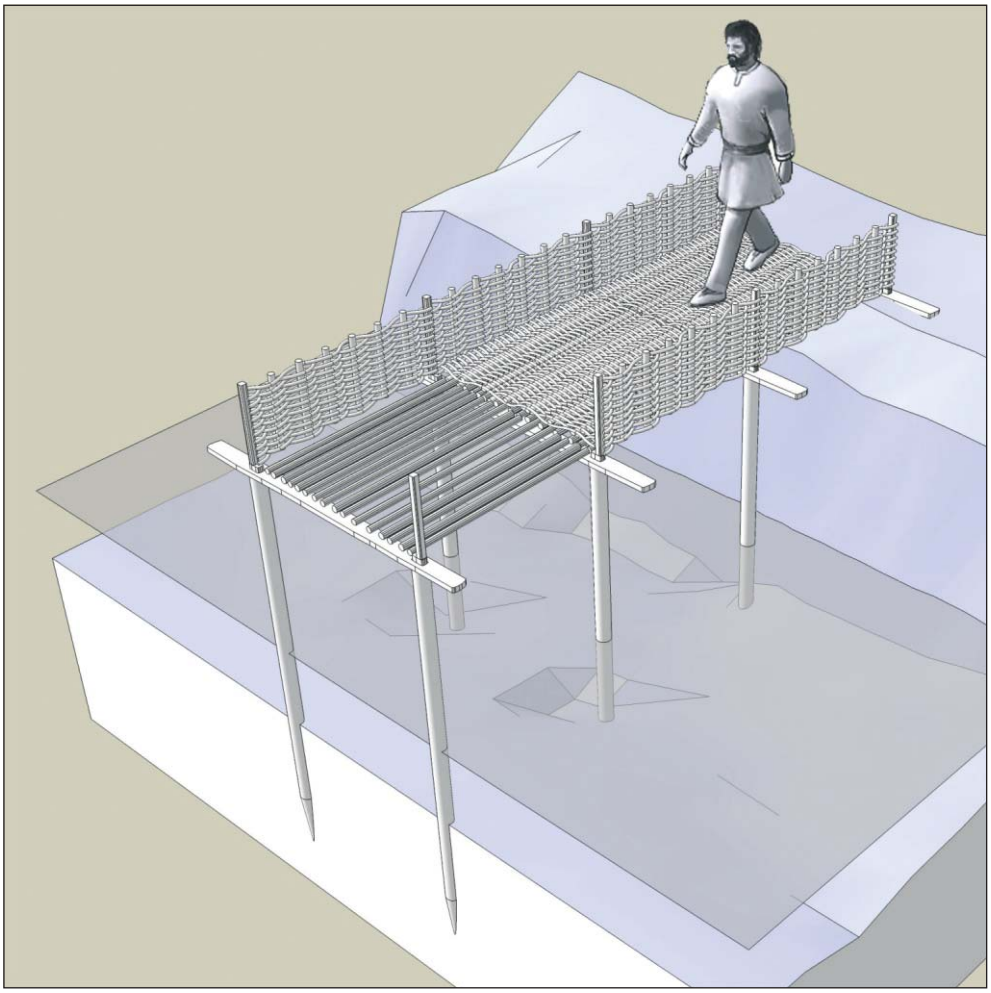
# Waterside management from the Middle Bronze Age to present day

## High Speed 1 Investigations at Stratford, London Borough of Newham

*By Hilary Valler and A D Crockett*



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# Waterside management from the Middle Bronze Age to present day:

# High Speed 1 investigations at Stratford, London Borough of Newham

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**SUMMARY**

*Archaeological investigations close to the River Lea at the High Speed 1 (HS1; formerly Channel Tunnel Rail Link) site known as Stratford Box, Stratford (NGR 538200 184810; London Borough of Newham) revealed waterside structures and associated environmental sequences dating from before the Middle Bronze Age to the post-medieval period. The earliest evidence for human activity on the site takes the form of a Mesolithic tranchet axe and a Late Neolithic/Early Bronze Age flake, both found as residual finds in later contexts. The first evidence for riverside management comprised an alignment of Middle Bronze Age stakes along the edge of a hollow, filled with a Lateglacial to mid-Holocene channel edge alluvial and peat sequence. A second series of stakes, dated to the Middle Iron Age, probably represents the remains of later channel-edge revetment.*

