (Fig 12). The former includes the consolidated footings which remain exposed today, soon to be seen by visitors on bookable guided walks. This building formed the north range of the villa which included the now-removed mosaic in room 2 (ibid, 4). The exposed remains measure 36m by 13m and include most of the excavated footings of the building. Part of the west range of the villa was mapped from historic aerial photographs taken by Anthony Pacitto whilst the 1969 excavations were taking place. These footings were subsequently reburied.

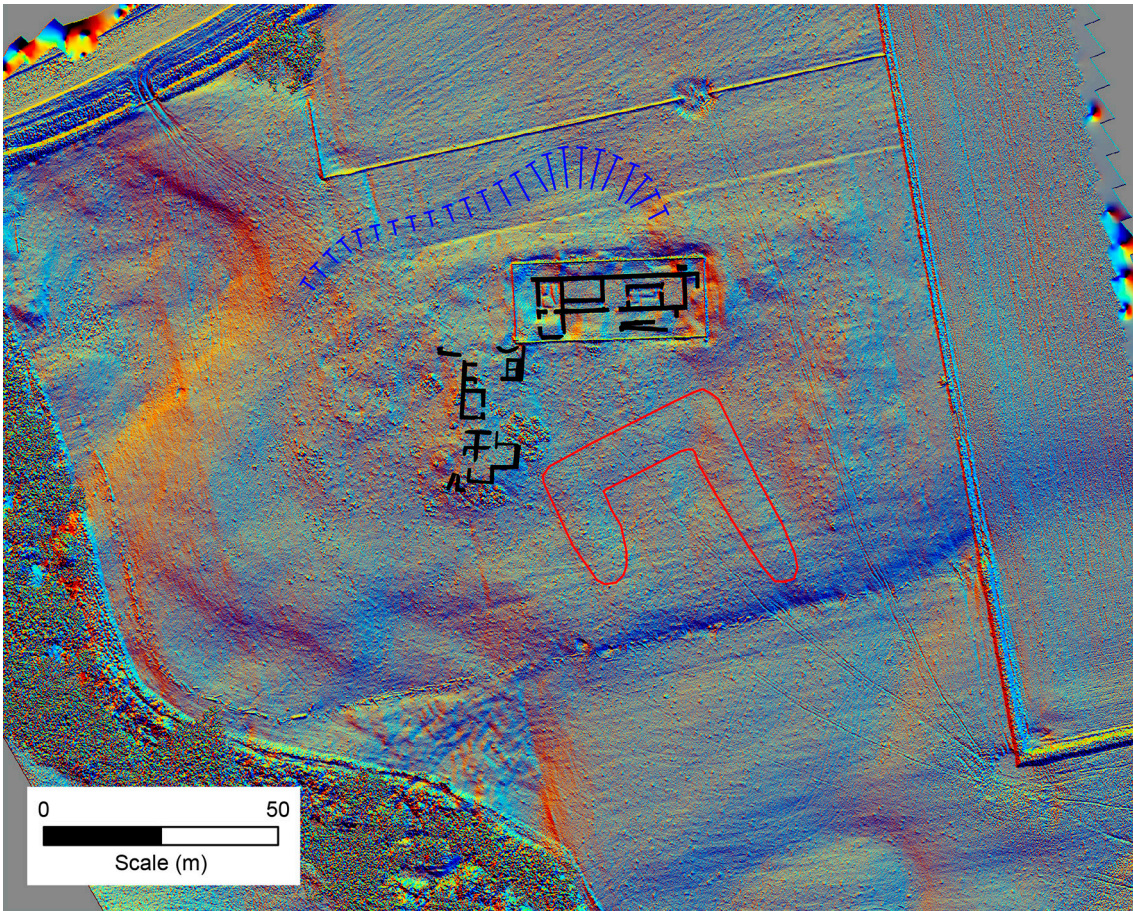


Fig 13: Archaeology visible at the villa site. The excavated buildings as seen on aerial photographs are in black. The shallow scarp (in blue) denotes the line of a pre-villa enclosure. It is not certain whether the embanked feature outlined in red is archaeological or more recent in origin. Archaeological mapping © Historic England; Structure from Motion Digital Surface Model 07-OCT-2021 © Historic England.

