Historic England

Research

Discovery, innovation and science in the historic environment

Going Underground

Funding Heritage Research

Historic England

Issue 01 | Spring 2015

As a Commissioner of Historic England and Chair of its Advisory Committee I am delighted to introduce this first issue of Historic England Research. A good understanding of the historic environment is fundamental to helping people appreciate and enjoy their heritage and provides the essential first step towards its effective protection. The work of discovery, interpretation and innovation that Historic England will now undertake and sponsor builds on our work as English Heritage and will be vital in improving this understanding.

In the next issue we will outline our future plans in more detail. In the meantime this issue explores a selection of the fascinating projects on which we are already working. These range from the use of aerial drones for survey to advances in ground penetrating radar and from man-made caves in Nottingham to housing for the elderly in London. I hope this will whet your appetite to learn more about the exciting and wide ranging research work of Historic England.

Mike Fulford

Commissioner, Historic England

In this issue...

The East Coast War Channels in the First World War

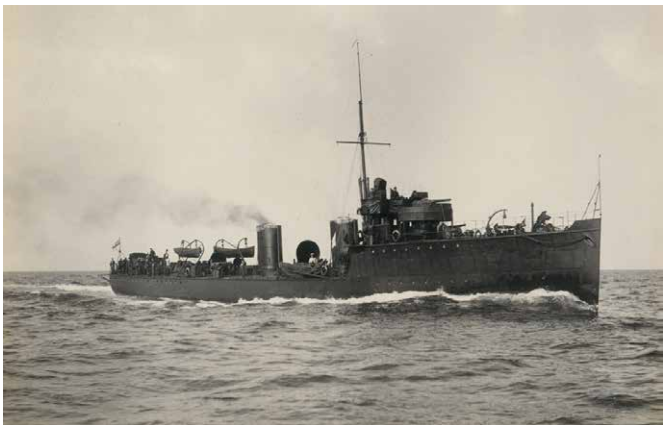
Rediscovering a lost battlefield in the North Sea.

At the very start of the First World War, the *Kaiserliche Marine* – the Imperial German Navy – laid mines off the east coast of England, sinking several merchant ships and fishing vessels. This was a largely unexpected and potentially devastating assault. It was vital for both the transport of cargo and the supply of food that the safety of vessels up and down the east coast was maintained. The transport of coal from the north east to the south of England was especially important, especially when, after the initial German advance, France lost access to its own coalfields.

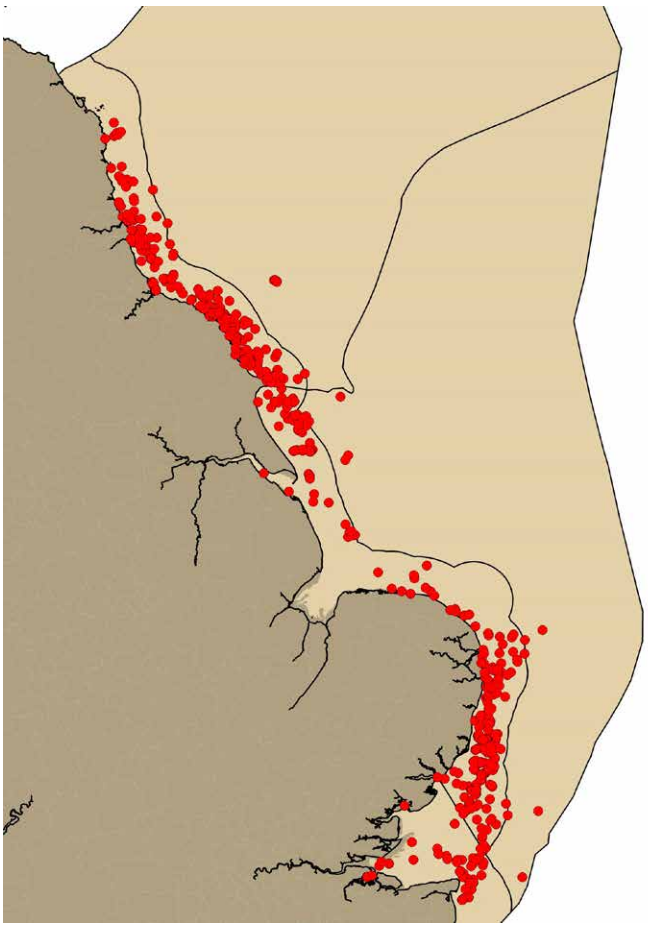
Faced with the invisible and extensive threat of mines off the east coast, the Admiralty concluded as early as August 1914 that attempting to remove entire minefields was not an option; minesweeping would have to be restricted to a specific channel. This became the known as the War Channel. As a result, Germany targeted the shipping that was confined to this channel and a fiercely contested battlefield developed that stretched from the Thames to the Tyne and beyond.

The battle on the east coast was fought throughout the First World War and was well-known at the time. As well as being a focus of huge operational and bureaucratic effort, the public were made aware of what was happening through posters, films, poetry, and songs; and through the impact that the many casualties had on families and communities. By the time of the current centenary, however, this battlefield had been almost forgotten. This is in spite of the fact that, unlike so many of the battlefields of the First World War on land, the East Coast War Channels are still covered in the standing remains of the conflict, including a huge assemblage of shipwrecks.

In order to raise the profile of the east coast battlefield and increase understanding of its importance, Historic England commissioned first a scoping project (Firth 2014)

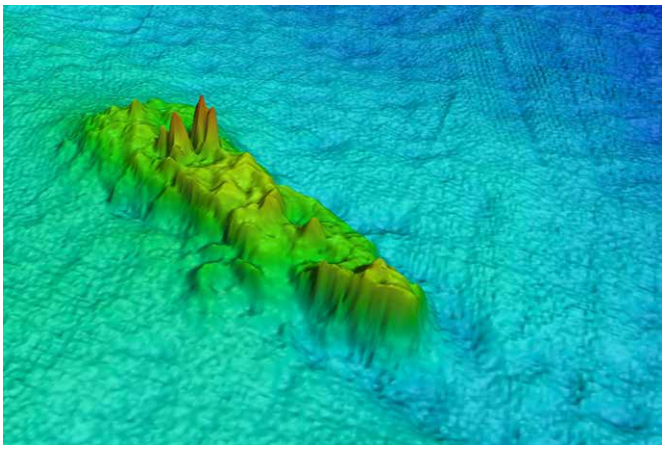


HMS Kale, one of the minor warships engaged in protecting the East Coast War Channels. The Kale hit a mine and sank in the outer Thames in March 1918. Tyne & Wear Archives & Museums



Distribution of known shipwrecks from the First World War on the east coast, as recorded in the National Record of the Historic Environment. Fjordr, data provided by Historic England

The Tower Hill Memorial records the names of thousands of fatalities from the Merchant Navy Marine. As just one east coast example, Madame Renee was torpedoed by a U-boat just off Scarborough in August 1918. AJ Firth / Fjordr



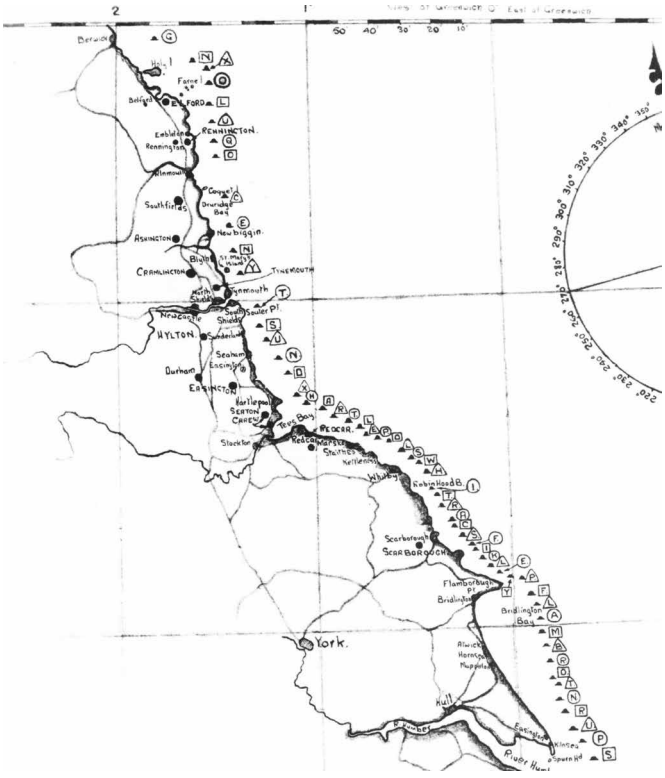
Multibeam image of the wreck of the SS Storm, sunk by a torpedo from a German floatplane in the outer Thames in September 1917. Multibeam data courtesy of London Gateway; image © Wessex Archaeology

and then a more extensive phase of work. The aim of this current phase is to work with a network of community-based initiatives to increase public awareness of the East Coast War Channels and generate additional information that can be incorporated into local and national historic environment records. On behalf of Historic England, Fjordr Ltd – a consultancy specialising in marine archaeology – has engaged with a range of local and national initiatives to improve records of wrecks and other sites.

The principal casualties of the battle were merchant ships, fishing vessels, and the minor warships such as minesweepers and patrol boats that sought to protect them. The wrecks number in their hundreds: the scoping project indicated over 550 known wrecks associated with the East Coast War Channels in the First World War; a further 800 losses are recorded from documentary sources but are not yet linked to physical remains.

Although the wrecks are predominantly of British cargo vessels, this generalisation masks great diversity. This was a world war, even on England's east coast. Ships built, owned or operated from many places around the globe lie just beyond familiar beaches and cliffs.

Many people died in these ships; often, they have no grave but the sea. Their names are recorded far from where they died, on war memorials at Tower Hill, Chatham, Portsmouth, Plymouth and elsewhere; the wrecks themselves are all that marks their last resting place.. The seafarers display the same diversity as their ships, and commemoration of their death has often separated them from their shipmates: Ghaus Muhammad and Muhammad Abdul of the Indian Merchant Service died when the SS *Audax* was torpedoed off North Yorkshire and are commemorated in Mumbai; whilst the only other casualty, Gustav Johansson – born in Sweden – is named alone at Tower Hill. Again, it is the wrecks themselves that can form the most powerful focus for piecing together the impact of the war.



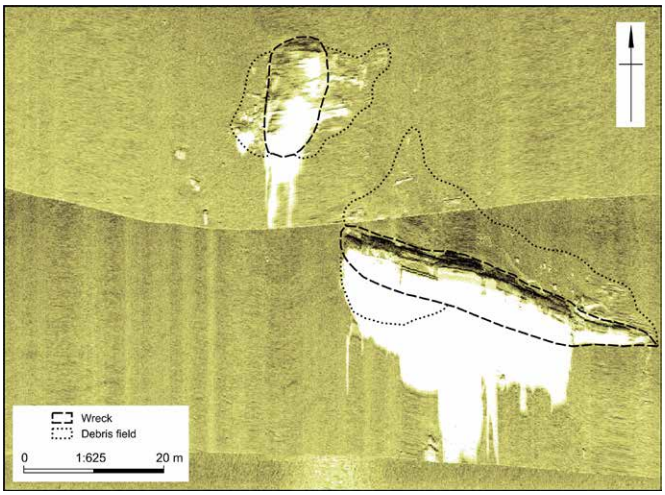
Airman's chart showing the buoys that marked the East Coast War Channel. Courtesy of Cross & Cockade International

U-boats were the main cause of losses. They sank ships using torpedoes, especially from 1917 onwards, but it was their role as hidden minelayers that caused the most destruction. U-boats also sank ships by gunfire, and by sending crew aboard their targets to set off explosives or to let in water by opening seacocks. German surface ships accounted for some losses too, especially by minelaying in the early months of the war. For example, while Scarborough was being bombarded in December 1914 by the German battlecruisers *Derfflinger* and *Von der Tann* the accompanying light cruiser *Kolberg* laid mines which sank 15–20 merchant ships and minesweepers, causing far greater loss of life than occurred in the onshore attack. Later in the war, Germany developed floatplanes that could drop torpedoes, sinking merchant ships such as the SS *Storm* off Essex in some of the earliest ever uses of torpedo bombers in action.

Although the wrecks on the East Coast are numerous they are by no means randomly distributed. The assemblage displays patterns both chronologically and spatially and these inform our understanding of the conflict. Many ships lie where they were attacked, but vessels often struggled on before succumbing elsewhere; in other cases the vessel was saved or the wreck was entirely removed so there are no remains still present.

However the character of the East Coast War Channels as a battlefield – a structured space in which defensive and offensive capabilities were organised – was not so much determined by the U-boats as by the ways in which the British authorities sought to maintain the flow of shipping. As these efforts were largely successful, the wrecks provide insight not just into individual losses, but into all of those ships that carried on their business without loss. The wrecks are a trace, in summary, of a designed landscape at sea that was very heavily used.

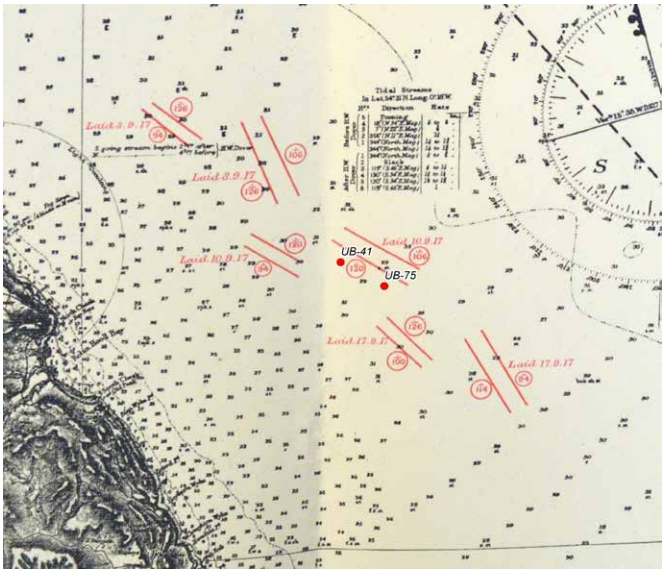
The East Coast War Channels themselves formed the spine of the battlefield. The main War Channel ran roughly parallel with the coast and had buoys marking its entire length. Other channels branched off landward from the War Channel to east coast ports, or seaward to join the principal routes to the Continent, the Baltic and Scandinavia.



Sidescan image of the wreck of UB-75, sunk in December 1917 with the loss of all hands. © Wessex Archaeology

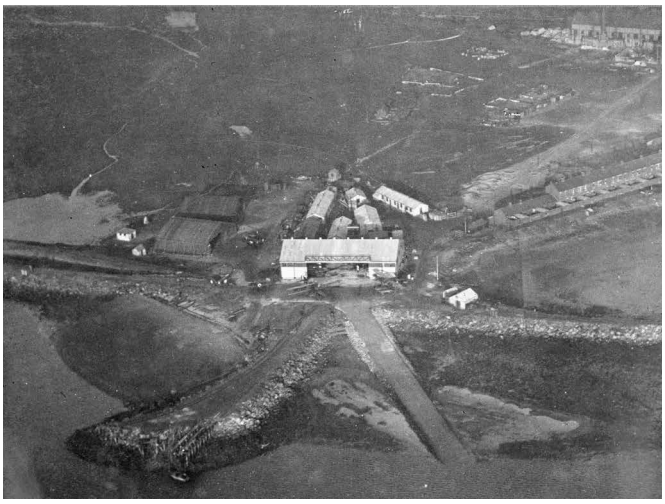
The constant sweeping of these channels was extremely hazardous. Many of the wrecks in the East Coast War Channels are of minesweeping trawlers that had been requisitioned from the fishing fleet. Although depleted by the large numbers of fishermen and vessels that transferred to the Royal Navy, commercial fishing had to continue because it provided an essential source of food. As a result, those vessels still engaged in fishing also became a target for the Imperial German Navy, which would wipe out whole fleets at a time.