*After an apparent hiatus in activity during the Roman period, there is evidence for land reclamation and channel management in the Saxon period. As well as alignments of stakes probably representing bank revetments, a probable bridge/jetty structure was also identified. Radiocarbon dates obtained from this structure suggest its construction dates to the Middle Saxon period, whilst radiocarbon dates obtained from other structural elements, including a disused/ discarded wattle panel, indicate continued activity and use into the Late Saxon period.*

*Limited evidence for medieval activity was recorded, possibly due to truncation by post-medieval and modern industrial activity on the site. Development of the 20th century railway marshalling goods yards was well-represented on site, in the form of numerous brick and concrete foundations,*

*structures etc. A wholesale reorganisation of the site was undertaken after the Second World War, in part because Stratford was one of the most heavily bombed areas of the United Kingdom during this conflict.*

## INTRODUCTION

High Speed 1 (HS1), formerly the Channel Tunnel Rail Link, is a new high speed railway linking London St Pancras to the Channel Tunnel, and crossing the River Lea at Stratford *en route*. Works undertaken at Stratford primarily comprised the construction of a substantial sub-surface structure, colloquially referred to as the 'Stratford Box', which carries the new track in a concrete-lined cutting across the east side of the Lea Valley.

The site lies on the NW perimeter of Stratford town centre in the London Borough of Newham, East London (Figure 1). It covers most of the eastern side of the floodplain of the River Lea, and is bounded by the river to the west and higher ground overlooking the floodplain to the east. To the north is the A12 trunk road, and to the south formerly Carpenter's Road, though much of this route has since been re-modelled as part of the London 2012 Olympic Park works. With specific reference to this more recent development, the Stratford Box passes centrally through the Olympic Village (within Olympic Delivery Authority Planning Delivery Zones 9 and 11; not illustrated).

## GEOLOGY AND TOPOGRAPHY

The land within the site is generally level, with modern ground surface at approximately 5m above Ordnance Datum (OD). Overall, the site comprises an approximate diamond-shaped parcel of land measuring at its extremities 1.2km east to west and 1km north to south, though the majority of archaeological investigations focussed on the central east to west corridor of Stratford Box itself.

The geology of the area comprises a sequence of Palaeocene deposits, collectively referred to as the Lambeth Group (Woolwich and Reading Beds). These deposits include sandy elements (Upper Thanet Beds) and pebble beds (Upnor Formation) (British Geological Survey 1993). Overlying this

material are Quaternary deposits of gravels and soft unconsolidated sands, silts, clays and peats, related to the gradual infilling of the River Lea valley (Bates 1997).

It should be noted that for consistency, this report will adopt the conventions *Lateglacial* and *Post-glacial* to describe the Palaeolithic – Mesolithic transition.

## ARCHAEOLOGICAL BACKGROUND

An initial desk based assessment (Wessex Archaeology 2002) showed that only limited archaeological remains were known within the area, including Upper Palaeolithic implements, former river channels, the medieval Chobham manor house, medieval or post-medieval field systems and post-medieval industrial activity. Additional documentary research (Phillpotts 2007b) was subsequently undertaken to assist with the phasing of the excavated structures and to complement the finds and environmental information.

## ARCHAEOLOGICAL WORKS

In summary, archaeological works undertaken on the site (Figure 1) comprised: a series of seven boreholes; five trial trenches; an excavation at the west end of the Stratford Box (divided into two areas); and a watching brief on associated HS1 construction works.

Seven geotechnical boreholes (3845BH to 3850BH inc. and 3952BH) were drilled at specified points; each was observed and recorded with samples taken through the full depth. The information recorded was used in conjunction with the results of earlier geotechnical work to create a stratigraphic model of the area. Sections across the Stratford Box were also sampled and recorded at pre-determined points during the construction watching brief in order to augment the model of the Holocene stratigraphy to a depth of over 6m below ground level. The sedimentary data gained from these sections and deep boreholes will be reported under the HS1 Thames Holocene Principal Study. Local Holocene sedimentary and environmental conditions are also examined here where relevant to the history of the site.

The five large stepped trenches (numbered ARC3839TT and ARC3841TT to ARC3844TT) covered a total area of *c*. 2,750 square metres. The detailed excavation area covered most of the westernmost 50m of the Stratford Box, and was excavated to the surface of the Quaternary river gravel, at a depth of *c*. 5m below modern ground surface. In addition to construction of Stratford Box itself, a watching brief was also undertaken during the construction of a balancing pond to the south of the west end of the box, centred on evaluation trench ARC3839TT.