Of the reburied remains, the visible earthworks are amorphous and do not reflect the shape of the buildings known from excavation. The only other visible archaeology is to the north of the villa – a slight scarp relating to a curvilinear enclosure identified through geophysical survey (Payne 1993, plan 3; Fig 13), which is considered to belong to a pre-villa site, possibly a later Iron Age or early Roman period settlement with stock enclosure. Additional shallow ditches and embankments visible as earthworks may have archaeological origins, but the sinuous nature of ancient meanders of the River Riccal have also left their mark and distinguishing between the two is difficult.

There appears to be a three-sided rectangular embanked enclosure to the south of the villa buildings which is visible on both the lidar data and the digital surface model produced from the UAS survey (Fig 13). Measuring 50m by 43m this low earthwork does not align with the villa complex, or the modern field boundaries. It is possible that it might relate to spoil heaps from one of the excavations, but it does not correspond with any alignments of the known excavations visible on historic photography. The feature is also not visible on the geophysical survey undertaken in 1992, and so its date remains uncertain.

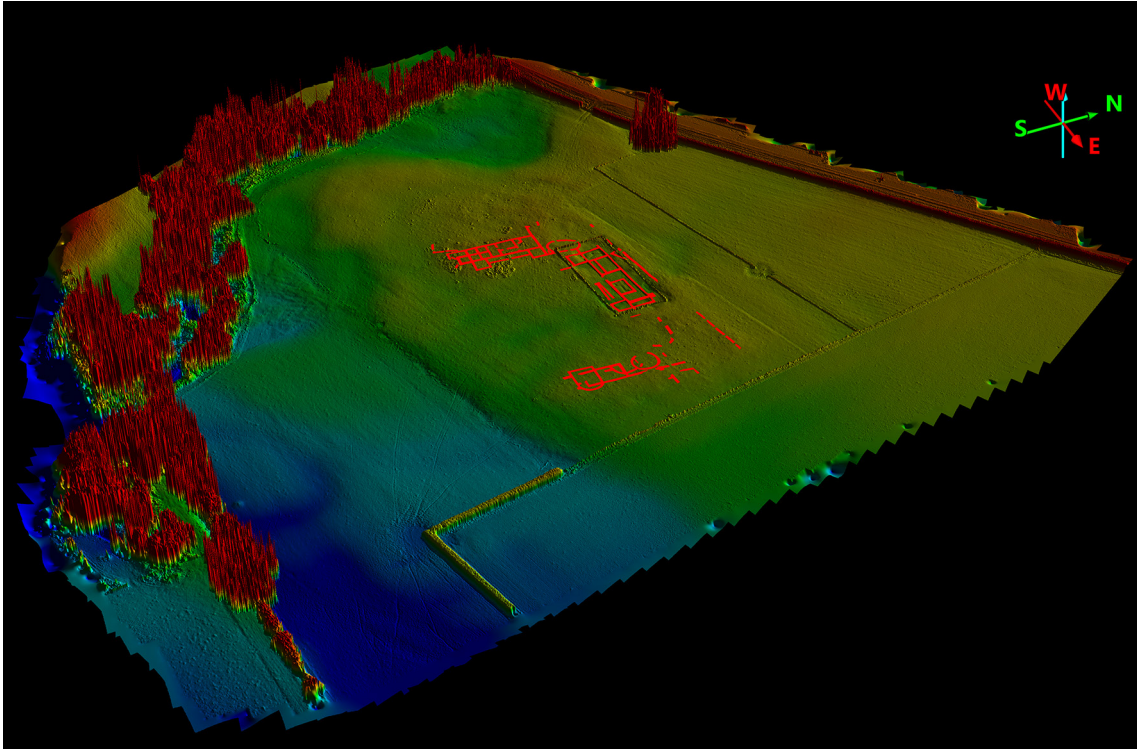


Fig 14: A digital surface model derived from drone photography showing the position of excavated footings of the Roman villa. The buildings were located on the slightly elevated dryer ground overlooking the River Riccal. Structure from Motion Digital Surface Model 07-OCT-2021 © Historic England.



Fig 15: The banks of the River Riccal are still actively eroding – the original position of the river during the lifetime of the villa may have been different to that of today. March 2022 © Historic England. Photographer Dave Knight.