Fishing vessels also fell victim to mines. Beyond the War Channels, the Admiralty constructed its own minefields, principally as a form of defence. But British mines were



The positions of the wrecks of UB-41 and UB-75 relative to deep mines laid by the Navy in September 1917. © Wessex Archaeology. Background chart from material held at the UK Hydrographic Office

Women of the Women's Royal Naval Service wiring glass floats to anti-submarine nets at Lowestoft in 1918.
© Imperial War Museum, Q 19642



Seaton Carew air station, from which floatplanes patrolled the East Coast War Channels; the slipway here survives to this day.
Courtesy of Cross & Cockade International

also a hazard to any shipping – irrespective of loyalties – that strayed within them, whether through navigational error or stress of weather. As well as mines, obstructions were constructed at sea, especially off Essex and Kent. Formerly secret charts show the individual lines of these mines and obstructions, adding to the sense of a constructed landscape. The material remains of these features may still lie on the seabed in the form of anchors and cables, as well as the mechanical sinkers from which mines were deployed.

The Royal Navy also laid small groups of 'deep' mines at depths where they could trap U-boats without endangering craft at the surface. The evidence for such deep mines is apparent off Robin Hood's Bay where the wrecks of UB-41 and UB-75, lost in October and December 1917 respectively, lie close to the charted position of mines laid that September.

Physical obstructions were deployed in rivers and estuaries approaching North Sea ports, including those of the Medway, Swale, Thames, Harwich, Humber, and Tyne. Submarine nets, torpedo nets, piles, rafts, and dolphins (wooden or concrete structures built into the seabed and extending above the water) formed booms across key approaches, which had gates tended by dedicated defence vessels.

Other port-related infrastructure included Port War Signal Stations, which controlled communications with ships entering and leaving harbour. These stations were re-used in the Second World War when they were mapped at Blyth, Tynemouth, Sunderland, Hartlepool, South Gare (Tees), Spurn Head, Great Yarmouth, Lowestoft, and Great Nore Tower in the Thames. It seems likely that the shore establishments – known as 'stone frigates' – in each of the ports where naval vessels were based would also have seen material changes, both to their buildings and to their waterfront facilities. The same might also be true of the wharves and jetties where the merchant ships themselves loaded and discharged, reflecting the same pressures that were affecting the whole wartime economy. Certainly, shipbuilding underwent expansion both to provide naval vessels and to make good losses to merchant ships, whether on the east coast or in other theatres. Wartime shipbuilding facilities ranged from smaller yards building trawlers to entirely new ones built under emergency powers, such as the Haverton Hill yard on the Tees, the slips of which are still visible today.

The effect that the maintenance of shipping through the East Coast War Channels had on the landscape was not just limited to ports. Though more often associated with the Second World War, air power and signals intelligence were also important in 1914–18. Wireless stations were situated along the east coast both to intercept enemy signals and to fix the position of vessels by direction finding.

Air power was used very extensively above the East Coast War Channels, both to patrol for U-boats and

Women excavating the basin of a new shipyard at Haverton Hill, Stockton-on-Tees, in 1918. © Imperial War Museum, Q 20143

to escort convoys. As the endurance of First World War aircraft was quite limited, numerous air stations were built at or near the coast. As well as land-based planes, flying boats and floatplanes were deployed from waterfront air stations, the remains of which still survive at some locations. Lighter-than-air craft played a surprisingly important role, especially self-propelled balloons that could patrol for many hours, again represented by air stations whose remains still stand, for example at Seaton Carew, County Durham.

Losses to merchant ships and fishing vessels on the east coast carried on right up to the end of the First World War – and indeed afterwards, as stray mines continued to kill. Nonetheless, traffic kept flowing along the coast. The battlefield was not ceded to the enemy, though enormous military, organisational, and human resources had to be deployed in holding the line. As a monument to the industry and attrition of total war, the East Coast War Channels have a certain amount in common with other, better-known, battlefields on land. But this battlefield was right on England's doorstep with civilians in the firing line, and it is only now that it is starting to be recognised.

Hunstanton Wireless Station, part of the chain of stations that intercepted signals and calculated the positions of U-boats. © Historic England

Author

Dr Antony Firth MCIfA
Director of Fjordr Limited (www.fjordr.com), and a member of the Historic England Advisory Committee and Historic Wrecks Panel.

Antony became involved in archaeology when working as a volunteer diver, and has since worked on a wide range of marine archaeological projects. He grew up in North Yorkshire near the east coast and continues to be fascinated by its hidden histories.

The East Coast War Channels 1914–18 project is due to continue until March 2016. For more information contact Antony Firth at info@fjordr.com.

Further Reading

Firth, A 2014 *East Coast War Channels in the First and Second World War*. Tisbury: English Heritage and Fjordr, available at: www.HistoricEngland.org.uk/images-books/publications/east-coast-war-channels-first-and-second-world-wars/

A 17th-century warship off Southend-on-Sea

The remains of the *London* are at risk of being lost entirely. Excavation of the site began in 2014.

The *London* was built in 1656 and saw active service in the siege of Dunkirk two years later. She was part of the fleet that transported King Charles II to England for the restoration of the monarchy in 1660, and in 1665 – at the beginning of the second Anglo-Dutch War – she was on her way to the Hope (near Gravesend) when she was torn apart by a massive explosion. The *London* had recently been made flagship of the Red Squadron and was about to pick up her admiral, Sir John Lawson. The event was witnessed by Samuel Pepys and recorded in his diary entry for 8 March 1665 (Grey 2002–14):

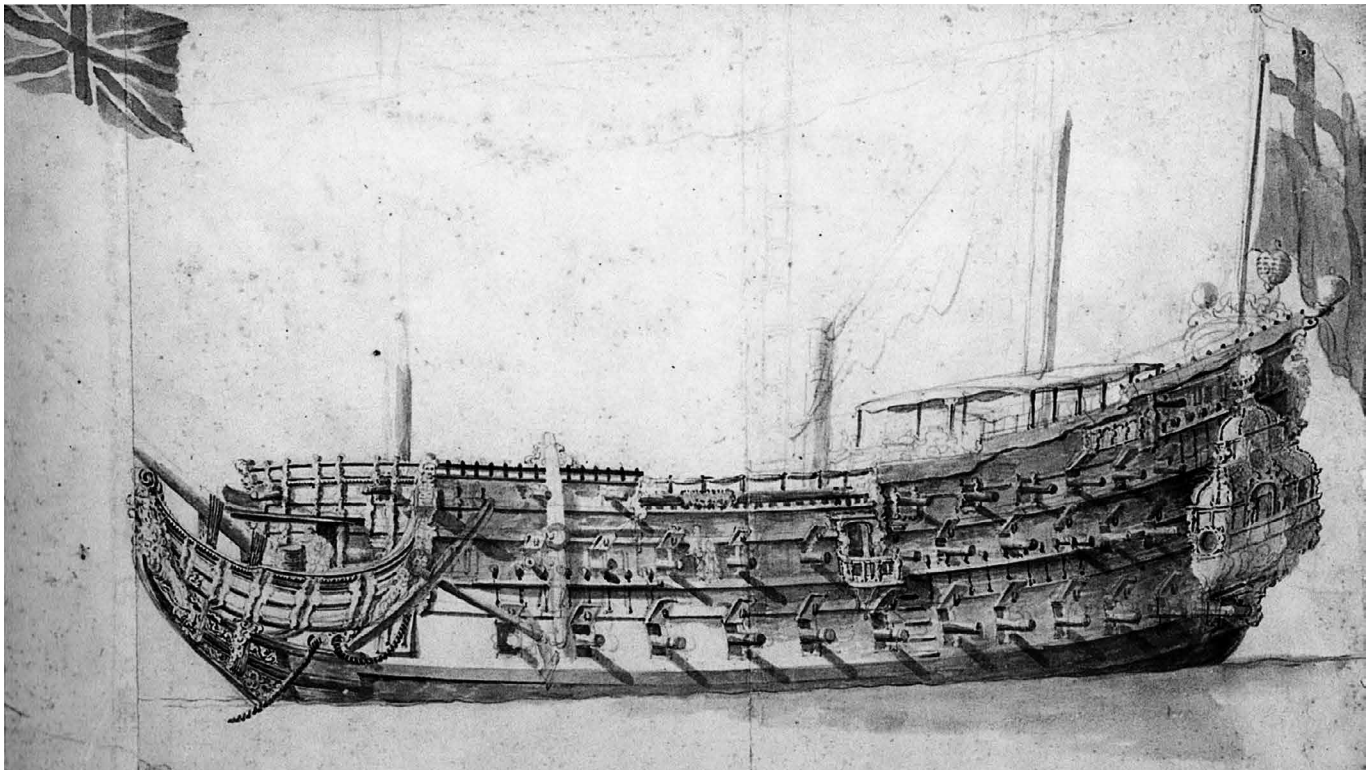
> This morning is brought me to the office the sad newes of 'The London,' in which Sir J[ohn] Lawson's men were all bringing her from Chatham to the Hope, and thence he was to go to sea in her; but a little a'this side the buoy of the Nower, she suddenly blew up. About 24 [men] and a woman that were in the round-house and coach saved; the rest, being above 300, drowned: the ship breaking all in pieces, with 80 pieces of brass ordnance. She lies sunk, with her round-house above water. Sir J[ohn] Lawson hath a great loss in this of so many good chosen men, and many relations among them.

The wreck of the *London* was rediscovered in 2005 during work in advance of the London Gateway Port development. In October 2008 the site was designated under the Protection of Wrecks Act (1973) and Wessex Archaeology, Historic England's maritime archaeological contractor, started the process of recording and investigation. From 2010 a group of local volunteers began to monitor the wreck, under the direction of the site licensee, Steve Ellis. They noticed that the seabed sediments around the site were unstable and that artefacts were being lost. In 2012 a programme of finds recovery began.

In 2014, with funding from the National Heritage Protection Plan, Historic England commissioned Cotswold Archaeology to undertake a two-year evaluation of the site in conjunction with Steve Ellis. The current work is designed to secure the recovery and preservation of at-risk archaeology, to gain a better understanding of the deposits present (including the structure of the vessel itself), and to assess the scale of the threat from erosion.

The Cotswold Archaeology dive team includes both professional archaeologists and Steve Ellis's volunteer team, avocational archaeologists who, like the Cotswold Archaeology team, have Health and Safety Executive-approved diving qualifications. The team thus combines local knowledge with expertise in both archaeology and safe, modern diving practices. Southend Museums Service are also closely involved. Having secured an Esmée Fairbairn Foundation grant, they have employed Luisa Hagel to accession any finds almost immediately, conduct initial processing and 'first aid', and have them conserved by Historic England at Fort Cumberland. Southend Museum has facilitated interaction between the project team, the media, and members of the public – for example by organising open days about the site, based on Southend Pier.

Left to right, in diving suits, Steve Ellis with divers Mark James of MSDS Marine and Dan Pascoe; the skipper of the boat (far left) is Steve Meddle. © Luke Mair



The *London*, as depicted by van de Velde in 1656. © National Maritime Museum

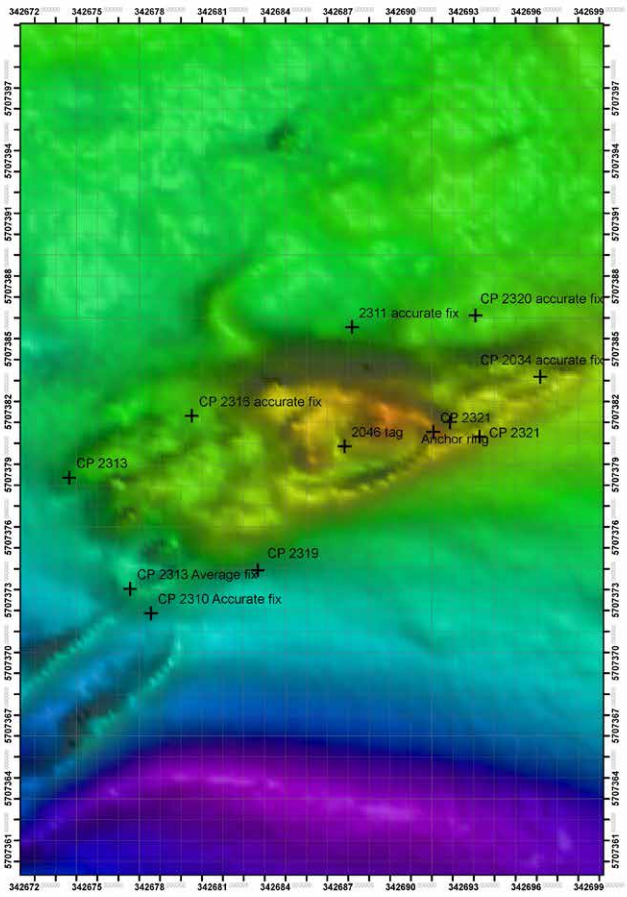
The excavations of 2014 aimed chiefly at understanding the challenges of working on the site, while making an initial investigation of the deposits there. In 2015 the 2014 trenches will be expanded and a small area excavated; a particular aim is the creation of a more coherent picture of the stratigraphy of the site.

The main challenge the team faced in 2014, then, was to establish a diving methodology that allowed work to be carried out safely and effectively. The site is subject to strong tidal streams and has very poor in-water visibility. Due to its close proximity to major shipping routes, it was not possible to mark the site with a buoy and the wreck's position had to be re-located at the beginning of each dive. The dive vessel would then anchor over the site and the divers once again locate the actual excavation areas, often in near to zero visibility. The season consisted of four short (two- to four- day) diving sessions, designed to work around the tides. The excavation strategy evolved considerably during this time. The initial plan was to excavate three trenches, two across the site and one at right angles to it. These would find, it was hoped, a profile for the inner surface of the hull and the site of a possible deck line. Excavation was by hand, due to the complexity and fragility of the deposits encountered. Progress was inevitably slow. Even with two divers working at the same time, the bottom of the depositional sequence was not reached in any of the trenches. Numerous timbers intruded in one area, and in another a gun carriage lay, complete with associated ropes, blocks, ramrods, and baskets; a significant find, but impeding access to the deposits beneath.

Notwithstanding all this, the information gained from each trench and from the recovery of loose artefacts on the seabed enabled the team to begin to understand how the wreck might lie.

The wreck of the *London* actually has two sections. The excavation site itself contains anchors, an anchor hawser and the remains of the ship's galley (indicated by the presence of the bricks from which the ovens were built). It thus appears to be located in the bows of the boat. A further section of wreckage c 400m to the east is thus believed to be the London's stern.

Along one side of the wreckage, from a point low down in the vessel close to the keel, trenches cut across the hold to an area of timbers that are consistent with cabins rather than main structure. This is possibly the orlop deck, traditionally placed low down and used to



Multibeam bathymetry image of the presumed site of the *London*. The large raised area in the centre of the site represents archaeological deposits from the wreck. Some of the linear features visible here are disarticulated structural components of the ship. To the bottom left the remains of a more recent vessel can be seen. © Wessex Archaeology

store cables. This area gives way to a deck line on which a further gun carriage lies face down in the seabed.