The HS1 Archaeology Programme was carried out under the guidance of a research strategy prepared by Dr P L Drewett (Drewett 1997), on behalf of Rail Link Engineering (RLE). This defined five broad Landscape Zones through which the route passes. The Stratford Box site lies within the Greater Thames Estuary Zone, for which defined priorities included establishing the presence/ absence, extent, condition, character, quality and date of any archaeological remains and/or Quaternary deposits of geoarchaeological importance within the area. Also the presence and potential of environmental and economic indicators preserved in any archaeological features or deposits; and investigation of the local, regional and national importance of such remains and the potential for further archaeological fieldwork to fulfil research objectives. Such priorities were specifically highlighted in relation to potential earlier prehistoric periods of activity, classified by Drewett as *Hunter-foragers* (400,000 – 4,500 BC) and *Early agriculturalists* (4,500 – 2,000 BC).

## RESULTS

### Lateglacial to Holocene alluviation and floodplain environments

The centre of the excavation area was dominated by a large hollow (feature 4271) that extended beyond the southern limit of excavation (Figure 2). The hollow was formed by a Lateglacial river channel and filled with a sequence of waterlogged alluvial channel edge and peat deposits (Figure 3). The primary peat fill(s) largely pre-date the archaeological evidence, therefore the full results from analysis of the sediments, pollen, plant macrofossils, wood and radiocarbon dating through this basal sequence are published separately (see Barnett *et al*. 2011). In summary, the results

indicate a significant Lateglacial to early Post-glacial alluvial and peat sequence, with the eroded top of the peat dated to the early Mesolithic at 8450-8240 cal BC (NZA-27376; 9099±45).

A series of alluvial, channel edge and calcareous spring deposits (such as chalk-rich deposit 4326; Figure 3) that overlie the peat are, however, of direct archaeological interest, with pollen and plant remains recovered from deposits of likely Middle Bronze Age to Iron Age date. Results indicate that the local floodplain environment from the Middle Bronze Age onwards was wet and prone to repeated high water inundation, supporting a rich grass and herb community, with willows growing on the edges. Drier areas on the flood plain had been opened up by human activity with rough pasture established and possible arable cultivation. An increase in the variety of woody taxa including ash, oak and hornbeam at this time indicates that although trees were fewer in number than in earlier deposits, they had increased in diversity, with the possibility of local management. The local later prehistoric community clearly exploited this resource, as demonstrated by the presence of Middle Bronze Age and Late Iron Age stake alignments (see below). Finds of a fig seed and charred glumes of spelt wheat in the top fill of the hollow (context 4316; Figure 3), suggest a Romano-British date despite the lack of other evidence for nearby settlement or riverside activity of this date (Barnett *et al*. 2011).

**Archaeology at Stratford Box**

*Introduction*

At the west end of Stratford Box (Figure 2) an area was excavated to the surface of the grey Quaternary sand and gravel, at an approximate depth of -0.70 m OD. Evidence of former channels of the River Lea and/or its tributaries was observed at this depth. The artefact assemblage is dominated by fluvially reworked material, such as unworked animal bone (cattle, horse pig, dog and beaver), which cannot be confidently considered as contemporaneous with the deposits from which they were recovered. Furthermore most of the recovered artefacts are undiagnostic in terms of date range. For example, a piece of worked red deer antler tine (Plate 1) from one of the uppermost fills of channel 4148 (deposit 4179; not illustrated), is comparable with similar items

dated from the Neolithic through to the medieval period. It has been suggested (Roes 1963, 43-5) that these items were either cheek pieces for horse bits or large needles for whickering and/or making fishing nets. Considering the local fluvial environment and associated waterside activities, the latter is considered more probable here.

The recovery of a beaver tibia from alluvium pre-dating all other archaeological remains is of note. The European beaver had been largely hunted to extinction in England by the 16th century, although in some areas of the country they are thought to have survived into the early 19th century (Coles 2010, 115). Most beaver finds in archaeological contexts are prehistoric in date and the few that have been found in Essex have all been dated to the Hoxnian and Pre-Ipswich periods (423,000-110,000 BP) (Yalden 1999, 140-143), while the channels and associated alluvium within the Lea Valley are generally considered to belong to the Holocene period.

*Prehistoric Activity*

The earliest evidence for human activity at Stratford Box comes in the form of two worked flints, both recovered as residual finds in later deposits. The first of these is a small Mesolithic tranchet axe, recovered during the watching brief (Figure 4) as an unstratified find. The axe is 130mm long, 50mm wide and 30mm deep, made on a rich brown flint with frequent orange-brown mottles and some cherty inclusions. The small patch of cortex remaining on the upper surface is thin and worn, indicating a raw material derived from a secondary context. Overall the piece is in good condition, with no significant gloss, rolling, edge damage or other signs of prolonged exposure prior to deposition. One surface has a very light patina, which probably indicates that the piece spent some time partially buried. The second worked flint is a single flint flake, probably Later Neolithic or Early Bronze Age in date, recovered from an upper fill of hollow 4271. The recovery of these worked flints suggests sporadic opportunistic activity in the valley, most likely hunting animals grazing on the floodplain.