Both the lidar and the UAS survey have allowed a detailed look at the topography and the siting of the settlement (Fig 14). The villa (and earlier settlement) were located on a slightly elevated plateau of better drained ground. The drop-off to the river to the west is only 1m but is enough to make a difference to the drainage of the soils. To the south the river is 2m below the site of the villa. The banks of the River Riccal at this point are very shallow and even today it is evident that the riverbanks are actively eroding (Fig 15), though the river can also run dry in the summer months. The current river course has been managed in at least one place by concrete shoring and is partly canalised under the bridges over the A170 and the old railway bridge. Historic meanders of the river are evident on the elevation models to the west and south of the river, but it is uncertain whether these are from recent-history or palaeochannels.

The medieval landscape

A great deal of the medieval landscape is preserved as earthworks, or at least was on early vertical aerial photographs. The remains appear to be focussed on the settlements of Helmsley, Harome, Beadlam, Nawton and Pockley. Large areas of ridge and furrow form part of a medieval open-field system to the east of Helmsley (Fig 17) and around Harome (Fig 16) and Beadlam/Nawton. Gradually over the last several decades, intensive farming practices have levelled many of the earthworks but they are well preserved in some areas, notably south-east of Harome and east of Helmsley.

There is less evidence of medieval agricultural practices further from the settlements. It is unclear whether the open fields were concentrated around the villages, or whether those areas most distant from the settlements have been subjected to more modern farming practices for longer – levelling earlier agricultural marks. This may also be a reflection of the geography. The north-western corner of the Vale of Pickering is largely dominated by water courses and the wetter land adjacent to the Rivers Rye and Riccal might not have been ploughed during the medieval period. Certainly, in the case of Beadlam villa sited on the east bank of the Riccal, this field had not undergone any intensive farming evidenced by the remarkable survival of the villa.

Precise dating of ridge and furrow is challenging and a medieval date is generally attributed where ploughs formed broad ridges and broad and sinuous furrows. A sequence of development can be determined through detailed examination of the earthworks but dates for the origins and longevity of the fields is difficult. Straighter and narrower ridges and furrows are usually associated with steam ploughing and the post medieval period. However, there is some evidence of use of ox-drawn ploughs into the post medieval period. Interestingly, the Helmsley estate 1642 survey allows a rare insight into early enclosure and the end of the open field system. As an example, a field known as ‘Swangs’ to the north-east of the town, was already enclosed by 1642 (McDonnell 1963, 210), therefore suggesting that the ridge and furrow (of which most remains extant) pre-dates this (Fig 17).



Fig 16: Ridge and furrow forming part of medieval open-field systems were mapped from a mix of historic aerial photographs (recording some earthworks since levelled) and lidar data around the village of Harome. Archaeological mapping © Historic England. Base map © Crown Copyright and database right 2019. All rights reserved. Ordnance Survey Licence number 100019088.