This suggests that the bow section of the wreck lies on its side. Sections from the keel, the main gun deck and, perhaps, other parts of the boat are likely to survive beneath the sediment. The finds support this interpretation. Elements of the ship's stores, containing quantities of leather shoes and barrels, were found in the hold area beneath the orlop deck. Personal effects, including navigation instruments, spoons, rings, and bottles, have been found in the possible cabin area; ordnance-related material was discovered on the proposed gun deck.

Over the years, significant quantities of human remains have also been recovered from the wreck. These lie in many parts of the ship, but clusters in locations such as the gun deck suggest that many people were below decks at the time of the sinking. The fact that a number of bones (including skull fragments) are female may at first seem odd on an operational ship of war, but is explained by what we know about the loss of the *London*.

This occurred on a cold day in early March; war with Holland had been declared a few days earlier. The *London* was sailing from her berth at Chatham, where she had been refitted and her guns upgraded or up-gunned, down the river Medway to the Thames. There she was to turn upriver and collect Admiral Sir John Lawson. A battle with the Dutch seemed imminent.

For this first leg of her journey she had all of Sir John's extended family on board and possibly many of the wives and girlfriends of the other officers and men. She would also have had a large complement of sailors and, probably, marines (the marine corps having been formed in 1664). Pepys says that 300 men were on board, but – given the large number of visitors, and with an 'at war' compliment on an up-gunned vessel – actual numbers may well have been over 500. Given the cold weather many of the non-combatants may well have been below decks near the galley at the time that the *London* was tacking to sail up the Thames; preparations would have been in hand to fire a 17-gun salute to the new admiral.

Volunteers from Southend Museum are filmed by the BBC displaying finds from the site during an open day on Southend Pier. © Luke Mair

Remains of a double pulley top, with rope still intact. © Luke Mair

Part of a sextant. © Steve Ellis

The exact sequence of events will never be known, but our eyewitness account and the archaeology both indicate that the wreck was cut in half by an explosion – presumably from a stray spark reaching the powder magazine. That only 25 people survived, in spite of the fact that the explosion occurred near to the shore at Southend, is testament to the sudden and devastating nature of the incident.

The work done in 2014 has generated a basic understanding of the site and the challenges involved in investigating it. It is also clear that the remains of the *London* are eroding rapidly and are at high risk of being totally lost. The vessel is a very rare example of a 17th-century second-rate warship. It is also something of a time-capsule. It offers rich insights into daily life in post-Civil War society, including the remains of those tragically lost in the explosion.

The sole of a shoe; the growth (right) is on the part which was exposed above the sea bed. Note the leather tooling marks.
© Luke Mair

Author

Steve Webster MCIfA
Marine archaeologist of over 30 years' experience.

He led the combined archaeological team for Cotswold Archaeology and worked for Wessex Archaeology's Coastal and Marine section for 13 years before leaving in March 2012 to set up a marine archaeology capability at Cotswold Archaeology. He has worked on contracts investigating protected historic shipwrecks throughout the UK and Northern Ireland since 2002 and is currently investigating a range of sites in Scotland, Wales and England as a freelance diver/consultant.

Further Reading

Grey, D S 2012–14, online edition of Mynors Bright (ed) 1875 etc, *The Diary of Samuel Pepys*. Available at: www.pepys.info/

The Tyneside Pioneers

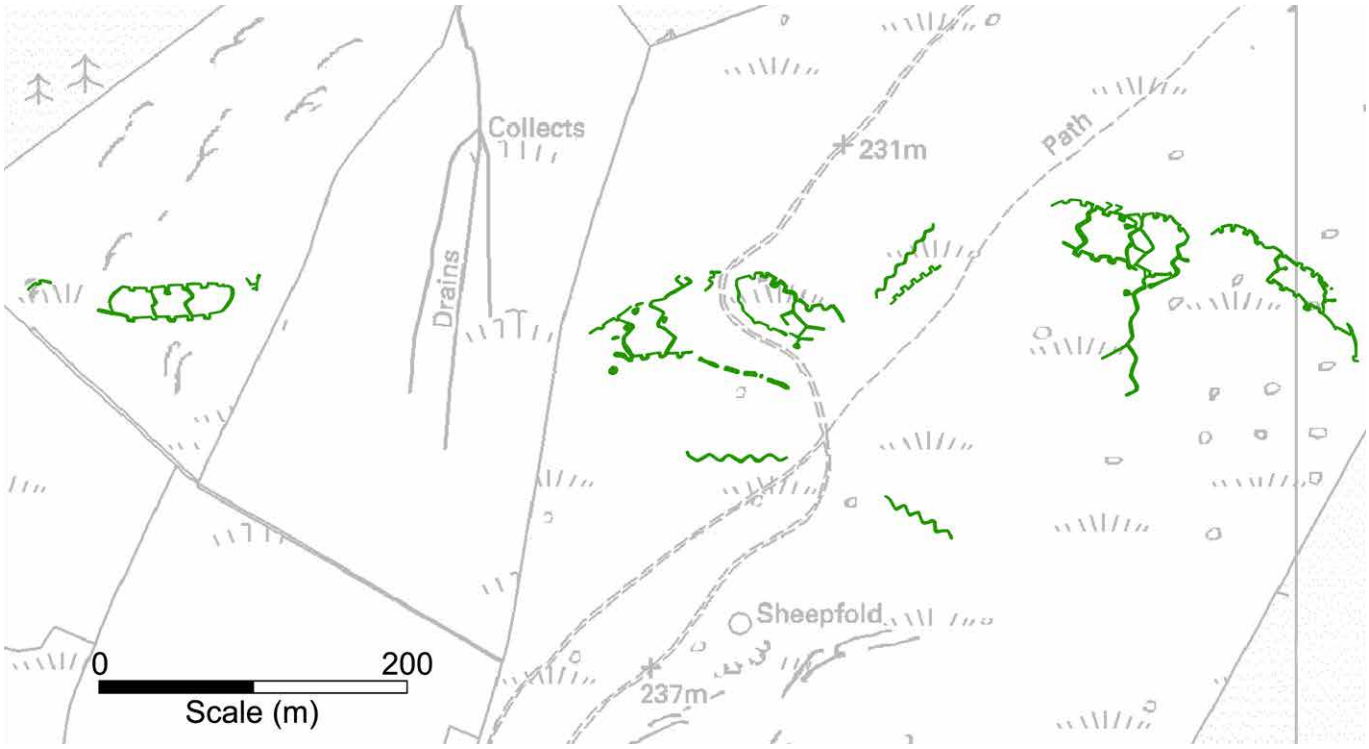
First World War Northumbrian practice trenches, as revealed by aerial reconnaissance.

The carnage and misery of trench warfare is for many the abiding image of the First World War. Practice trenches, built by soldiers in training, are among the more emphatic monuments to that conflict to remain visible in the English landscape. A complex of such sites in Northumberland throws light on the achievements of one such group of soldiers, known as the 1st Tyneside Pioneers.

By the end of 1914 the war in France was still in its infancy. Trench warfare developed rapidly, however. The 'Race to the Sea' led, by the time of the First Battle of Ypres in the Autumn of that year, to the construction of a line of entrenchments stretching from the Franco-Swiss border to the North Sea. The form of warfare that resulted would come to define the conflict.

Meanwhile, the army was rapidly growing. In August 1914 Lord Kitchener, the newly appointed Secretary of State for War, announced plans to raise a large volunteer force. The resulting influx of men came from every corner of the United Kingdom, particularly the working-class populations of the nation's industrial cities. In Newcastle the 16th Battalion of the Northumberland Fusiliers was raised within a week, and the Newcastle and Gateshead Chamber of Commerce began at once to form another. Before long the 17th, 18th, and 19th battalions were complete. Shortly before Christmas 1914 the newly-formed 18th Battalion travelled to Rothbury, Northumberland to start their training (Shakespear 1920, 6). They were still largely unequipped, without khaki uniforms and with limited and outdated firearms.

The practice trenches above Rothbury survive remarkably intact.



The trenches at Rothbury, mapped from aerial photographs.

The 18th battalion, it was decided, would be 'Pioneers'. As Shakespear puts it (ibid 8–9), 'The Pioneer is a peculiar person who can be an infantryman one day, a trench digger in "No Man's Land" at night, an expert in barbed wire, a bridge builder, a layer of railway tracks, a sapper, and suchlike.' In February 1915 they acquired their full title, the 18th (Service) Battalion Northumberland Fusiliers (1st Tyneside Pioneers).

Rothbury is a small town on the River Coquet, some ten miles south-west of Alnwick, on the edge of the Simonside Hills. Training began on the rugged slopes to the north , where:

> "Lord Armstrong kindly made us free of the moorland above the town, a position on which was selected and each company was given [*sic*] a length of front to prepare for defence. We took to trench-making very kindly. Many of us were miners, and those who were not did their best to master the art of handling the pick and shovel. Battalion drill succeeded company drill, and soon we were practising attack and defence over the rough slopes of Simonside" **(ibid 9).**

The soldiers spent many hours constructing their trenches. The earthworks they created have survived remarkably intact, spanning the western slopes and top of Blaeberry Hill, clustered into small groups, no doubt illustrating the 'company' layout mentioned above.

Surveyed and mapped from air photographs, most of the trenches have a crenellation-like plan, the line of the trench being broken up by fire bays (traverses) 3m to 5m wide, angled to limit the distance shrapnel can travel. In several areas the trenches are flanked by earthen structures: a parapet on the attacking side, and a defensive mound or parapet orparados to the rear. The layout of the trenches is typical for the period: it comprises a front line, or fire trench, which is linked by communication trenches to a support line. Dugouts and saps are scattered throughout the site, and might be used for anything from officers' quarters to a first-aid post to a latrine. In one or two places it is possible to discern what might be the firestep in the wall of the trench, designed so soldiers could look out over the edge of the trench during an attack or while on watch.

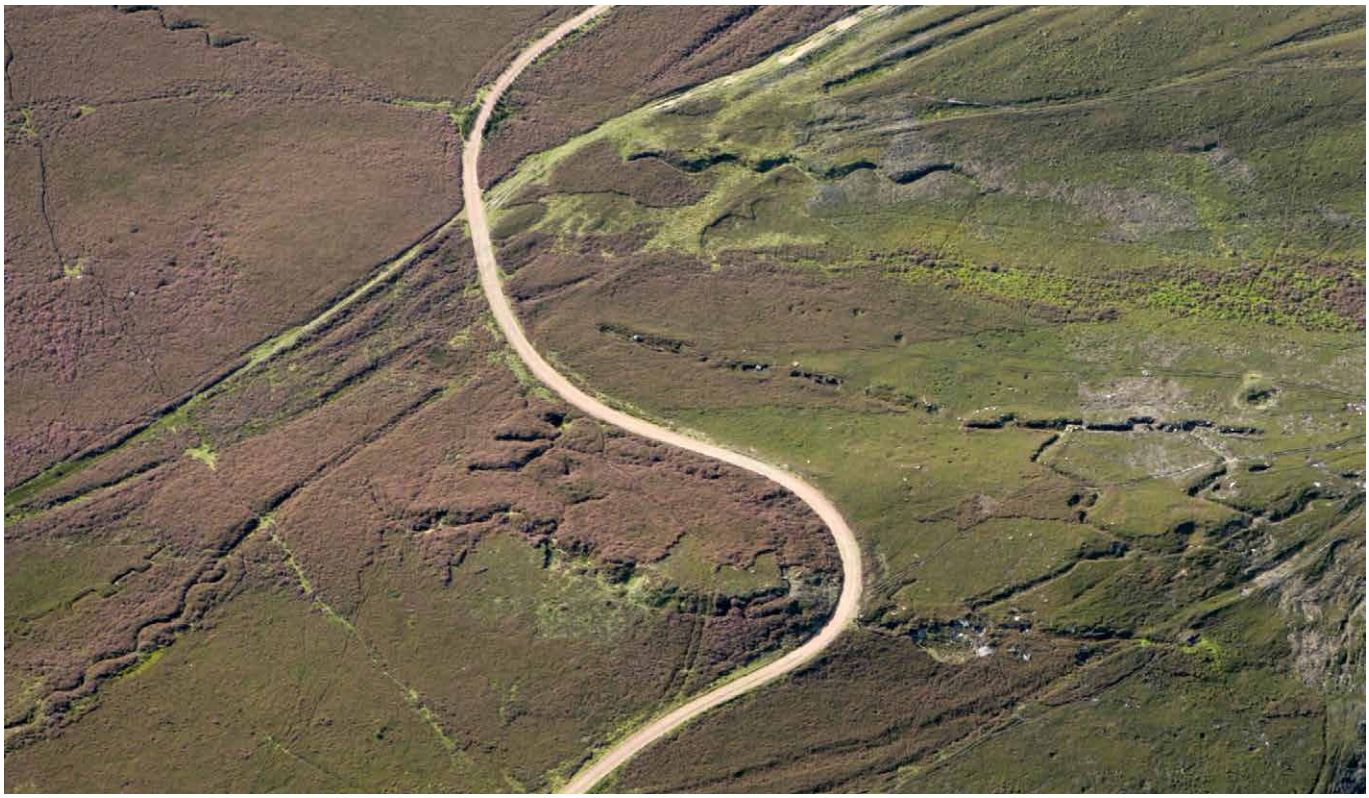
A trench construction party at Martinpuich, Flanders, September 1916.

The trenches at Rothbury appear to be fairly rudimentary in nature, being less well preserved, if far more extensive, than a similar example excavated on the Otterburn Ranges, also in Northumberland, in 2005 (Nichol and Brown nd). In 2008 the Rothbury trenches were also subjected to an excavation, conducted by Coquetdale Community Archaeology (Burgess 2008). These showed that some of the trenches were constructed to a depth of 2.5m, whilst others were considerably more shallow, relying chiefly on the parapet for cover. They were probably never completed to the standard expected in the field, perhaps because of the thinness of the moorland soils. Despite this the excavation revealed residual remnants of iron revetting, a trench-bottom drainage channel, and post holes for a possible overhead structure. The excavation also suggested that many features had been partly backfilled, possibly to prevent loss or damage to livestock or through natural slumping of the sandy soils (ibid 5–7).

Few artefacts were found at either Rothbury or Otterburn (ibid 6; also see Nichol and Brown nd), suggesting the earthworks were primarily dug for practice in trench construction. Such work was a primary function for the 18th Northumberland Fusiliers, but we know the trenches were also used for 'attack and defence' manoeuvres. At this stage in their career the recruits were still underequipped and probably brought very little into the trenches with them.

The battalion history does however record the use of a 'miniature rifle range equipped with moving and vanishing targets' (Shakespear 1920, 8), which most likely refers to a late Victorian firing range on the southern slope of the hill, immediately above the town. The target butts of this range are visible on 2009 vertical photography, with embanked distance markers at 100, 300, and 500 yards extending south-east down the slope.

The 18th Battalion left Rothbury in April 1915, finishing their training on Salisbury Plain. They embarked for France in 1916 and served with distinction on the first day of the Somme (Shakespear 1920, 11, 43–4). The Tyneside Pioneers never returned to Rothbury and it seems the trenches fell into disuse for a short period before being used at least three more times by other units located in the era. Some elements of the



'Each company was given a length of front to prepare for defence.'

earthworks may even have been re-excavated during the Second World War (Burgess 2008, 6).

Nearly 250 members of the 1st Tyneside Pioneers never returned home from France. These lonely trenches, high on the Northumberland hills, remain a poignant reminder of their sacrifice.

Author

David Knight
Investigator, Aerial Investigation and Mapping, with Historic England.

He joined English Heritage in 2010 following a number of years working in the private sector as an archaeologist and as an interpreter of air photographs. He is currently leading the aerial photographic element of the National Archaeological Identification Survey for south-west Cambridgeshire.