The first clear evidence for human management of the landscape dates to the Middle Bronze Age. A series of five stakes (4079 to 4083 inc.) were recorded on the north eastern periphery of hollow

4271, on an approximate north south alignment and extending over a distance of *c*. 5.6m, the first four (4079 to 4082 inc.) covering a distance of 3m, the fifth stake (4083) a further 2.6m beyond. The stakes had all been driven into the eroded top of the early Mesolithic peat filling the hollow, but were not directly related to its formation/ infilling.

Three of the stakes were retained for further analysis and two, one elder (4079) and the other alder (4081), were dated to the Middle Bronze Age (NZA-15956; 1520-1260 cal BC and NZA-15960; 1530-1300 cal BC respectively; Table 1 and Figure 5). This represents a period of increased fluvial activity, with deposits sealing the peat-filled hollow (Barnett *et al*. 2011) to the west of the stake line. In this context it appears that the use of these stakes was a direct response to increasing water levels and minor flood events, either in an attempt to stabilise the wetland edge to protect agricultural land to the east, or as part of a structure to facilitate access to the river edge. It is noted that although elder macrofossils and unworked wood have been found elsewhere, no other worked pieces are known for this period.

Use and, perhaps, management of locally available wetland material such as willow is indicated from its significant representation in the unworked wood assemblage (see Table 2), as well as in the plant macrofossil and pollen assemblages throughout the prehistoric sediments at the site. It is feasible there were osier beds in the local area (Barnett *et al*. 2011).

The third stake (4083), however, was fashioned from ash heartwood and dated to the Middle Iron Age (NZA-15959; 410-190 cal BC), demonstrating its apparent spatial relationship to the other stakes as purely coincidental. Additional worked timbers were recovered to the south, both in trench 3839TT and during the watching brief on the excavation of the balancing pond in the same area. These include another series of stakes on an apparent NW/SE alignment noted during the machine-excavation of the balancing pond, one of which (oak stake 4108, not shown on plan) also returned a Middle Iron Age date (NZA-15814; 410-340 cal BC). These remains may therefore collectively suggest the presence of revetment-style structures persisting along the edge of the channel through until at least the Middle Iron Age. Small timber ‘chips’, the remains of timber

working cut-offs, which probably represent a stockpile (383917) were recovered from trench 3839TT, and are likely to be of a similar Iron Age date (Figure 6).

*A Romano-British hiatus?*

Very little evidence for the Romano-British period was observed and there were few finds. This is surprising given the proximity of *Londinium*, the road between *Camulodunum* and *Londinium*, which crosses the Lea valley somewhere close to the south, and other known sites in the immediate area. These include the settlement and cemetery at Old Ford, a causeway, sarcophagus and a coin filled urn reportedly discovered just to the north at or near Temple Mills. Actual evidence for Romano-British occupation at the site includes a few fragments of pottery, and an almost complete (but broken) samian bowl from alluvium filling a shallow natural scour or hollow (4153). The vessel is a form 18/31R, probably of Hadrianic to early Antonine date (*c*. AD 120-150), and stamped AVRINV.M - *Avrinvs+manu*, 'by the hands of Avrinvs', a potter probably working at Lezoux in Central Gaul during the first half of the 2$^{nd}$ century AD. Given the alluvial context from which it was recovered, it is by no means certain that the vessel was *in situ*. Further evidence for Romano-British activity in the vicinity includes the incorporation of Romano-British brick and tile fragments in an Early to Middle Saxon bridge/jetty abutment structure (below), and less certainly by the recovery of charred spelt wheat and fig remains in the upper fill of hollow 4271 – though neither are secure chronological indicators, collectively they suggest activity during the Romano-British period.

*Waterside activity during the Saxon period*

Prior to these excavations, there was little evidence for Saxon activity known in the immediate area (Wessex Archaeology 2002). The town was first recorded between 1066 and 1087, when William I confirmed Westminster Abbey in its possession of a watermill at *Straetforda* ('a ford on a Roman road'), suggesting an established settlement by at least the Late Saxon period.

With western Stratford on the River Lea's alluvial floodplains, the process of reclamation of the marshlands probably started during the Saxon period, and proceeded from east to west.