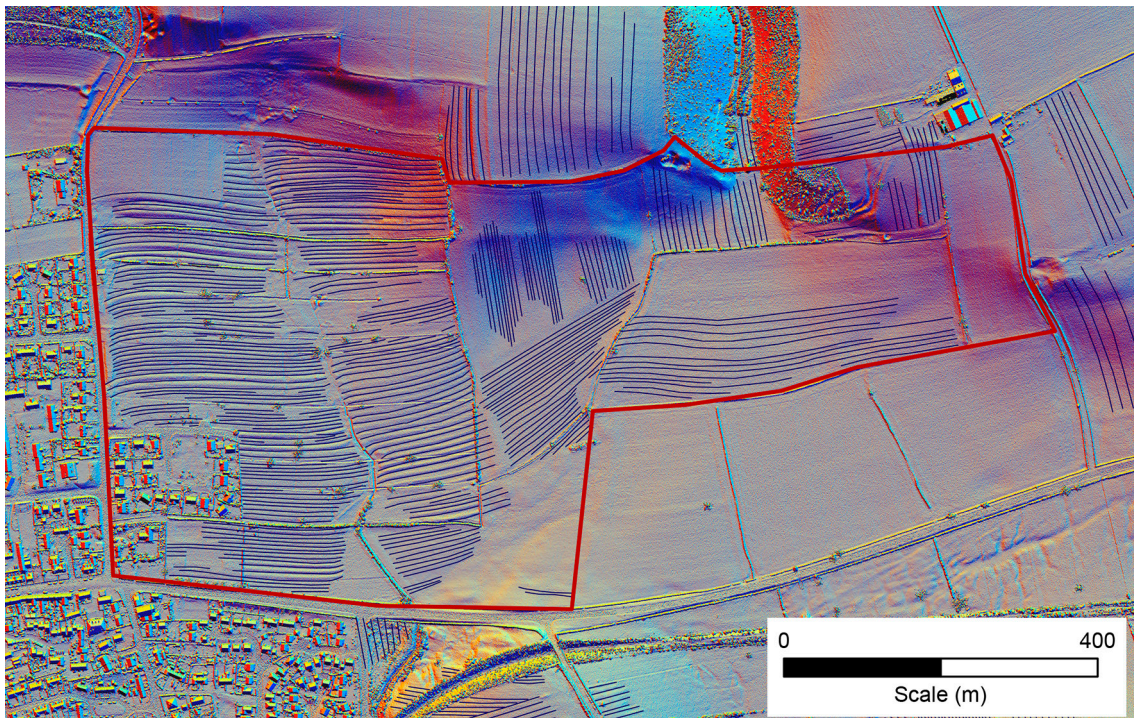


Fig 17: The parcel of land known as 'Swan Field' or 'The Swangs' was already enclosed by 1642, suggesting that the remains of open-field system ridge and furrow (partly mapped in dark blue – that to the west outside the project area and visible as earthworks) pre-date this. Archaeological mapping © Historic England. LIDAR Digital Surface Model composite 2017 © Historic England; source Environment Agency.

Isolated fragments of medieval and post medieval occupation were identified in and around the primary settlements. There are numerous earthworks within the present-day village of Pockley that are the remains of previous land division, small-scale extraction, buildings and cultivation (1629409; Fig 18). Buried field boundary walls and a probable building are located on land to the immediate south of the Church of Saint John the Baptist. The earthworks of a possible range of buildings are visible on an oblique photograph from 1984 in the south of the village, though they do not appear on other photography, so may relate to ephemeral agricultural use rather than a farmstead. There are likely additional earthwork building footings throughout the village, but the quality of the photography is generally poor and identification is difficult.



Fig 18: An orthomosaic image of Pockley derived from oblique aerial photographs. Numerous earthworks, including field boundaries, cultivation and buried building footings are visible. NMR 1705/10-23 02-NOV-1979 © Crown copyright. Historic England Archive.

There is a concentration of archaeological earthworks in Beadlam and Nawton (1629425). There are earth covered foundations of a building to the north of the village of Nawton (Fig 19), in the field opposite to the lane running down to what was Nawton Hall. The earthworks suggest it was a large rectangular building with at least two internal divisions. The building sits atop medieval ridge and furrow and is likely to be a post medieval building/farmstead. A small circular structure appends the building to the north. This is a post medieval pond for the watering of livestock – a common feature in this region and which remained in use until at least 1912 as it is marked on the Ordnance Survey maps. Numerous examples of these ponds are visible in the mapping area, often showing as the soilmarks, but as they were all illustrated on early edition Ordnance Survey maps, they were not mapped by this project– except in this once instance due to the association with the building.