Further Reading

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Nichol, K and Brown, M nd *The Otterburn Ranges: all Quiet on the Western Front.* Place of publication not given: Defence Estates

Shakespear, Lt-Col J 1920 (2009 edn)*Historical Records of the 18th (Service) Battalion Northumberland Fusiliers (1st Tyneside Pioneers).* Uckfield: Naval & Military Press

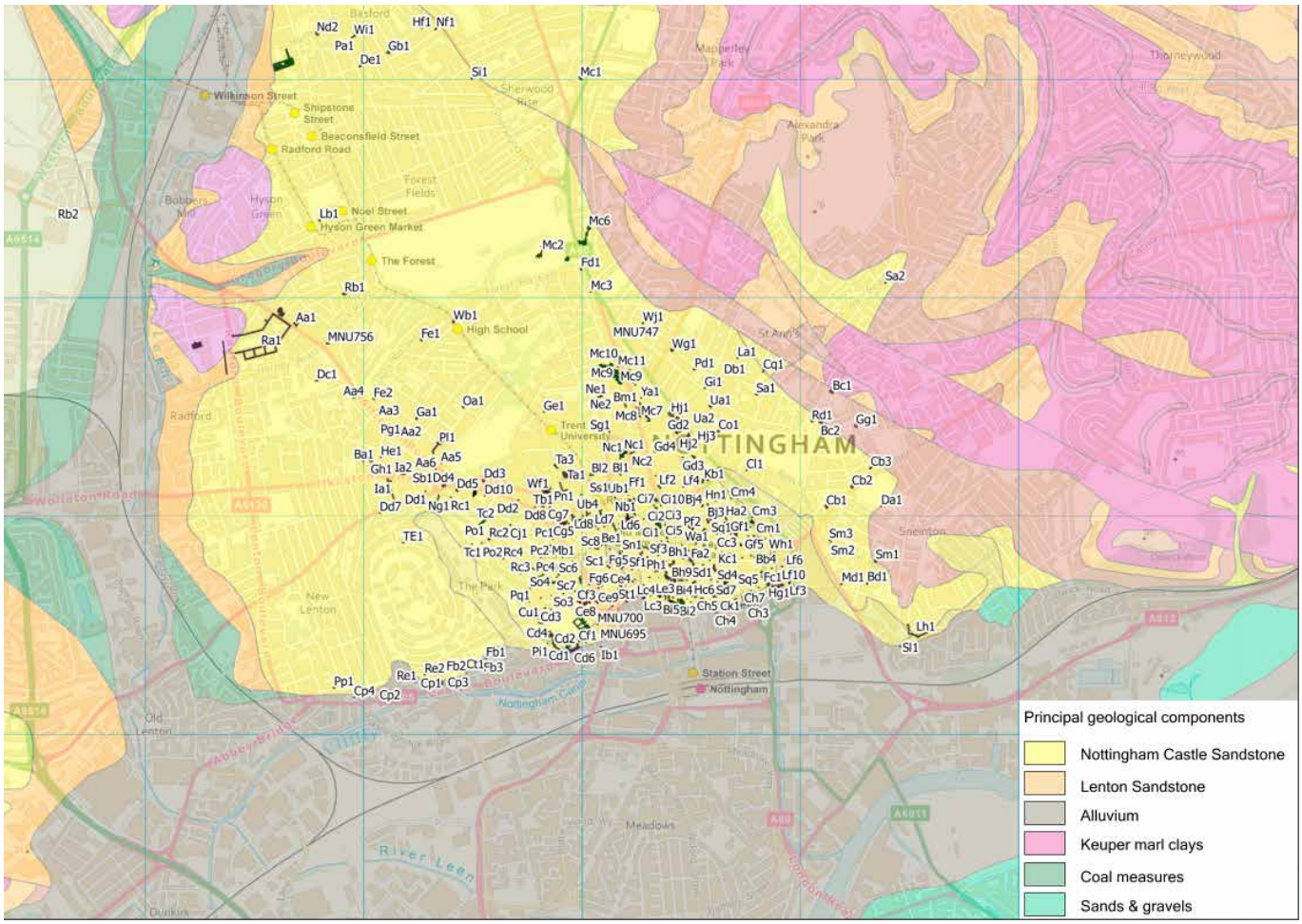
The Nottingham Caves Survey

The remarkable man-made caves beneath the city of Nottingham have been fully surveyed for the first time.

In 893AD the Welsh Monk Asser briefly mentioned Nottingham in his *Life of King Alfred*. The settlement, he reported, was called by the British *Tigguocobauc*. Translated into Latin this was *speluncarum domus*: the house of caves. Fast-forward 1,100 years, and the Historic England-funded Nottingham Caves Survey is investigating the 549 known man-made sandstone caves which have been cut into the rock below the city.The caves have a huge range of dates, forms, and purposes. Nottingham was founded on top of a cliff of sandstone carved by the rivers Trent and Leen, and it seems likely that the first caves were cut into the cliff's base. The geology of this Nottingham Castle Sandstone is itself fundamental to the story. It was laid down by flash floods in deep horizontal bands during the Triassic period, and then, critically, stayed unaltered for 250 million years. Unlike many sandstones it shows little sign of fracture, movement or unconformity: its widely-spaced bedding planes remain resolutely horizontal. Sandstone is too friable to be a likely site for natural cave systems, but this very weakness makes it easy to carve, and here the deep, horizontal bedding planes make any resulting artificial caves reasonably stable.A plateau of high land above the cliff was the site of the first Anglian *burh*, but after the Norman Conquest the town spread across a spur to the peak of Castle Rock. As the town grew, so did the number of caves beneath it. Cellar caves developed, cut below standing properties and accessed from above, a sign that the people of the town were seeking to make more intensive use of land that was becoming quite heavily built up.

From the medieval period through to the Second World War, the sandstone was widely exploited, both to create usable spaces, and for its potential as a construction material. The caves are known to include medieval dungeons, chapels, tanneries, kilns for malt and pottery, and secret (and not-so-secret) tunnels to the castle; and post-medieval butcheries, wine cellars, beer cellars, ice houses, and 'gentlemen's caves'.

Badder & Peat's 1744 map of Nottingham shows the layout of the medieval town and is here wrapped over the underlying topography. The lower mound on the right is the site of the Anglo-Saxon core, the taller peak on the left that of Nottingham Castle. Heights are exaggerated x 5.



Geology of Nottingham and location of caves, from the British Geological Survey's *Register of Caves*.

Then there are Victorian spaces, used as stables, for cold storage and fireproof storage, or as tourist attractions, follies, and summerhouses, or simply to mine sand; and 20th-century catacombs, garages, and air-raid shelters. There is even an underground skittle alley, with a slot carved in one wall through which to return one's ball.

In the modern age the caves have become both a blessing and a curse. They can be of great inconvenience to developers, who may discover unknown caves only when building is actually under way and can struggle to deal with them in a cost-effective and sympathetic way. Numerous caves have been blocked, filled or destroyed as a result.

The work of a small number of keen individuals and societies in the 1960s prevented the complete destruction of a series of medieval and later caves during the construction of the Broadmarsh shopping centre. Today these are one of the city's most popular tourist attractions and showcase a fascinating section through Nottingham history, with medieval tanning caves, 17th-century pub cellars, 19th-century cottages, and 20th-century air-raid shelters all nestling beneath the concrete shopping centre itself.

The challenge of managing, promoting, and protecting this great variety of known and unknown heritage assets led to the development of the Nottingham Caves Survey in 2010. The project has been funded and supported by a number of organisations, including the Greater Nottingham Partnership, Nottingham City Council, Experience Nottinghamshire and the British Geological Survey, but Historic England has been a major and constant partner throughout. The project has a wide remit: to investigate, record, visualise, promote and preserve Nottingham's caves. It is run by Trent & Peak Archaeology, now part of the York Archaeological Trust.


A


B

A. The deep strata of Nottingham Castle Sandstone, here pierced by an 18th-century coaching tunnel.
B. Panoramic view of a well-preserved medieval malting complex, now located beneath a Victorian lace warehouse.

The first phases of project work took place in 2010–12 and consisted of documentary research and three-dimensional metric survey. The project's researcher, Scott Lomax, digitised and archived over 4,500 documents, maps, plans, slides, prints, and newspaper cuttings relating to the caves. This material was added to a GIS database, forming a layer in Nottingham's (EH-funded) Urban Archaeological Database. This GIS was in turn based on work carried out by the British Geological Survey since the 1980s. It now forms a single repository of all known information about Nottingham's caves.

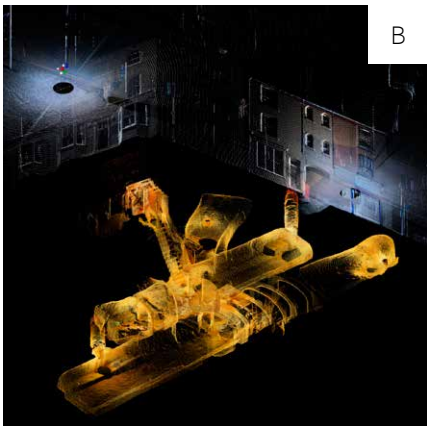
The metric survey of caves by terrestrial laser scanning formed the bulk of the project's work in this phase. The project team used a Leica HDS6100 phase-based laser scanner, coupled with digital photography, to capture three-dimensional surveys of 76 caves accurate to within a millimetre or two. By traversing the caves from their lowest point to the open air and stitching the scans together into one large point cloud, accurate surveys could be made and linked to the sites of their parent buildings. These surveys thus form an accurate record of all the city's known cave-forms. The work has led to the development of a compelling methodology for the recording of caves, one that is especially useful where such sites are vulnerable or at risk from development.

From the outset the project aimed to do more with the survey data than just create plans and sections. The point clouds could be used to create vivid images, increasing awareness and understanding of the caves. To this end, a project website, www.NottinghamCavesSurvey.org.uk, was created. Each surveyed cave has its own set of pages on this website, with images, history, videos, and virtual tours. From the point cloud data the team created short fly-through and fly-round movies, which are also available on YouTube's Nottingham Caves channel www.youtube.com/user/NottinghamCaves/. To date these videos have had over 250,000 views from 175 countries, with only 35 per cent of viewers based in the UK.

The project's second phase is underway at the moment, and it looks to the future of the caves. The team is creating a smartphone app which will allow people to see the caves hidden beneath the ground as they move around on the surface. The app will be distributed through the city's tourist information centre, in partnership with Experience Nottinghamshire; QR codes will also be placed on buildings with caves so casual visitors can stumble across the secrets that lie beneath. In a quest to find more caves, a team of volunteers is currently exploring the city, knocking on doors and following up leads.

Finally, and most significantly, the project is producing a set of management documents for the caves. Three reports will be produced: the first will synthesise current knowledge on the form, scope, use, and survival of these remarkable sites. The second will aim to identify caves that have the greatest potential to be used as tourist attractions, filming locations, art spaces, coffee shops, etc. The final report will establish the significance of the caves, both individually and as a group, and consider the level of threat to them. Information on recording processes will be given and strategies for protection proposed.


A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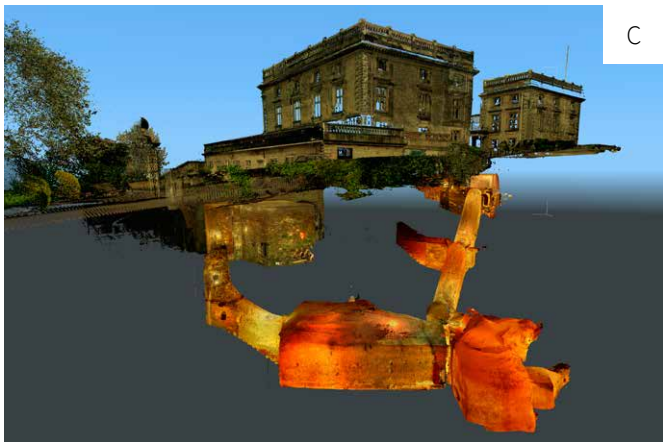
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D

A. Statues and a carved sofa in a Victorian folly at Fishpond Drive. The image is rendered from laser-scanned data. **B.** Victorian pub cellars beneath the Sir John Borlase Warren Inn. **C.** Medieval and later caves beneath Nottingham Castle. **D.** Two small medieval caves and a sequence of larger, deeper, post-medieval caves stretch below the present Old Angel Inn, which stands on one of Nottingham's oldest roads.

This broad approach has had a demonstrable impact within the city. Awareness of the caves is at an all-time high, and there has been a notable increase in political support for their preservation and re-use.

Historic England's timely and ongoing support has done much to ensure that Nottingham's unique caves will continue to be valued in the years to come.

Author

Dr David Strange-Walker MSc
Head of Geomatics at Trent & Peak Archaeology, part of the York Archaeological Trust.

He has particular interests in high-definition survey, laser scanning, and HDR photography. David has worked for the unit since the early 1990s, with interruptions for higher degrees in archaeological science and experimental archaeology at the University of Nottingham, and occasional jobs in sunnier climes.

He has managed the Nottingham Caves Survey since its inception in 2010, and spends a disproportionate amount of time underground

Further Reading

The Nottingham Caves Survey, more information at:
www.NottinghamCavesSurvey.org.uk and
www.youtube.com/user/NottinghamCaves

Using drones for field survey

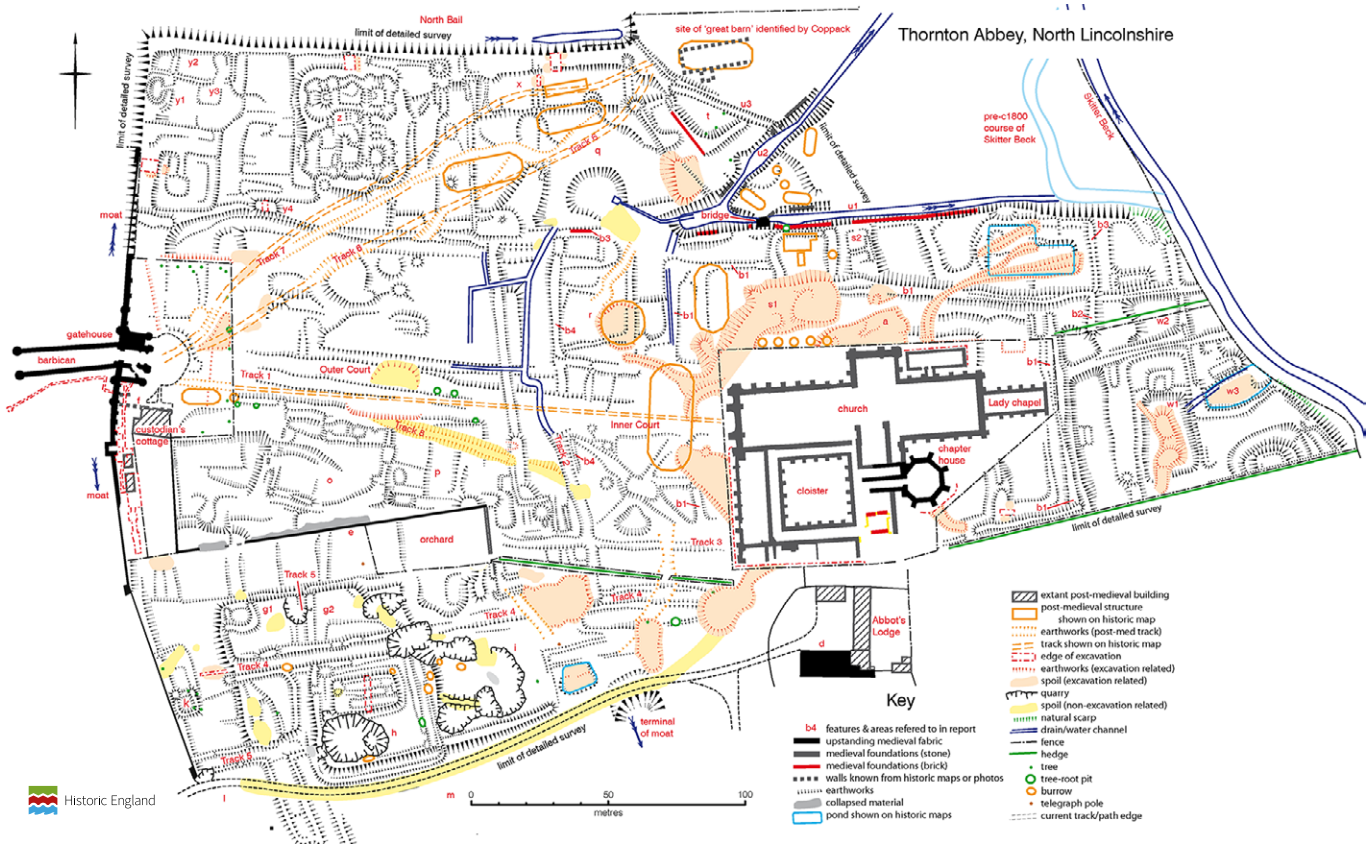
Small unmanned aircraft, often known as drones, can now be used to create digital field surveys. Assessment of the results suggests a technique with considerable potential.