Excavations to the south of the site at Station Road revealed that the eastern bank of the Channelsea was reinforced with driven stakes or piles late in the Saxon period (site code HW-GY94) (Phillpotts 2007b). A series of earthen banks or walls were constructed along the marsh edge, and the land behind was then enclosed and drained in a series of smaller parcels divided by cross-walls or counter walls, thereby advancing the area for cultivation and pasture over time. These counter-walls were used as access lanes into the marshes, and survive to this day as routes such as Temple Mills Lane, the roads to Chobham Farm and Hop Ground, and Abbey Lane (Figure 7). The successive stages of reclamation are represented by the watercourses of the Channelsea River, Waterworks Rivers, City Mill River and Pudding Mill River to the north of the High Street, and the Channelsea, Three Mills Wall River and Three Mills Back River to its south.

The reclamation of the marshlands is likely to have reached as far west as the site by the Middle Saxon period - the excavation at the western end of the Stratford Box exposed the former course of the Channelsea (as palaeochannel 4015) and the eastern bank of the former channel of the Waterworks River (as palaeochannel 4148, see Figure 2). Along the bank of the Waterworks River were the remnants of a bridge/jetty structure (4274) dating to the Early to Middle Saxon period, constructed using flint, limestone and timber and by incorporating pieces of Roman brick and tile (Plate 2). Three oak timber piles (4110, 4114 & 4234) that appeared to form part of the superstructure for this bridge/jetty abutment provided a date range within the (Early to) Middle Saxon period (NZA-15870; cal AD 600-780, NZA-15815; cal AD 590-780 and NZA-15869; cal AD 600-810 respectively, the earliest date range coming from oak heartwood and potentially therefore too early) (Figure 2 and Table 1). This dating is consistent with similar results from other worked timbers found in the near vicinity. The bridge/jetty was most probably constructed using oak timber piles driven into the ground beneath the water, and would have extended out over the channel possibly with wattle panels along the sides to enclose the walkway. With only the easternmost abutment within the excavation area, it was not possible to determine with certainty whether this structure was used as a bridge across, or jetty out into, the adjacent Waterworks River.

Two other timbers found in the vicinity of the structure are of particular note (Figure 8). Though possibly slightly later in date (NZA-15868; cal AD 670-890) than the stakes, they could have been part of a later stage of construction. The first is a small cross rail, roughly hewn to a sub-rectangular cross-section from an oak log cleft in half (4243) and pierced by an oval through socket. The second is an oak pile (4225), 3.6m in length with a faceted, pencil-type point at the base and an axe-carved complex form of tusk tenon at the top, with an elongated prong projecting above it. It appears that the cross rail fitted over the pronged pile and that the prong may have been used to secure wattle panels as sides for the structure (see Figure 8). The complex carpentry (or 'treewrightry') seen in this 'socket and tenon' pairing is particularly interesting, since such woodwork is rare in the Saxon period. The best parallels are the shorter piles used for the raised foreshore board walks found in the City of London, where they date to *c*. 900 AD, and are associated with the early beach market at Ethelred's Hithe, now known as Queenhithe (Wroe-Brown 1999).

A bundle of wattle rods (4264) was recorded against the eastern bank of the Waterworks, approximately 6m north of the possible bridge/jetty. Although probably used for stabilisation of the bank, these may alternatively represent a stockpile for wattling. A date obtained from one of the rods in this bundle is also consistent with the structure and timbers mentioned above (NZA-15824; cal AD 610-780, see Table 1). A wattle panel (4169) was also recovered from the eastern bank of the palaeochannel to the south (Figure 2 and Plate 3). This panel measures 2.60m by 1.45m and consists of single rods wound round the uprights (sails). The remains of three footprints can be observed moving from east to west over the panel, cleanly breaking the panel on each step. The date range for the panel (NZA-15813; cal AD 770-1000) is most probably later than the construction of the bridge/jetty and associated timbers, the panel may therefore have been used to stabilise the bank south of this structure. The footprints and breakage of the panel need not have occurred much later than the deposition of the panel in this spot, since wattle used externally will decay to a brittle condition within three to four years if untreated. One long alder timber (4206) was found near to the wattle panel, in the upper layers of a naturally filled scour pit (4155), but not in its

original context. It was dated to cal AD 770-1020 (NZA-15816) and could have formed part of a later stage of construction or have been part of a river-related structure such as another bridge, jetty or fish trap.