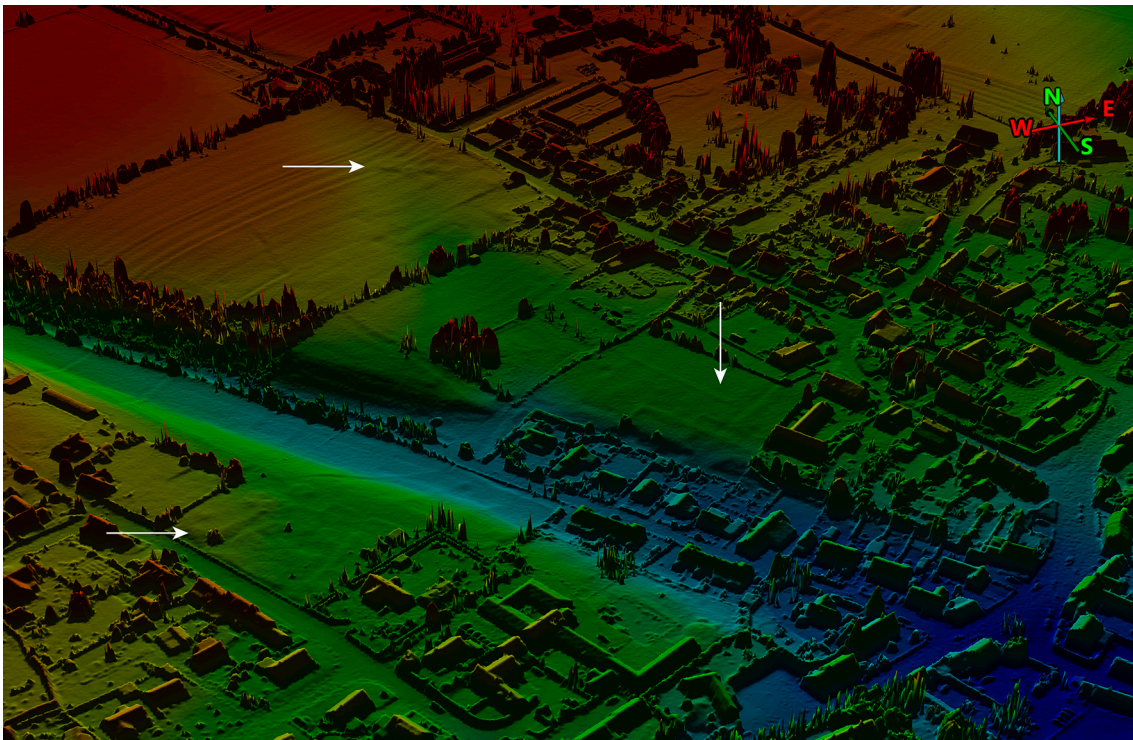


Fig 19: There are several locations in the villages of Beadlam/Nawton where buildings and land parcels are visible as earthworks. They are largely post medieval in date, though elements may be medieval. LIDAR Digital Surface Model composite 2017 © Historic England; source Environment Agency.

There is further evidence for buried building remains on either side of Howdale Lane in Beadlam (Fig 19). In both cases rectangular elements interpreted as buildings are associated with small land parcels and other earthworks which might represent smallholdings or farmsteads.

Away from the settlements there are numerous instances of buried building remains, or concentrations of amorphous earthworks that might suggest settlement. One such site is located to the east of Helmsley at the junction between Acres Lane and the A170 (58784). At least one building is visible, with possible hints of additional building platforms. The earthworks in this small triangle of land appear very disturbed. There is ridge and furrow to the west and south. Along with amorphous earthworks to the north side of the road (908695), the undulating nature of the

earthworks might again suggest livestock management and excess trampling, related to the hollow way extending towards the River Riccal a little to the east (1629407). The earthworks to the north of the A170 survived as earthworks until the 1990s but now only show intermittently as confusing soilmarks – but some suggest structures may have been present before being plough-levelled.

A medieval moated site is located in the south of the project area, adjacent to Harome Siding (58816). The moat was truncated by the Gilling and Pickering Branch Railway in the 1870s (Fig 20). There appear to have been internal banks with depressions between where the hall was located, which was reputedly still visible in 1948. There is sub-circular enclosure to the east of the moat defined by a broad bank on the west and narrow banks enclosing the rest. A sinuous north-south hollow way curves around the east side of the enclosure. Within the enclosure is a small circular platform of unknown function and a possible long rectangular building to the south.