Images taken by cameras mounted on small unmanned aircraft may now be photogrammetrically processed without requiring access to expensive software and specialised hardware. Such techniques have enormous potential for the visualisation of landscapes, sites and monuments and are being applied in a number of ways by Historic England's Imaging and Visualisation Team. Here we outline one of these applications: the use of images captured by such aircraft to assist in the making of archaeological field surveys.

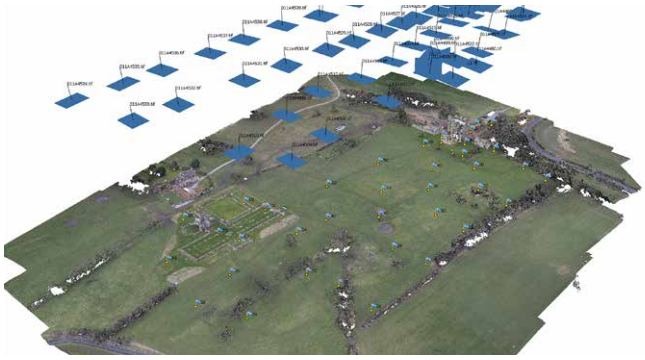
This is done using a technique known as structure-from-motion (SfM). This matches images of objects taken from different overlapping viewpoints so as to create a digital model of a site or landscape.

The matching of images is based on pixel patterns in the images themselves and the calculated locations of the cameras which took them; it also takes into account distortions created by the lenses used.

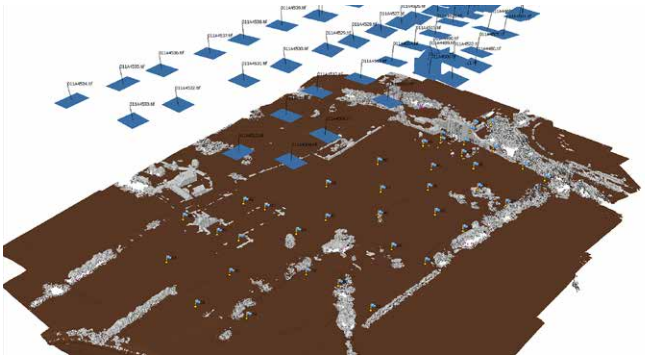
Photogrammetric multi-view stereo algorithms are then used to project the pixels to form a digital model of three-dimentional space. The result is a digital surface model of the monument or landscape depicted in the original images. Everything from entire landscapes to small objects can be represented in this way.



Results of the 2010 research: a Level 3 hachured interpretative plan of the earthworks.
© Historic England, Phil Sinton



The dense point cloud generated from the aerial photography. Camera positions can be seen above the point cloud, while the small flags denote ground control points.

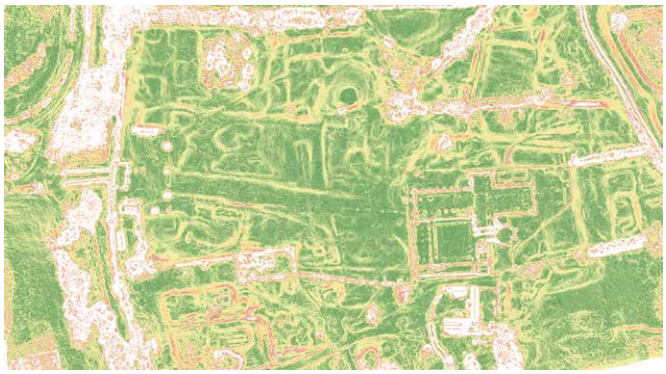


The point cloud, classified to filter out buildings, trees, scrub, and dwarf walls. © Historic England, Jon Bedford (both images)

Input imagery is not limited to that generated by normal cameras – near-infra-red and other imagery from beyond the visible spectrum can be processed, as can historical imagery, provided (amongst other things) that the images overlap with each other sufficiently.

A field survey plan produced in this way was recently tested by Historic England at Thornton Abbey in north Lincolnshire. Now chiefly known for of its large and ornate fortified monastic gatehouse, Thornton Abbey was the subject of research by English Heritage between 2007 and 2010 (Oswald *et al* 2010). One product of this was a detailed, and conventionally produced, archaeological field survey of the earthworks that lie between the former claustral buildings and the gatehouse. With a good recent field survey already in existence, this was an ideal site in which to assess the effectiveness and accuracy of the new technique. The area surveyed for the 2010 report measured approximately 500m×250m; it was flown by the small unmanned aircraft and the results compared with the traditional survey.

A hillshade image of the unfiltered digital elevation model. Archaeological features are clearly visible between the gatehouse and claustral range. © Historic England, Jon Bedford



Slope analysis of the filtered digital elevation model. Flatter areas are shown in green, intermediate slopes in yellows, steeper slopes in shades of red.

Hachure plan overlaid on slope analysis, showing the strong correlation between the two.

The earthworks being surveyed provide evidence for medieval buildings, for the landscaping associated with the creation of a stately home on the site by Sir Vincent Skinner in *c* 1607, and for a number of 19th- and 20th-century archaeological excavations. The entire precinct is a scheduled ancient monument, while the main part of the site, including the gatehouse and ruins of the church and claustral buildings, has been in state guardianship since 1938.

The site was flown by a subcontractor, Skyline Images Limited, who used a Droidworx Aeronavics XM8 octocopter, carrying a Canon EOS 5D Mk III digital SLR camera. The amount of ground surface represented by each pixel (ground sample distance) was specified at 40mm, which meant flying at the legal ceiling of 120m. The site was covered by 56 vertical or near-vertical shots. The brief specified a front-to-back overlap between images of at least 80 per cent and a side-to-side overlap of at least 60 per cent. A small number of oblique images were also taken.

Immediately prior to taking the images, a network of ground control points was established across the site. These are used to optimise alignment of the aerial images and to place the survey accurately 'on the map'. As paint marks could not be used (livestock were present on the site, and the abbey's summer opening to the public was imminent), paper plates were pinned to the ground using survey pegs. These proved very effective: they are cheap, clearly visible and unambiguous in the photography itself. They are also easy to place and remove.

The imagery was processed using Agisoft PhotoScan Pro software. After SfM alignment and filtering a sparse point cloud of approximately 250,000 tie points was produced. Next, a denser point cloud was generated and control points added.

This point cloud was then classified, so that features such as trees, scrub and buildings could be separated from the ground surface itself. The result was a digital elevation model (DEM) which was exported for analysis in a GIS; and a composite orthoimage – an image in which the scale is uniform – which was derived from all the input images.

This DEM was then analysed using ArcGIS software so as to create a composite hillshade note that the techniques employed are straightforward and could be replicated in many open-source alternatives. This elucidated many of the ground variations hinted at in the raw DEM. A slope analysis was also made: indeed, many other analytical processes could have been applied to the data.

As hoped, both the DEM and the hillshade image correlated very strongly with the hachured plan produced by the 2010 survey. It seems, then, that the technique has potential use as an aid to the survey and investigation of archaeological landscapes. Indeed, the analyses highlighted certain features and areas not previously noticed, and which may benefit from further examination.

These results were encouraging and it was decided to test the process further at a site which had not been surveyed before. This was the scheduled former lead

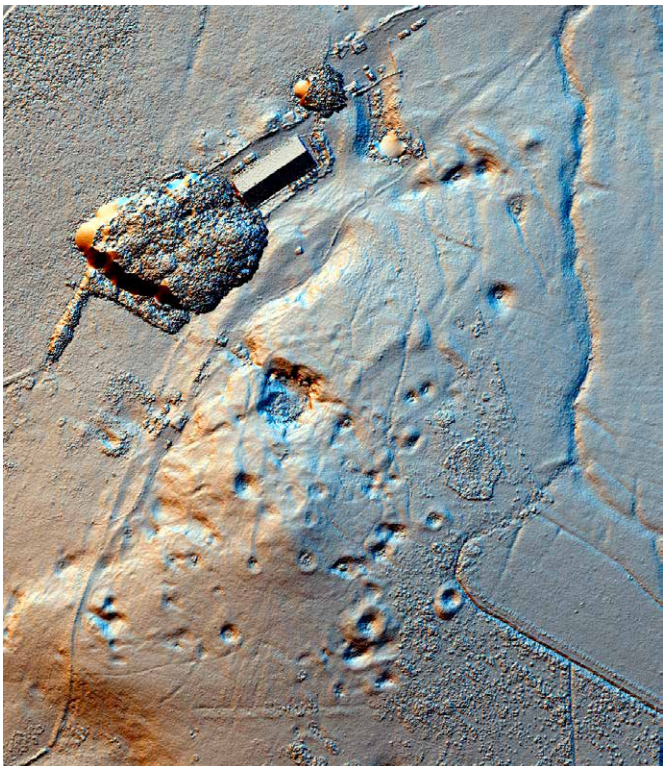
mine at Ashnott in Lancashire, a Heritage at Risk site on a small limestone knoll on the edge of the Hodder valley north of Clitheroe, in the southern part of the Forest of Bowland AONB. Historic England's Assessment Team had been asked to survey the site as part of plans to improve its future management.

Documentary research suggests that Ashnott mine could have been active around 1300; it was certainly a going concern when Thomas Proctor entered into a three-year lease with the Duchy of Lancaster to 'digge, take & myne leade' at 'Asshe Notte' in 1538 (The National Archive 1538–9). By the time the mine closed in the 1830s, the victim of a general slump in lead prices, generations of miners had left behind a tightly-knit complex of surface workings and underground levels by chasing the erratic patterns of mineralisation throughout the knoll.

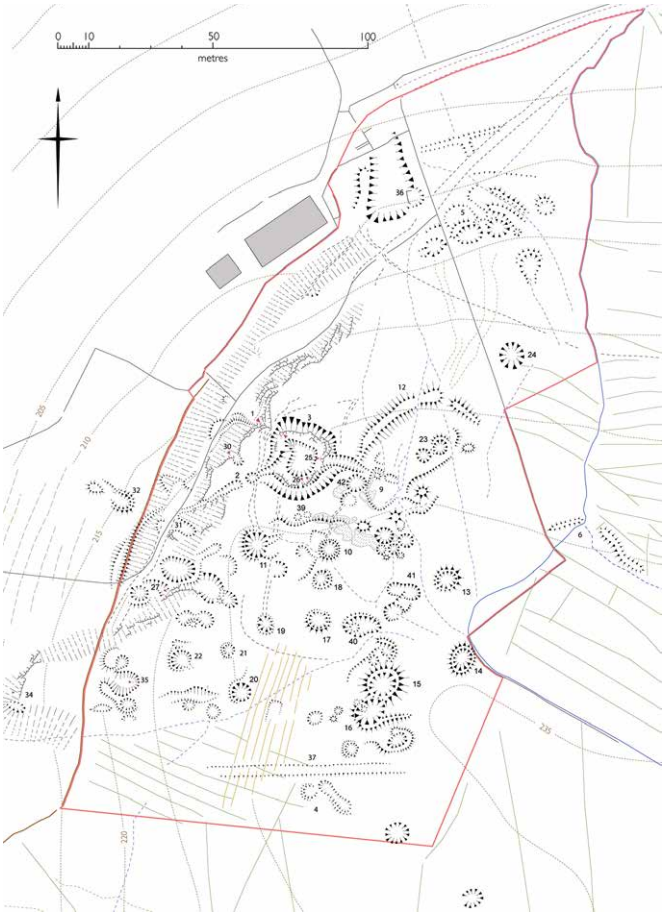
The survey aimed to understand how this mine developed, and to ensure that new fences, intended to safeguard the remains by improving stock management, were correctly placed. It was also designed to highlight areas where the collapse of old, poorly-sealed shafts presented a danger to livestock and hill-walkers.

The site was flown in a similar fashion to Thornton Abbey, this time by Aerovision UK using a fixed-wing SenseFly eBee SUA carrying a Canon Ixus point-and-shoot camera. The imagery was gathered and processed in a comparable way to that for Thornton Abbey, but in this case the digital models were used in AutoCAD to draft an outline plan of the earthworks similar to those employed in traditional earthwork surveys. This plan was then taken back into the field, where it was verified, refined, and augmented by close observation and the judicious use of survey-grade global navigation satellite system equipment. The resulting earthwork plan, with slopes expressed as hachures, is somewhat less detailed than that which would normally have been produced by traditional ground-based survey. It is metrically accurate, however, and sufficiently nuanced to support archaeological analysis of the site.

Crucially, this plan was perfectly adequate for the purposes required of it. Measured against the scale of survey standards published by English Heritage, in



A hillshade image of the unfiltered digital elevation model of Ashnott Mine. © Historic England, Jon Bedford



Extract from the earthwork interpretation plan for Ashnott, derived from both the digital elevation model and from ground observation. © Historic England, David Went

which Level 2 records the general form of a monument and Level 3 captures its full complexity, this SfM-derived method might sit at 2.5 or perhaps a little higher. It also took less than half the time that would have been required had traditional methods been used to create a comparable plan.

A word of caution, however, to others encouraged to pursue this approach. Detailed and highly flexible three-dimensional imagery is a tremendous tool, but interpretations derived from it must still be informed by an experienced eye if they are to be robust. From the surveyor's perspective, the most valuable parts of the process are the site visit before the flight, which helps develop a good understanding prior to mapping the patterns observed from the air, and the detailed reassessment of the SfM-derived plan once it has been taken back on site. Only then do the finer distinctions between such features as paths and watercourses, washing floors, and working areas become fully apparent.

Authors

Jon Bedford MCIfA
Senior Technical Survey and Graphics Officer with Historic England.

Jon worked in commercial field archaeology for 16 years before joining English Heritage 11 years ago. He specialises in buildings survey, and the application of new survey techniques. Current research topics include the use of SfM and other photogrammetric methods for landscape, building and object visualisation; the development of new measured survey techniques; and the implementation of mobile mapping solutions for field teams.

Dave Went MCIfA FSA
Senior Investigator, Assessment with Historic England.

Dave joined English Heritage in 1993, working first for the Monuments Protection Programme and later the Characterisation team, before joining the Research Department in 2007. His particular interests are Roman archaeology, the early church and medieval landscapes. His survey of Whitley Castle Roman fort is published in the 2013 edition of *Britannia*.