A number of upright stakes were recorded in the north western corner of the excavation area, apparently forming part of a second structure aligned north east to south west. Radiocarbon dates from several of these timbers (4135, 4132 and 4134) all date to the Middle to Late Saxon period (NZA-15957; cal AD 640-830 (92.9%) to cal AD 840-870 (2.5%), NZA-27374; cal AD 650-770 and NZA-15867; cal AD 660-880). A large amount of coppiced wood caught in among the upright timbers of this linear structure included two pieces (4141 and 4144) dated to the Early Saxon period (NZA-27357; cal AD 430-490 (13.9%) to cal AD 500-600 (81.5%) and NZA-27352; cal AD 530-650 respectively). These had presumably been brought downstream from an earlier disintegrating/ collapsing structure to the north. Further waterside management was recorded close to the southern edge of the excavation area, comprising a line of stakes on a north west to south east alignment, and probably represent the remains of a revetment or similar river bank structure. Three timbers from this structure (4203, 4210 and 4125) provided dates of cal AD 770-1020 (NZA-15908), cal AD 810-990 (NZA-27355) and cal AD 870-1020 (NZA-27356) respectively.

Evidence for probable Saxon or later woodland exploitation comes from the analysis of charcoal from a shallow sequence of alluvial layers within the excavation area (4251), not shown on plan but overlying the Saxon bridge pile 4225. The charcoal assemblage recovered contained a range of taxa (Table 3) and although the deposit was not securely dated, the stratigraphy indicates a Saxon or later date. Thermophilous tree types predominate, all of which are common native trees of mixed deciduous woodland and hedgerows. The presence of alder attests to the continuation of waterlogged channel edge soils at the site, whilst most of the other tree types prefer drier soils further back from the river edge on higher free-draining gravel terrace(s). Ash, hazel and birch in particular require relatively open conditions rather than closed canopy woodland to survive.

Roundwood dominates this sequence, perhaps suggesting the exploitation of coppiced wood stands for domestic use or small scale industry (cf Carew *et al.* 2010, 26).

*Medieval Stratford*

In 1086 the Domesday survey recorded that the manor of Athelstan in Hamme, in which Stratford was situated, was under joint ownership by Robert Gernon and Ranulf Peverel. This was bestowed upon them for being followers of William I during the Norman Conquest. The ownership of the land subsequently passed through various owners and eventually into the hands of the Savigniac Abbey of Stratford Langthorne, which was founded by William de Montfichet in 1135. The Abbey joined the Cistercian order in 1147 and was dissolved by Henry VIII in March 1538.

The Roman road crossing the Lea valley from Old Ford to Stratford continued in use until the 12th century, when Queen Matilda, wife of Henry I, provided the initiative and finance to construct a new crossing, allegedly after suffered a soaking at the ford. The road crossed the valley via two bridges over the Rivers Lea and Three Mills Wall (the latter representing the confluence of the Waterworks and City Mill Rivers immediately up stream from the bridge), the bridges linked by a central gravel causeway. The Bow Bridge over the Lea was reputedly the first stone arched bridge in England, and helped to maintain the old Roman road as the main route from London to Essex until the 20th century (Figure 7). It was after the construction of this crossing, early in the 12th century that Stratford started to develop significantly as a settlement.

The reclaimed marshland became an area which encouraged industrial activity and, in particular, developed into an important corn milling centre from at least the 11th century, processing corn from Essex for the London market. Fulling mills are known to have been in use in the area during the 13th and 14th centuries (CLBN 1986). In *c*. 1329-31, the edge of the marshland to the north of Stratford was bought and formed the sub-manor of Chobham. Chobham manor house lay in the north-eastern part of the site (Figure 7) and, though nothing is known of its form, it is likely to have been moated. Stratford became an area specialising in the grazing and slaughtering of cattle driven from Essex and destined for London markets during the 14th and 15th centuries and, from

this, ancillary trades such as tanning and leather-working developed. A royal ordinance stated that obnoxious trades were to be kept out of the city and, on the eastern side, Stratford was the closest that they could be brought in.

Although there is a comparative wealth of documentary evidence for the medieval period at Stratford, there is a general paucity of supporting archaeological evidence. Field boundaries pre-dating more recent remains were recorded in Trench 3841TT, two running parallel on a NNW-SSE orientation (384144 and 384172) and a single ditch aligned NE-SW (384134) (see Figure 9), but none could be closely dated. It is likely that other evidence has been destroyed by the intensive industrial development witnessed during the 19th and 20th centuries, including the construction of the extensive railway network, sidings etc. and associated infrastructure.