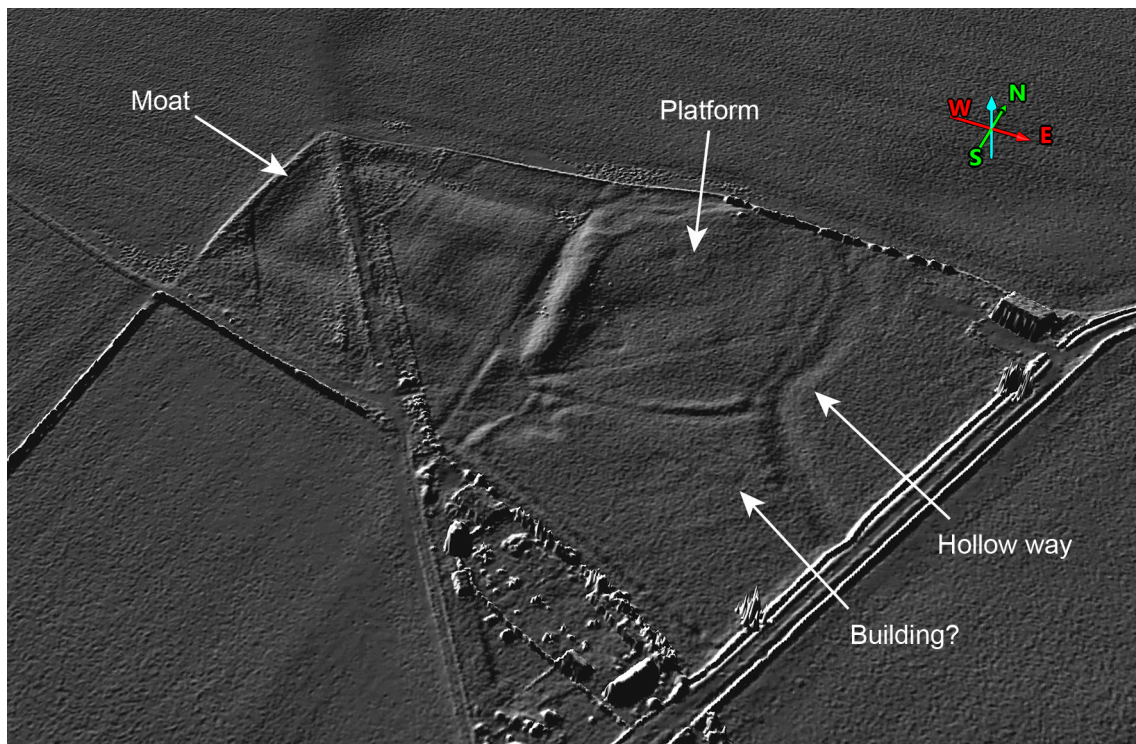


Fig 20: A moated site immediately north of Harome Siding is visible on lidar as a complex of earthworks, including an outer enclosure, circular platform and possible hall-building. Hollows within the moat might show where buildings were once located. LIDAR Digital Surface Model composite 2017 © Historic England; source Environment Agency.

Industrial activity

Localised small-scale extraction was visible concentrated along the edge of the Tabular Hills and along the River Rye, and where labelled on historic maps, was exclusively for limestone. In one instance a kiln is shown on the first edition Ordnance Survey map, now only visible beneath the tree cover as two small depressions on the lidar digital terrain model (1629448). These small areas of extraction, some of which are in the villages themselves, were probably for the use of local farms for the production of lime for land improvement (McDonnell 1963, 181).

Second World War

There are a number of ancillary camps associated with the Second World War airfield RAF Wombleton, on the east edge of the project area (1629417). Eight camps led off Gale Lane to the south of Beadlam. They all comprised a series of accommodation blocks with separate toilet blocks, some linked by roads and some with concrete and embanked air raid shelters. Additional camps were noted to the east outside the project area and not mapped.

A further dispersed camp (1629424) was mapped in Nawton as three rows of accommodation huts aligned along existing field boundaries which afforded some degree of camouflage from above. This particular camp did not follow the usual layout or include features commonly associated with airfields so might have been an army base.

Recommendations

This mapping survey has provided a useful archaeological context for the setting of Beadlam Roman villa, drawing on previous work and providing an accurate mapping dataset. Although no archaeology was positively identified as associated with the villa, the results illustrate the subsequent development of the landscape throughout later periods. The isolated fragments of cropmarks also hint at the large degree of the buried earlier landscape which is not visible in the aerial record, which lends more questions about the Roman period in this corner of the Vale of Pickering.

The study has also highlighted the importance of the earthwork survival of many features throughout the project area. Of particular note are the previously unrecorded probable Bronze Age round barrows. These are candidates for potential designation assessment should the need arise. Further work, including analytical earthwork survey and geophysical survey would aid interpretation.

The two enclosures adjacent to the villa site also warrant further work. The small octagonal enclosure between Beadlam Roman villa and Helmsley is an anomaly. If it is an enclosure and not simply extraction, then an enclosure of this type with tentative internal round houses is not what would be expected in the lowlands – being more akin to the uplands. The site needs to be assessed further on the ground to establish its probable use before it is assigned a date.