Further Reading

Bedford J, forthcoming *Archaeological Uses of SfM/MVS at English Heritage: an Overview and Practical Guide.* English Heritage Research Report Series **79–2014**

English Heritage 2007 *Understanding the Archaeology of Landscape: a Guide to Good Recording Practice*, available at Research.HistoricEngland.org.uk

The National Archive, lease by King of Ashe Notte to Thomas Proctor, E210/1477 1538 –9

Oswald, A Goodall, J Payne, A and Sutcliffe, T 2010 *Thornton Abbey, North Lincolnshire: Historical, Archaeological and Architectural Investigations.* Swindon: English Heritage Research Report Series **100–2010**, available at Research.HistoricEngland.org.uk

Went, D 2014 *Ashnott Lead Mine, Ribble Valley, Lancashire: an Archaeological Survey of the Landscape Evidence*. English Heritage Research Report Series **74–2014**, available at Research.HistoricEngland.org.uk

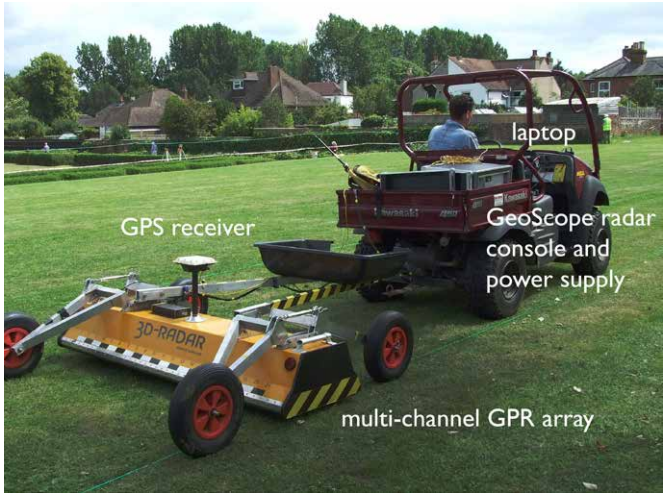
Now you see it! Instant GPR results in the field

Rapid access to ground-penetrating radar imagery improves the gathering, analysis and visualisation of data.

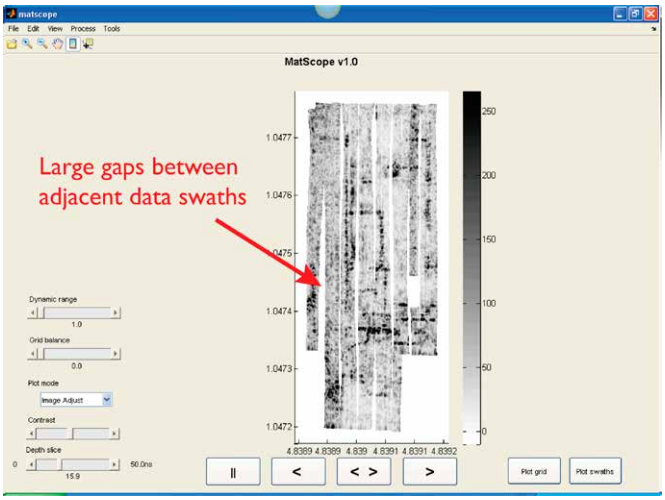
Recent developments in multi-channel ground-penetrating radar instrumentation allow unprecedented levels of data to be collected, covering many hectares while taking samples less than 100mm apart. Whilst this greatly improves our knowledge of buried remains, the volume of data that results is considerable. Processing of the data can often only be done after fieldwork has been completed, leading to significant problems if errors are discovered.

To address these issues, Historic England's Geophysics Team has developed bespoke software tools for the rapid processing of datasets. The program creates images of the subsurface on a laptop while the data itself is being collected, and usually before the operator has had time to turn the apparatus around and begun the next swath of data collection.Such processing can be carried out using existing commercial software, but these systems generally require users to manually transfer the data, a process usually left until the end of the day or after fieldwork has been completed. This is particularly true for multi-channel ground-penetrating radar systems, which can gather over 20gb of raw data during a single day in the field. The new tools run in parallel with the acquisition software. They automatically detect the presence of a newly completed instrument swath and start background processing on a laptop without interrupting collection of the next line of data. A full range of processing options is available to cope with different site conditions. The data is then processed together with the accompanying GPS measurements. The location of any buried objects detected by the survey can thus be overlain on Ordnance Survey mapping.

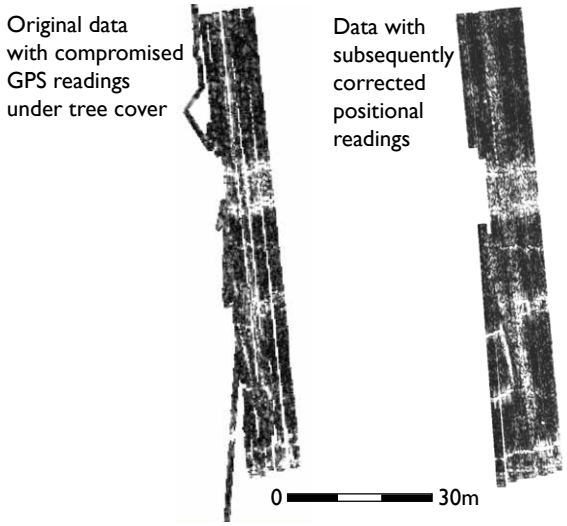
By getting rapid feedback such as this, the user can quickly check data quality, assessing for example whether buildings or trees have compromised any of the positional data, or gaps have been left between swaths. Instant display of processed results also proves useful when demonstrating ground-penetrating radar to those who have not used it before. It can be particularly effective if an animated version of the dataset is required as this can often reveal subtle anomalies that might otherwise be missed when only static time slices are available to be seen.In a survey of the west wing of Fishbourne Roman Palace, for example, a slight problem



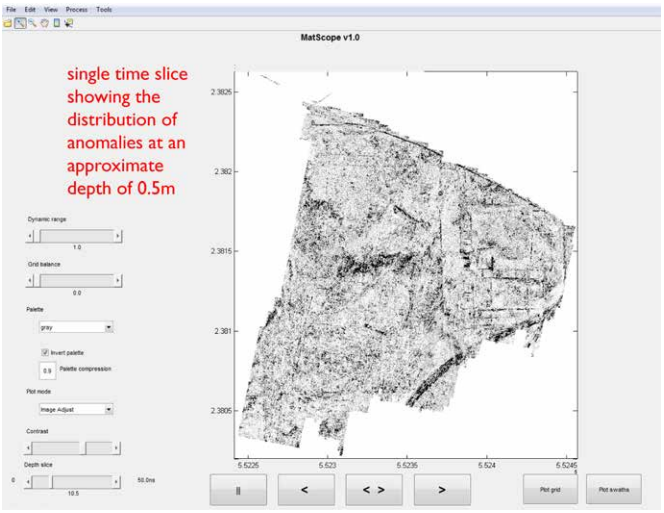
GeoScope three-dimensional ground-penetrating radar survey, utilising a 21-channel towed antenna array.



Use of the new software to correct gaps in coverage.



Identification and correction of compromised GPS data under tree cover.



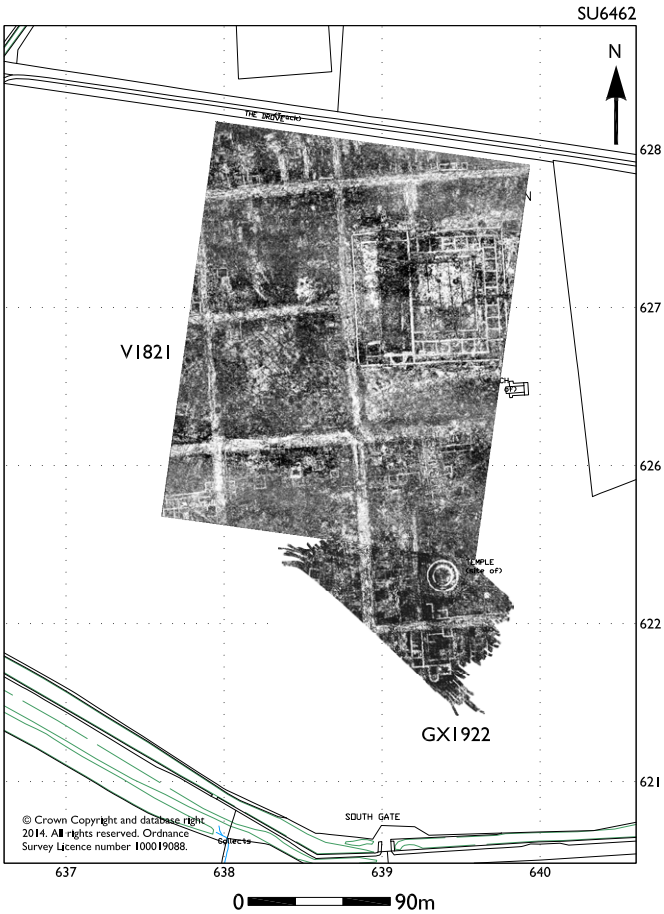
Large area ground-penetrating radar survey at Audley End House, Essex.

with navigation in one area resulted in an unacceptable gap between adjacent swaths. Thanks to the new system this was recognised immediately, additional survey lines were collected, and the final interpolated dataset quickly presented (fishmovr.wmv). The production of fully-georeferenced data in the field can also reveal problems with the quality of GPS positional measurements. For example, in a survey at Wrest Park in Bedfordshire, mature tree cover at the sides of the formal garden degraded the recorded signal. Thanks to the new software the problem was identified quickly and rectified by marking out new survey lines.

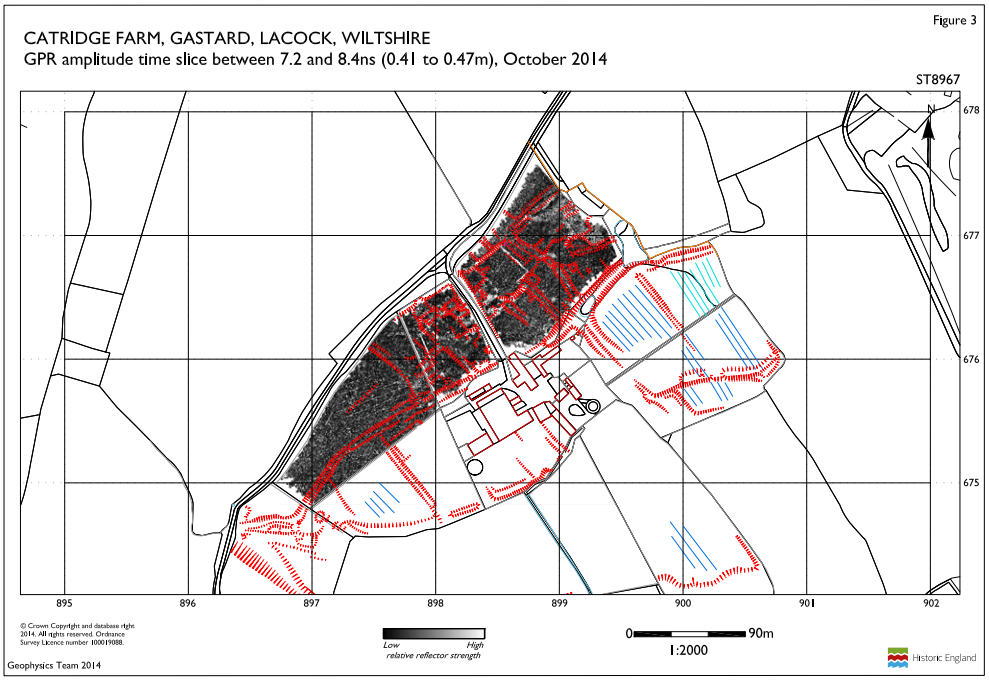
The software can efficiently display datasets that cover very large areas. For example, at Audley End House, Essex, the survey was initially focused on an area identified by previous earth resistance coverage, but after the results were reviewed in the field, it was decided to extend work beyond the original target area.

The March 2014 upgrade to a MkIV GeoScope radar system was a new challenge. This system allowed even faster data acquisition, across a wider frequency bandwidth, and using a newly developed ground-coupled antenna array. The new hardware brought with it significant changes in the format used for data storage and the way that the radar energy was transferred into the ground. Results collected over the Roman remains at Silchester, Hampshire have successfully tested both the new hardware and an updated version of the software.

The results of ongoing testing have included the GPR coverage of a medieval settlement site in Wiltshire, resulting in a useful example of the integration of the results with those of an earthwork survey.



Test results from the ground-coupled antenna apparatus at Silchester, Hampshire.



Highly detailed ground-penetrating radar data from Catridge Farm, Wiltshire, combined with the earthwork survey of the same site.

The ability to visualise large scale ground-penetrating radar datasets from array-based antenna during field acquisition provides an important means of quality control and the ability to make an on-the-spot assessment of results. While this does not replace the need for more considered, post-acquisition processing, the ability to achieve useful, geo-referenced results during field survey can bring considerable benefits with it.

Author

Dr Neil Linford
Senior Geophysicist
with Historic England.

Based at Fort Cumberland, Portsmouth. He has experience in the use of ground-penetrating radar to image a range of buried archaeological remains and historic buildings. He is seen here (right) with his colleagues Andy Payne (middle) and Paul Linford (left) who have helped with the development and field testing of this system.

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Housing for the elderly in post-war England

A survey of housing for the elderly is the first modern study of this much-threatened type of building.

A terrace of pensioners' bungalows is a familiar sight on many English housing estates of the 1950s. They were a new form of housing for the elderly, and further types of specialised accommodation were to follow over the next twenty years.

Many such structures are now under threat as local authorities seek to modernise their stock or make cutbacks, and these buildings sometimes come in for listing assessment. Historic England has been responding to such requests on a case-by-case basis, but no overview of the subject exists. As a result, Tim Brooks of Historic England is conducting detailed research on the subject as part of his Diploma in Building Conservation at the Architectural Association.

The story of this much-neglected aspect of late 20th-century residential architecture is, as a result, now being revealed. It is a story intimately tied to the creation of the Welfare State.

The 1950s bungalows usually occupy a central position in an estate, close to the bus stop and any shops; with their bijou quality and comparatively delicate

Scudamore Place, Ditchingham, Norfolk; listed housing for the elderly by Tayler & Green.

detailing they also provide visual interest in what can otherwise be a sea of two-storey houses and taller blocks of flats. They were the product of the policy of 'mixed development', the wider range of social housing advocated in the late 1930s by housing reformers such as Elizabeth Denby, a school of thought perhaps better known for encouraging taller blocks of flats so as to provide more room for family houses on tight urban sites. But they were also an early response to changes in both demographics and government policy.

As lifespans increased, an additional need to provide accommodation for the elderly had become apparent and was identified in the Beveridge Report of 1942. Wartime conditions had exacerbated the situation, with extended families unable to provide care when their younger members were called into the forces or munitions work away from home. The London County Council (LCC) was among many authorities that, as a result, provided 'rest homes' for elderly people bombed out in the war. More specialist housing began to be produced following the National Assistance Act of 1948.

The LCC produced an internal report in 1944 that recommended the building of bungalows and flats for those who could look after themselves, and the Farmers' Union led a vociferous campaign in 1946 for similar accommodation in rural areas. Tayler & Green, architects of distinctive social housing in rural Norfolk, built their first pensioners' bungalows in 1948 after a circular the previous year from the Ministry of Health and Housing encouraged more provision.