*Post-Medieval and modern development*

INDUSTRY

The gradual industrialisation of the area continued into the 16th and 17th centuries; osiers were cultivated on plots of marshland adjacent to the water channels, reflecting the use of the wetland environment to produce locally coppiced willow strands that may have originated during the prehistoric period. Both osiers beds and butchers' grazing grounds were still features of local agriculture by at least 1738 (Phillpotts 2007b), and a small farm called Hop Ground is noted on Rocque's map of 1746 (Figure 7), a name probably derived from hope or hoppet denoting a small enclosed plot of land (c.f. Field 1993, 129; Mills 1991, 178).

Other industries were also established at Stratford during the late 16th and 17th centuries including textile trades such as dyeing, embroidering, and silk weaving. These were succeeded by calico printing, with works established next to the River Lea from the late 17th century, which became one of the main industries during the 18th century. Phillpotts (2007b) records that two calico printing works were depicted on the north part of the Channelsea River, on either side of the river in the southern half of the site. They appear on Chapman and André's Map of Essex from 1777 (Figure 10) as well as a later sketch map of 1810 (not shown).

During the late 18th and early 19th centuries both Chobham Farm and the Hop Ground were owned and leased by the Henniker family, who were prominent in affairs of the parish. Soon after 1853, Chobham Farm and much of the surrounding land were bought by the Eastern Counties Railway (ECR) Company for the extension of its works and sidings. The house was finally demolished to make way for the High Meads Loop before 1894; it appears on a map of 1877, where it is depicted as being reached via a bridge (Figure 11). The Hop Ground suffered a similar fate. Prior to 1821 it had become a tannery yard with extensive buildings, as depicted on Crutchley's map of 1829, and it was bought by ECR in 1852 and demolished soon afterwards.

THE RAIL NETWORK

Through the purchase of land and the development of the railway works on the site, Stratford became a hub of industry and transport (Philpotts 2007b). A station was opened in June 1839, with the railway carried over the marshes and watercourses by an embankment and a series of bridges, the station entrance was via Station Road from Angel Lane. Trench 3844TT (Figure 12) was positioned on the eastern periphery of the site and contained only modern services above natural layers, demonstrating that there is no evidence for occupation prior to the station road construction.

The rail system continued to grow to link Stratford to Liverpool Street station and later extended to Colchester, also to the north to Hertford and Cambridge by 1845. A small repair depot was on the site by 1839, with new workshops being built on the west side of Angel Lane in 1846. These included an engine shed, a wagon shed, carriage shops, a carpenter's shed, a coppersmith's shop and a smithy. They were built of brick and stone work in trench foundations and had slate roofs with skylights. ECR transferred its main locomotive works from Romford to the new site in 1847 with locomotives and rolling stock being manufactured and repaired at Stratford. The ECR amalgamated with other companies in 1862 and became the Great Eastern Railway, which rebuilt the station in 1885-8.

The works were subsequently reorganised in the late 1880s and locomotive production was standardised in the interest of speed and efficiency. It was during this reorganisation that a new

Wheel Shop was built and the works also consisted of foundries, a Spring Shop, the Carriage Department and a Running Department. Annotated on an ordnance survey map of the area from 1916 (Figures 9 and 12), the building's functions have been transcribed from a map of the Stratford Locomotive Works (NA RAIL 227/284 (1914) and NA RAIL 227/285 (1915) - not shown). This shows that the three central trenches which were excavated (3841TT, 3842TT and 3843TT) were all positioned over buildings from this period.

Trench 3841TT (Figure 9) revealed a series of brick and concrete walls orientated NW-SE (384166-384171) and NE-SW (384117), part of the foundations of a demolished Running Shed. Trench 3842TT was located over the demolished Carriage Department Extension Shed and contained two large timber plank 'containers' (384285 and 3842100) with three horizontally laid planks secured with vertical planks on the corners. Also recorded in the trench was a north-south aligned section of wall constructed using bricks set in concrete (384218), presumably the footings for an internal wall of the building with a drain cover in the south east corner (3842144) and several modern service trenches.

Trench 3843TT (Figure 12) was positioned over the Carriage Department Saw Mill and office. A series of yellow bricks in stretcher bond brickwork and concrete walls with concrete foundations was recorded, together with a 2.4m wide section of yellow brick path (3843144) orientated northeast-southwest. The internal brickwork of the path was the same as the walls, and bordered by a single row of brick edging. These features probably related to the internal layout of the Wheel Shop with designated walkways bypassing machinery. The remains of a railway line (3843127) orientated NE to SW and still containing rails and sleepers was recorded on the northern side of the trench.