Similarly, the interpretation of the enclosure on Wykeham Dale Hill is also largely an uncertain. In this case there is little doubt through the complexity of the sites, that it is an enclosure, probably a settlement or farmstead of unknown date. However, it does not fit into the later prehistoric, Roman or medieval landscapes based on its location and morphology alone. Further study, perhaps in the form of geophysical survey, might be most suited to establish a date for the site.

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APPENDIX 1. METHODS AND SOURCES

Archaeological Scope

Mapping and recording was carried out for an area of 20sq km, centred on the site of Beadlam Roman villa. The mapping and recording scope included all archaeological features visible as earthworks, cropmarks, soilmarks and structures visible on aerial photographs and lidar ranging in date from the late prehistoric to the 20th century. Mapping was undertaken to Historic England's Aerial Investigation & Mapping (AI&M) Standards.

Earthworks

All archaeological earthworks, including features that were visible on early aerial photographs that have since been levelled, were mapped. This includes features that were depicted on historical OS maps when they were deemed to be within the AI&M sphere of interest.

Cropmarks and soilmarks

All sub-surface archaeological remains visible as cropmarks and soilmarks were mapped.

Buildings and structures

Standing and roofed buildings and structures were not mapped. Exceptions to this were in specific archaeological contexts, such as military and wartime features.

Ridge and furrow

Medieval and post medieval ridge and furrow was mapped, regardless of preservation. Each furrow was depicted with a single polyline.

Post medieval field boundaries

Field boundaries (upstanding or levelled) that are depicted on historical OS mapping were not mapped unless they were specifically associated with other archaeological features.

Industrial features and extraction

All extraction, irrespective of size, was mapped and recorded.

Second World War and military features

Military features up to and including the Second World War were mapped as seen, including roofed structures.

Natural features

Geological and geomorphological features were not mapped.

Sources

Aerial Photographs

The aerial photograph collections of the Historic England Archive, the North Yorkshire County Records Office and the North York Moors National Park Authority were assessed.

A total of 189 vertical and 189 oblique photographs were loaned by the Historic England Archive. Of these, 148 were supplied as original prints, 41 as laser prints and 18 digitally. The vertical photographs ranged in date from 1941 to 1994 and were predominantly RAF, Meridian Airmaps and Ordnance Survey photography. The oblique photography ranged from 1929 to 2006 in date. This was primarily reconnaissance photography taken by the RCHME, RAF imagery or photography taken by local fliers such as Anthony Pacitto.

Additional photography taken by Pacitto was supplied by the Aerial Archaeology Committee of the Yorkshire Archaeological and Historical Society (YAHS).

The oblique aerial photographs and some vertical cover held by the North Yorkshire County Records Office and the North York Moors National Park Authority were also assessed. A small number of oblique images were scanned and used to aid archaeological transcription and interpretation.

In addition to these collections, full coverage of digital ortho-rectified photography at 12.5cm and 25cm resolution was supplied as TIFF files through the APGB agreement by Next Perspectives, ranging in date from 2001 to 2020. This imagery was used as the latest evidence attribute in the mapping and was also used as control for the rectification of printed aerial photographs. Google Earth orthophotography was also assessed.

Evaluation of photographs

All vertical print photographs were viewed under magnification and stereoscopically where possible. Images supplied digitally were viewed in 2D on screen.

Rectification of photographs

In order to map from an aerial photograph, it must first be rectified to remove distortions and georeference the image. Rectification of vertical and oblique aerial photographs was undertaken using Aerial 5.36. Control was derived from 12.5cm resolution APGB orthophotography. Digital height data, derived from the APGB 5m digital terrain model were incorporated to improve the accuracy. The accuracy of rectified images is normally to within $\pm 2\text{m}$ of the source used for control, but this

error may be larger in areas with a larger topographic variation. Consequently, the accuracy of mapped features relative to their true ground position will depend on the source used for mapping.

To attempt to streamline this process for one run of oblique photography, Structure from Motion (SfM) was used to mosaic and rectify multiple images at once. This is a digital photogrammetric method of rendering a single mosaicked orthophotograph from a series of images using Agisoft Metashape Professional 1.7.5. Control was taken from a combination of APGB orthophotography and 5m height data.