The best-known example of bungalows for the elderly within a mixed development is perhaps the listed group of 1955–8 at Alton West in London. These tiny bungalows form a sympathetic neighbour to Mount Clare, an 18th-century house retained as a higher education college, and their tall chimneys act as a foil to the ten-storey slabs of maisonettes across the narrow valley. The Ministry of Health noted that this type of accommodation was normally allocated to women, as male widowers were rarely able to cook for themselves.

Much less is known about housing for those who needed some form of supervision. Workhouses were officially abolished in 1929 and the welfare services previously administered by the Poor Law guardians (and in London by the Metropolitan Asylums Board) passed to local authorities. County councils and county boroughs took over hospitals and health services, but the provision of accommodation for the long-term sick, the elderly, and children often passed to borough and district councils, which were the lowest tier of government. The 1929 Local Government Act transferred to the LCC's care some 75,000 inmates of workhouses and other Poor Law establishments, including homes for the elderly, each of which housed over a thousand residents. In 1934 the council introduced a policy of building what it called 'small homes', housing no more than 250 people, but the war cut short the resulting construction and conversion programme.

The National Assistance Act of 1948, which finally abolished the Poor Law with the introduction of the National Health Service, required local authorities to provide sheltered accommodation for the elderly and infirm. A very early and unusually lavish home was the LCC's Lansbury Lodge, built in 1950 as part of the 'live architecture' exhibition of the Festival of Britain, held in London's East End. By 1964 the LCC had created 42 'small homes' housing 2,858 pensioners, though over half were converted villas that had been retained within new housing estates.

The most interesting housing for pensioners, however, was that which offered a middle way between full-time care and wholly independent bungalows. The London Parochial Charities built Isleden House in 1948 as a model block that combined studios and small flats for the elderly with a community centre and a matron's house; a bowling green in its enclosed courtyard is now a garden. The LCC, too, began to build flats where pensioners could live more independent lives but with some warden supervision, often adjoining a home where residents could get meals and join in social activities if they wanted to.

The first of these opened at Eastway Park, Homerton, Hackney, in 1958 with thirty flats, and further examples followed across the capital. This model was recommended nationally by the Ministry of Housing and Local Government, which assumed responsibility for all forms of public housing from the Ministry of Health in 1950.

269 Leigham Court Road, Streatham, London by Kate Macintosh for the London Borough of Lambeth.
Kate Macintosh

In 1956 and 1957 they published circulars suggesting that old people could share bathrooms and manage with a simple hob and sink within a studio room. Two booklets produced a few years later (Ministry of Housing and Local Government, 1958, 1960) illustrated examples from Oxford, Devonport, Royton in Lancashire and Barrow in Suffolk, comprising one- or two-storey blocks of up to 24 flats with a warden.

Tayler & Green built a series of sheltered bungalows, better appointed and with a warden's house and community hall, for Loddon Rural District Council in Norfolk. Most of their schemes were built piecemeal and included Scudamore Place, Ditchingham (1958–65) and Davy Place, Loddon (1959–63) both of which are now listed. Their designs met the government's requirements while using an imaginative variety of materials, barge boards, and changes in level to give an extra architectural swagger.

A committee chaired by Parker Morris in 1961 recommended higher space standards and central heating for old people's flats, including bathrooms that were large enough for assistance to be given if needed. These standards were not immediately obligatory, but they were widely adopted by local authorities. Arthur Greenwood, Minister of Housing and Local Government, finally declared in June 1967 that that they would become mandatory in two years' time, when a further circular was issued, entitled *Housing Standards and Costs – Accommodation Specially Designed for Old People*.

Well-designed sheltered flats were only the tip of the iceberg. A survey of residential institutions and homes for the aged in England and Wales, made by Peter Townsend for the Nuffield Foundation, was published in 1962 as *The Last Refuge* (Townsend 1962). This harrowing report, still almost impossible to read, argued that standards of care for the most dependent elderly people had scarcely moved on from those of the workhouse, with many of the old buildings still in use and lacking such essential elements as privacy, compassion, and respect. It made a powerful impact, and an LCC working party was set up to improve standards in pensioners' flats, made up of architects

from both its general and housing divisions, one of whom was Edward (Ted) Hollamby. When Hollamby became chief architect at the London Borough of Lambeth in 1963 he took many of the resulting ideas with him. One of his assistants, Kate Mackintosh, recalls the shock of reading *The Last Refuge* when in 1968 she was asked to design sheltered housing in Leigham Court Road, Streatham (a current listing assessment), as her first job at the council.

In April 1967 the Minister of Health, Kenneth Robinson, wrote to all local authorities asking them to provide accommodation that would replace that of all the old workhouses. Many authorities built new, smaller homes, but some, Lambeth included, built little flats with a common room and accommodation for a warden and her family. One model was a 1961–2 scheme by the Ministry of Housing and Local Government at Ross Court, Stevenage, soon adopted by Wandsworth and then by Lambeth councils. The Stevenage flats had shared bathrooms, but their London successors were at last completely self-contained. Lambeth's exceptionally long waiting list prompted the council to adopt an unusually ambitious policy, building sheltered flats as well as care homes and constructing mixed developments of flats and family houses well into the 1970s. Macintosh's scheme of 44 self-contained flats with a community room, laundrette, guest accommodation, and a warden's flat was approved in January 1970 and completed in 1973. It was one of the first schemes designed to exceed Parker Morris recommendations on room sizes and amenities. Indeed, with its sophisticated blockwork and the careful way in which it broke down the accommodation into small units set between retained mature trees, the development set new standards of design in the creation of sheltered housing for old people.

Author

Dr Elain Harwood
Senior Investigator, Assessment with Historic England.

Her books *Space, Hope and Brutalism* and *England: a Guide to Post-War Listed Buildings* (with James O. Davies) will be published in 2015.

Timothy Brooks would love to hear of well-preserved examples of housing for the elderly. He can be contacted at timothy.brooks@HistoricEngland.org.uk

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Railway goods sheds and warehouses

The first-ever survey of a building type that is important, easily overlooked and widely threatened.

Few people under the age of 60 can remember when individual railway wagons were unloaded by hand or by the use of a simple timber rotating crane in a country goods shed. Equally unfamiliar is the massive warehouse, within which wagons were moved about on ropes turned by hydraulic capstans, their contents winched aloft through trap doors to floors filled with sacks of produce. Yet until about 50 years ago such scenes were commonplace throughout Britain.

Goods traffic was actually more important for the railways than passenger traffic, yet both it and the buildings that were associated with it tend to be neglected. This is partly because goods trains lack the glamour of express trains, and partly because loading and unloading took place where few people saw them. Many goods trains ran at night, especially the long distance freight services which linked the great cities. Freight terminals were, like docks, concealed behind high walls: they were places where outsiders were not welcome unless they were there on business.

Although the buildings associated with goods traffic have not, in most cases, been used for their intended purpose for many years, it does not mean that they are of negligible importance. They played a fundamental role in the economic infrastructure of the 19th and earlier 20th centuries. The goods shed was the hub through which raw materials arrived and finished goods were forwarded. It was essential to the development of modern retailing, making possible the distribution of national brands to shops in cities, towns, and villages. As late as the 1960s, most of the products sold by Woolworths were distributed to their shops by rail. A goods shed was, in effect, the predecessor of the 'big shed' distribution warehouse of today and played just as significant a part in the economy. It deserves study on the same basis as the textile mills, ironworks, potteries, and other industrial plant that played such a vital role in making possible Britain's dominant 19th-century economic position.

Dr Michael Nevell (Nevell 2010) has drawn attention to the lack of a study of railway goods sheds and warehouses, the failure to assess accurately the total number built (or their survival rate), and a tendency to view and assess them on an art-historical basis, failing to recognise their significance as functional structures.

Although many still remain, development pressure – combined with this widespread lack of appreciation or knowledge – means that they are very much under threat, not in the same way as signal boxes (where an entire building type will be eliminated within a generation), but by a process of gradual attrition. An analysis of those in Sussex revealed that over half of those extant in 1980 had been demolished in the subsequent 35 years.

A project on goods sheds and warehouses was thus created as part of the National Heritage Protection Plan. The project will enable significance to be assessed much more adequately and is now well advanced. It differs considerably from that previously undertaken on signal boxes (Minnis 2012) as these were, by comparison, well documented. There was no overall survey of goods sheds as a building type, and even the number of survivors was unknown. It was therefore difficult to answer such questions as, for example, how many Midland Railway goods sheds still existed, where they were located, when they were built, and how a particular example compared with others of its type.

The first task, therefore, was to compile a database of surviving goods sheds and warehouses. The information was initially gleaned from a variety of sources: published accounts, information from friends and colleagues, and examples uploaded to Geograph, Flickr and various websites on the subject. Extracts from the resulting

The interior of the North Eastern Railway's now-demolished Newcastle Forth Banks goods shed on 14 November 1893. The view gives an idea of the sheer scale of a major city goods depot. Historic England Archives/Bedford Lemere, BL 12500_003

In the late Victorian era, the London, Brighton & South Coast Railway's standard design of goods shed was a handsome one. This 1888 example, at Edenbridge Town, Kent, is listed Grade II.
© Historic England, James O. Davies

database were then sent to the appropriate historical societies for each of the individual pre-1923 companies, inviting members to add any that had been missed.

Such an approach invariably works better than appeals for information as people love to point out when you have missed something! A great many buildings were thus added to the total; the results were then checked by comparing present day Ordnance Survey mapping with historic 25in mapping on Historic England's GIS mapping database. This was then confirmed by looking at the sites on Google Earth and, where possible, Google Street View. This enabled details of design, present use, and condition to be noted in many cases, though it could not cover every example.

The database has over 510 entries at the time of writing. It is hoped that this figure will increase. It reveals that, as might be expected, goods sheds are particularly thin on the ground where development pressures are greatest: in urban areas and the south east. The largest numbers of surviving examples, by contrast, are in agricultural counties such as Lincolnshire, where property values are low and the buildings remain useful, for example as scrapyards or for agricultural storage. Very few of the once-important multi-storey city centre warehouses survive and, of those that do, the vast majority are listed. With their great open internal spaces, goods sheds lend themselves to re-use: current functions for such buildings include everything from churches to garden centres, TV studios to vets surgeries; examples even include a surfing museum, a health club, a rowing club, and a snooker club.

To highlight awareness of this important building type, a book in Historic England's Informed Conservation series is planned. This publication will incorporate a gazetteer of extant examples. Project data will also be made available to local historic environment records, and recommendations for listing will be made. The full database will be available with the electronic version of the book; this database will also be made accessible through the Historic England website.

The survey methodology, meanwhile, is itself a sign of the changing times. Thanks largely to digital technologies, from GIS to the internet, the entire project has been researched by one desk-based individual, when not long ago information of this kind would have been impossible to gather without the support of large regional teams, working in the field. This is a noteworthy achievement in itself, but it does have disadvantages.

It is difficult to gather much information about buildings that are isolated in the middle of private land, for example. A blurry internet image is no substitute for a detailed field survey. The information is only as current as the mapping and photography available online; it is always possible that the odd structure will have disappeared during the intervening period. But that is also a factor in carrying out a physical survey. Overall, the project is an example of how, by harnessing new technology and engaging with voluntary groups and the enthusiast community, it is possible to achieve significant protection outcomes, even in times of falling budgets and economic austerity.

Author

John Minnis
Senior Investigator, Assessment with Historic England.

He has a special interest in transport buildings and his publications include *England's Motoring Heritage from the Air* (English Heritage 2014), *Carscapes: the Motor Car, Architecture and Landscape* (as co-author with Kathryn Morrison, Yale University Press 2012) and *Britain's Lost Railways: the Twentieth-century Destruction of our Finest Railway Architecture* (Aurum 2011).

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The English railway station

The first-ever national survey of these iconic structures has now been published.

The English Railway Station **(Parissien 2014) is an accessible, engaging, and comprehensively illustrated general history of the architectural development and social history of this iconic building type. It covers the entire history of the station, from the dawn of the Railway Age, through the ravages of the 1960s, and onto the rebirth of the form at the end of the 20th century. Tracing how the station evolved into a recognisable building type, the book examines the great 'cathedral' railway termini alongside the evocative country stations of the Victorian era, and looks at how the railway station has, over the last fifty years, regained its place at the heart of our communities.**

The absence of such a book before now is a surprising one. Before 1980, the endless shelves of literature on the railways of Britain contained almost no books on the subject at all. Even the best-illustrated and most authoritative of railway studies, though they covered such subjects as signal boxes and track layout in exhaustive detail, lacked illustrations or information on the stations themselves. Likewise very few internet sites provide views historic or contemporary of England's railway stations.

The lack of authoritative pictorial sources extended to Swindon. Historic England's impressive photographic archive includes unexpectedly few stations, with the notable

The former Cirencester Town Station in the early 1980's. © Historic England, BB BB038281

exception of the collection of postcard-photographs amassed by the Rev H D E Rokeby (1904–69). Even then, Rokeby's evocative views, often quickly snapped from the carriage or platform as his train paused at a particular stop, frequently failed to show the principal station buildings.

Site visits, then, played a crucial role in research for the book. While many fine main-line stations, such as (famously) King's Cross, London (Lewis Cubitt, 1850–2), have seen award winning programmes of adaptation and refurbishment, other research visits were rather deflating. The delightful 1846 cottage ornée at Fenny Stratford, on the Bletchley-Bedford section of the long-defunct 'Varsity Line', turned out on inspection to be empty and deteriorating. The Great Western Railway's Cirencester Town -- a fine, two-storey building of 1841–3 by Brunel and his assistant R P Brereton, marred by insensitive remodelling in the late 1950s -- now lies stranded in the middle of a car park in the centre of town. And all traces of the impressive 1873 brick station at Mablethorpe in Lincolnshire (closed in 1970) have vanished, save for a short section of platform in a municipal garden.

Perhaps the most depressing visit of all was to Wakefield Kirkgate in Yorkshire. Here the deteriorating station of 1854 was partly demolished in 1972, when the remaining historic fabric was pared back so that all the service pipes and wires can now be seen. Kirkgate's future remained uncertain even after it was listed in 1979, and in 2009 the station was branded the worst in the country by the then Transport Minister, Lord Adonis. Thankfully, Wakefield Council has unveiled a comprehensive development scheme for the building. More depressing still were visits to sites where the line still operates but the stations have been unnecessarily razed. The fine Brunel station at Marlow was needlessly demolished soon after 1967, and trains now pull up at a tarmacked platform.

Likewise, some former railway stations retain much character, but others have been mutilated almost beyond recognition. Brunel's handsome symmetrical Italianate design at Chard Central, Somerset survives as offices, although the line has long gone. Closed in 1957, William Hurst's splendid station of 1856 at Stamford East in Lincolnshire survives as the private house which it always resembled. The stone station at Wadebridge, Cornwall, immortalised in verse by John Betjeman but closed in 1967, survives as a daycare facility -- named, appropriately enough, the Betjeman Centre. Some old stations even offer accommodation, such as George Townsend Andrews' 1846 tongue-in-cheek pastiche of Vanbrughian Baroque at Castle Howard station in North Yorkshire, which now offers residential and self-catering holiday accommodation. The sturdy Italianate station at Alton in Staffordshire (1849) was closed in 1964 and reopened as prestigious and atmospheric holiday accommodation by the Landmark Trust in 1972.

More depressing were visits to sites where the line still operated but the stations themselves have been unnecessarily razed. The single-storey Tudor station at Henley-on-Thames was demolished as late as 1975, with a utilitarian substitute completed on roughly the same site only a decade later. The delightful gabled building at Dorking West, with its superb decorative bargeboards and fake timber framing, has been mindlessly destroyed.

Reassuringly, some of the stations closed in the 1950s and 60s have found a new lease of life in the hands of enthusiast-operated heritage railways. These provided perhaps the most cheering of all site visits. At Wansford in Cambridgeshire, John William Livock built a grandiose, stone-walled Jacobean pile in 1845 for a village of just 400 people. The station closed in 1957, and Livock's buildings were sold to a haulage company, yet the station is now the headquarters of the Nene Valley Railway. The handsome stone building at Midsomer Norton of 1874 – immortalised in Flanders and Swann's celebrated musical lamentation, 'The Slow Train', two years before it was closed in 1966 – today hosts the burgeoning Somerset and Dorset Railway Heritage Trust. Further north, G T Andrews' stations at Pickering and Grosmont of 1847 similarly prosper as the principal stations on the North York Moors Railway; there are several other examples.

Such inspiring stories as Wansford, Midsomer Norton and Pickering give the book its happy ending and served to renew faith in the future of the railways. Meanwhile, it is hoped this handsome volume will serve a fitting reminder of some of the greatest architectural achievements of the industrial era.

Grosmont Station (1847) prospers as one of the principal stations on the North York Moors Railway. © Historic England

Author

Dr Steven Parissien

Worked for The Georgian Group and English Heritage before joining Yale University's Paul Mellon Centre for Studies in British Art in London, as Assistant Director, in 1995. In 2003 he became Professor of Architectural History and Dean of the Faculty of Arts at the University of Plymouth, and in 2006 he joined The Prince's Foundation for the Built Environment as Director of Education. He is now Director at Compton Verney. Steven has written extensively on architectural and cultural history and has frequently appeared on national radio and television.

Further Reading

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South-west textile mills project completed

Publication wins major award.

The Historic England project to identify and record the textile mills heritage of the south-west region, published as *Textile Mills of South-West England*, has shared the 2014 Association for Industrial Archaeology's Peter Neaverson Award for Outstanding Scholarship. The book represents the final stage in the organisation's comprehensive overview of this important aspect of the region's historic environment.

The project began in the late 1990s with an assessment of listed textile mills, largely based on previous fieldwork by the Royal Commission on the Historical Monuments of England. It evolved to encompass studies of important places, including a publication on the textile industry of Bridport (Williams 2006), and detailed work on individual sites, most notably Tone Works an exceptionally well-preserved cloth finishing works (Williams and Jessop 2007). The latter won the Association for Industrial Archaeology's Main Award in 2008.

The textile industry developed in the south-west from the medieval period onwards leading to an exceptionally diverse range of sites. Some industries have remained in their original locations since that early date, resisting the relocation of manufacturing to the north that occurred during the Industrial Revolution. Different areas became associated with specific types of textile product, often based on the area's natural resources and topography. The woollen industries of Gloucestershire for example developed an extensive network of water-powered mills whilst Wiltshire's industry became concentrated in its market towns. In Dorset and Somerset, the flax and hemp industries were established as early as the 13th century, originally using locally-grown raw materials to produce sailcloth, rope, and nets.

The decline of the traditional woollen industry in the 17th century saw a crisis in the textile trade in some south-western areas. However in the 18th and 19th centuries new textile industries capitalised on the existence of a skilled labour force, moving into the south-west from other regions, to produce silk, hosiery, and machine-made lace. These industries introduced distinctive styles of architecture and new methods of production.

The *Textile Mills of South West England* draws together documentary research, measured survey and area assessment to demonstrate the significance and value of the surviving buildings and landscapes of the textile industry. It also examines the regional and national context of each of these industries, and makes a strong case for their further protection and conservation.

Author

Mike Williams
Investigator, Assessment with Historic England.

Mike Williams has worked as an architectural investigator for English Heritage and the Royal Commission on the Historical Monuments of England since 1990, specialising in industrial archaeology and vernacular buildings. He previously worked on the Greater Manchester Textile Mill Survey. The heritage of the textile industries, widely threatened and increasingly protected throughout England, has been a key professional interest since the mid-1980s.

Further Reading

Williams, M 2006 *Bridport and West Bay: the Buildings of the Flax and Hemp Industry*. Swindon: English Heritage

Williams, M 2013 *Textile Mills of South-West England*. Swindon: English Heritage

Williams, M Jessop, L 2007 *Tone Works, Wellington, Somerset: Survey and Analysis of Buildings, Power Systems and Machinery*. 2 vols. Swindon: English Heritage

Ham Mill, Stroud, illustrates the range of buildings associated with Gloucestershire's integrated woollen mills.

A history of the National Heritage Collection

An authoritative overview of how English Heritage's properties were acquired and conserved.

A history of the National Heritage Collection, English Heritage's stock of over 400 monuments and sites, has been published as a series of eight reports that are available as free online downloads. This is the most in-depth research into the history of the collection ever undertaken.

The series examines both why and how the state accumulated so many historic buildings and sites, along with the responsibility to repair them, protect them, and open them to the public. It is set within the wider context of the development of heritage protection in Britain. The research contained in these reports helped inform English Heritage Chief Executive Simon Thurley's book *Men from the Ministry: How Britain Saved its Heritage* (Thurley 2013). However it covers the history of the collection between 1882 and 1983 in more detail. It will be of interest to anyone studying the history of the conservation movement or of heritage protection.

Author

Sebastian Fry
Designation Advisor
with Historic England.

He assesses the significance of buildings and archaeological sites for listing and scheduling. An archaeologist by training, Seb has carried out fieldwork on Iron Age hillforts, Roman villas and medieval manorial sites. The reports were authored by himself and (for three of the series) Nick Chapple, formerly Places of Worship Advisor at English Heritage and now with Alan Baxter and Associates.

A 1930s railway poster advertising Goodrich Castle, Herefordshire, then in the care of His Majesty's Office of Works.

Further Reading

The reports are available at: Research.HistoricEngland.org.uk. Put 'Heritage Collection' into the search box.

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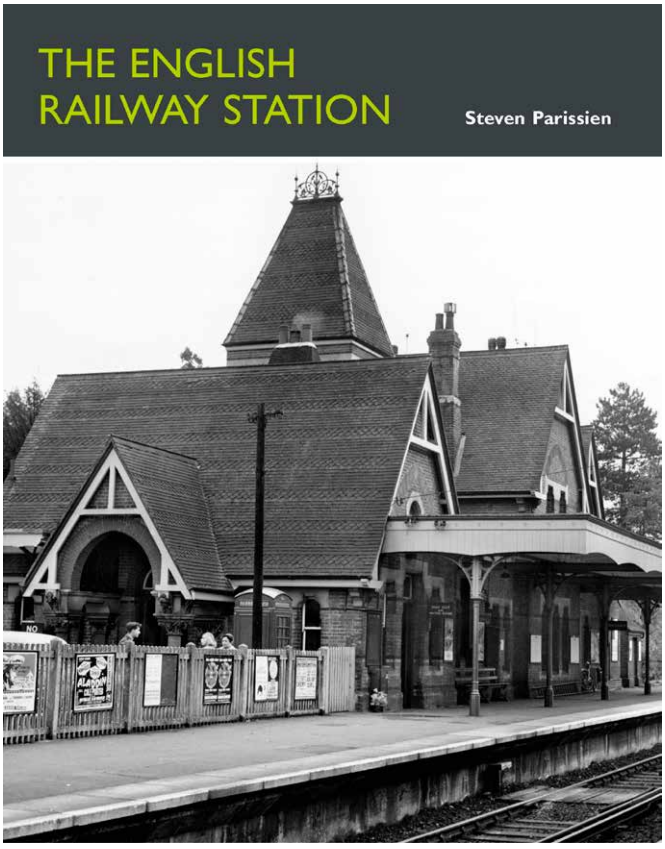
Historic England publications

Varied, rigorously researched, authoritative, and always generously illustrated the Historic England publishing programme reflects the aims and ethos of the organisation. Recent and noteworthy titles include those on the English railway station, and on south-western textile mills, both described earlier in these pages. Others include a ground breaking and encyclopaedic history of sport in London, and an innovative account of the story of hill farming on Exmoor. To find out more about all of our titles go to www.HistoricEngland.org.uk/imaging-books/books and view our catalogue.

The English Railway Station
Steven Parissien



This distinctive and well-loved building type has often been overlooked or dismissed and has suffered accordingly. Today a new interest in railways – fuelled by the need for sustainability, by a growing awareness of the realities of transport economics and by the dedication of enthusiastic volunteers at heritage railways across the country – has sparked a renaissance for the historic railway station and a new appreciation of the aesthetic virtues and regeneration potential of imaginative station architecture.

The English Railway Station traces how the station evolved into a recognisable building type, examines the great city 'cathedral' and evocative country stations of the Victorian era, and looks at how the railway station has, over the last fifty years, regained its place at the heart of our communities. Engaging and authoritative, it will be of wide appeal.

£25 : December 2014 : 978-1-84802-236-2 : hardback
172pp : 276×219mm : 250 illustrations

http://heritagecalling.com/2014/12/04/10-great-english-railway-stations/ Available at: www.HistoricEngland.org.uk/images-books/books/

Textile Mills of South West England
Mike Williams

Joint winner of the Association for Industrial Archaeology's Peter Neaverson Award for Outstanding Scholarship in Industrial Archaeology, 2014

> Mike Williams' book is able to bring that heritage vividly to life through a rich array of high quality photographs, both modern and archival, reproductions of contemporary prints, superb maps, and technical drawings which are liberally scattered throughout. This beautifully-produced and highly informative volume marks a most welcome contribution to the study of the textile industries of the south-west of England.
>
> **Journal of Rural History 25:2**

> ... one of a growing number of substantial, analytical studies by English Heritage which are characterised by rigorous field investigations and copious illustrations ... It is hard to find fault with such a thoughtful, thoroughly researched, well-written and beautifully presented volume.
>
> **Landscape History 35:2**

The textile industry has been one of the most prolonged and widespread influences on the development of historic buildings in the south west. The regional industry predated the classic period of the Industrial Revolution by several centuries, resulting in distinctive types of vernacular buildings, industrial buildings, townscapes, and landscapes, all contrasting with those in other areas.

This book provides a wide-reaching analysis of historical context, an account of the origins and development of each of the industries, an interpretation of the distinctive features of the buildings, a clarification of the historical importance of south west textile mills and clear statements on the benefits of their conservation.

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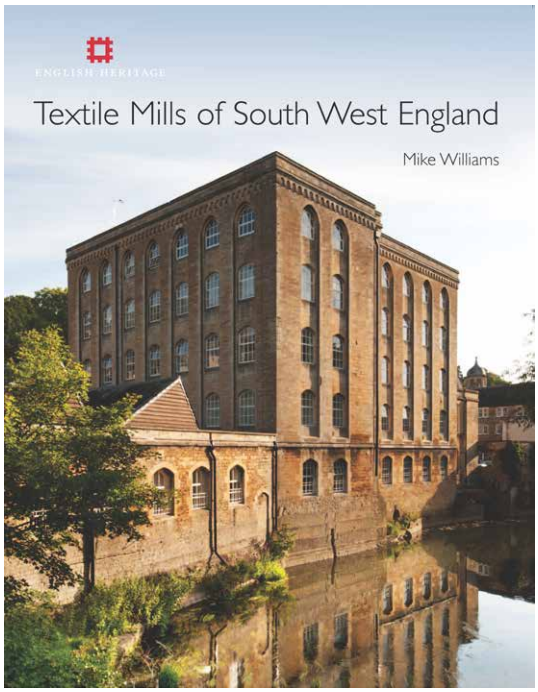

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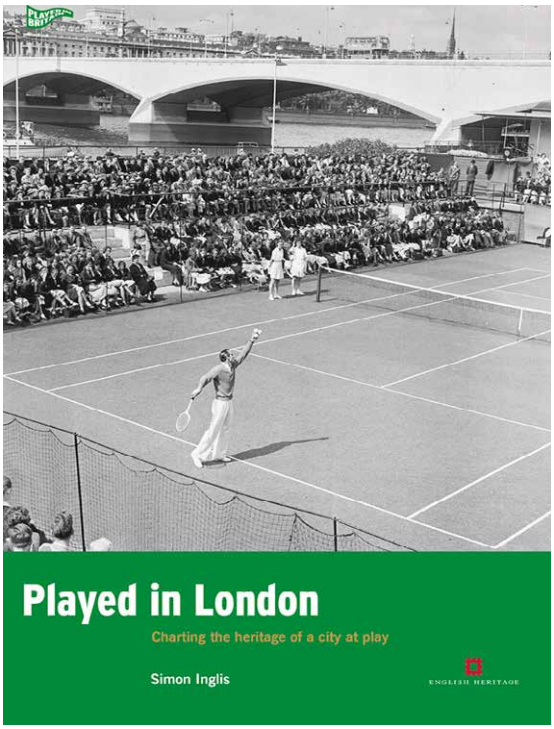

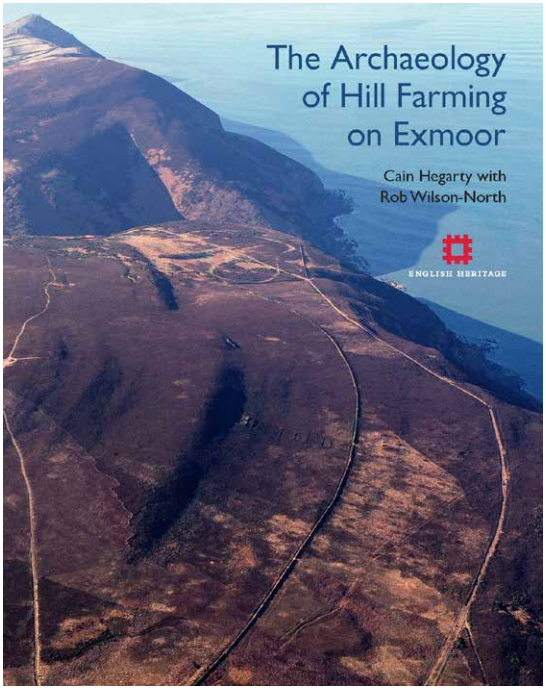

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Contact Historic England

East Midlands
44 Derngate
Northampton NN1 1UH
Tel: 01604 735400
Email: eastmidlands@HistoricEngland.org.uk

East of England
Brooklands
24 Brooklands Avenue
Cambridge CB2 2BU
Tel: 01223 582700
Email: eastofengland@HistoricEngland.org.uk

Fort Cumberland
Fort Cumberland Road
Portsmouth
Hampshire P04 9LD
Tel: 023 9285 6704
Email: fort.cumberland@HistoricEngland.org.uk

London
1 Waterhouse Square
138-142 Holborn
London EC1N 2ST
Tel: 020 7973 3000
Email: london@HistoricEngland.org.uk

North East
Bessie Surtees House
41–44 Sandhill
Newcastle Upon Tyne
NE1 3JF
Tel: 0191 269 1200
Email: northeast@HistoricEngland.org.uk

North West
Suites 3.3 and 3.4
Canada House
3 Chepstow Street
Manchester M1 5FW
Tel: 0161 242 1400
Email: northwest@HistoricEngland.org.uk

South East
Eastgate Court
195-205 High Street
Guildford GU1 3EH
Tel: 01483-252000
Email: southeast@HistoricEngland.org.uk

South West
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Tel: 0117 975 0700
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Swindon
The Engine House
Fire Fly Avenue
Swindon SN2 2EH
Tel: 01793 414700
Email: swindon@HistoricEngland.org.uk

West Midlands
The Axis
10 Holliday Street
Birmingham B1 1TG
Tel: 0121 625 6820
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