Lidar and height data

Environment Agency lidar at 1m resolution was downloaded from the Government DEFRA Survey Data Download website in ASCII grid format. This came as digital surface model (DSM) and digital terrain model (DTM) data. The DTM could allow a view of the ground beneath vegetation cover and was particularly useful in mapping remains in woodland.

The lidar and height data were processed using Relief Visualisation Toolbox 2.2.1 (Kikalj and Somrak 2019; Zakšek *et al* 2011) to produce 2D GeoTIFF images. The visualisations used were 16 direction hillshade, slope, simple local relief and positive openness. Lidar was also viewed as 'live' data in Quick Terrain Reader v8.0.4. Where used for mapping, the lidar has sub-metre accuracy.




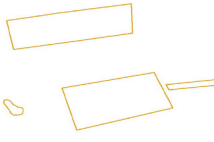


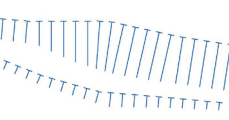
UAS Survey

A mapping survey was undertaken of the scheduled area of Beadlam Roman villa using a DJI Phantom 4 Pro drone. The flight was undertaken at 35m above ground level and captured 553 vertical photographs. With the aid of ground control taken using a Trimble R10 integrated Global Navigation Satellite System (GNSS) calibrated using a Virtual Reference Station (VRS) for networked real-time kinematic (RTK) survey, the imagery was processed using the digital photogrammetric method, Structure from Motion to produce an orthomosaic and digital surface model at 2cm resolution.

Mapping from aerial sources

The georeferenced imagery was imported into ArcGIS 10.7.1 ArcMap where features were digitised. All archaeological features were mapped as closed polygons, apart from scarps, where a schematic t-hachure was used, and the polyline denoting furrows. Due to the inability to create linear arrays of t-hachures in ArcMap, the tops and bottoms of slopes were depicted as lines and exported to AutoCAD Map 3D 2019 to illustrate the schematic t-hachures, which were then reimported as line data to ArcMap.

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	Grey	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	

All vector elements of the mapping had attribute data, as defined in Table 2. The monument polygons simply had the HE_UID and HER_NO (where available) attached.

Table 2. Aerial mapping attribute data

Attribute	Description	Sample data
LAYER	Mapping layer in which feature has been mapped	BANK
HE_UID	Historic England Research Record Unique Identifier	1629409
PERIOD	Date of feature (HE Thesaurus)	MEDIEVAL/POST MEDIEVAL
NARROWTYPE	Specific monument type for individual features (HE Thesaurus)	BUILDING
BROAD_TYPE	Broader monument type to enable grouping of individual features (HE Thesaurus)	SETTLEMENT
EVIDENCE_1	Form of remains as seen on PHOTO_1 (HE Thesaurus)	EARTHWORK
PHOTO_1	Source feature was mapped from	NYCCRO ANY 169/29 23-JUL-1984
EVIDENCE_2	Form of remains as seen on PHOTO_2 (HE Thesaurus)	LEVELLED EARTHWORK
PHOTO_2	Latest available source to give indication of current state of preservation	Next Perspectives APGB Imagery 24-JUN-2020
HER_NO	Historic Environment Record concordance UID	MNY1234

Recording the archaeological monuments

Archaeological monuments were recorded to Historic England Data Standards as Historic England Research Records. Some of these were updates of the previous National Record for the Historic Environment (NRHE) database. Where relevant, records were concorded with HER data. In total, 54 new monument records were created and 16 were amended. Monument records can currently be accessed via the Heritage Gateway website (www.heritagegateway.org.uk). This is only a transitional phase – all existing and new records will eventually be transferred to the local authority Historic Environment Records (HERs). The mapping is deposited with the relevant HER and the Historic England Archive and will be available to view on the Aerial Archaeology Mapping Explorer (<https://historicengland.org.uk/research/results/aerial-archaeology-mapping-explorer/>).

Historical Mapping

Early edition Ordnance Survey maps were assessed to establish the dates of features including field boundaries, extractive pits and ponds.

Digital data sources

From the outset of the mapping, several digital data resources were loaded into the ArcMap drawing document and routinely consulted throughout. These included the point, polygon and polyline monument record and event data for both the North Yorkshire County Historic Environment Record and the North Yorks Moors National Park Authority and for the NRHE. The National Heritage List for England (NHLE) was also consulted, primarily for information relating to scheduled monuments and listed buildings.



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