Considerable developments occurred during the 20th century with the development of the marshalling goods yards. The most significant change to the site was undertaken in 1946 when the whole area was reorganised due to the widespread damage which occurred during the Second World War. Stratford was one of the most heavily bombed areas of the United Kingdom with over a

quarter of the housing stock in West Ham borough destroyed. The grounds where Chobham Manor had once stood were noted to have been hit by a V2 rocket. No investigation on that area of the site has been undertaken in the past or during this phase of archaeological fieldwork.

Stratford railway works finally closed in 1963, with an international freightliner terminal opening in 1967, with new buildings constructed. On the south eastern side of Trench 3843TT a parquet 'type' floor, constructed of interlocking triangular-shaped wooden blocks was recorded during the fieldwork (384332) which could have been associated with offices from this period. This had been truncated by concrete foundations, a brick wall and a brick with concrete structure. The freightliner terminal was subsequently closed in the early 21st century to make way for HS1 and the new international station.

DRAINAGE AND LANDSCAPING

The ground level of the area was raised for the construction of housing, factories and railways and rendered the old drainage system of the branches of the River Lea redundant. The Northern Outfall Sewer was built by the Metropolitan Board of Works in 1868 to replace this worn out drainage system with a flat-topped embankment to an outfall into the Thames at Barking Creek. By 1931 all foul drains in Leyton and West Ham Boroughs had been linked to the new sewer. The Channelsea River was infilled and culverted under the railway yards during the 1930s and the former channel was exposed in both the excavation at the west end of the box (4015) and evaluation trench 3839TT (383927; Figures 2 and 6).

## DISCUSSION

Archaeological fieldwork carried out at Stratford Box has shed considerable light on the history of the lower Lea valley, with the remains of a Lateglacial channel providing important evidence for the local environment at this time, and evidence for human activity from the Late Neolithic through to the modern period. From the Middle Bronze Age onwards, it is clear that human activity on the site was largely concentrated on the exploitation of riverine resources, water management and land reclamation. The Lower Lea Valley is cut by numerous streams and river channels, and these

formed a significant barrier to movement along the north bank of the Thames, however the need to provide permanent crossing points to these watercourses created a focus for settlement during the medieval and post-medieval periods. It is only in the modern period, and in particular from the second half of the 19th century onwards, that the river and its floodplain ceased to dominate settlement and transport patterns in the area. The coming of industry, and ultimately the railway first saw widespread harnessing of the power of the watercourses and ultimately their formalisation and canalisation, culminating in the culverting of the Channelsea River in the 1930s. This pattern continues into the 21st century with the construction of the HS1 development.

The fieldwork recovered significant evidence for the environment in the Lateglacial and Early Post-glacial period (Barnett *et al*, 2011). This culminated in the formation of peat deposits in the Early Mesolithic period. The earliest evidence for human activity comprises worked flints of Mesolithic and Late Neolithic/Early Bronze Age date that were found in later contexts. The presence of these worked flints points to sporadic activity within the Lower Lea Valley, where both the watercourses themselves and the animals which watered at them would have attracted small bands of hunter-gatherers, despite the apparently marshy nature of the ground.

By the Middle Bronze Age, the immediate environment seems to have changed, with the earlier peats sealed by alluvial and channel edge deposits indicative of repeated episodes of flooding, whilst further afield there is evidence for both pasture and possible small scale arable farming. This opening up of the landscape coincided with the first attempts to manage the floodplain environment. Although the purpose of the line of wooden stakes recovered from along the edge of the earlier hollow is not clear, their location clearly indicates they belong to a waterside structure.

By the Middle Iron Age, there is clearer evidence for revetment of the river bank – the second alignment of stakes, recorded to the south of the Middle Bronze Age group and radiocarbon dated to the Middle Iron Age, appears to define the eastern edge of a channel, and probably acted as a revetment.

There is little evidence for Roman activity on the site – the only significant finds were a few sherds of pottery and a 2nd century AD Samian bowl that were found in a later scoop/hollow. Roman settlement in the vicinity appears to have largely focussed on the point at which the Roman road from Colchester (*Camulodunum*) to London (*Londinium*) crossed the River Lea at Old Ford and on the nearby settlement at Temple Mills. The site is therefore likely to have been marginal to this settlement pattern, on the low-lying floodplain, and subject to occasional flooding episodes. Although no timber structures related to waterside management were identified within the main excavation area at the west end of Stratford Box, this may indicate nothing more than that the eastern edge of the contemporary channel lay beyond the extent of the excavation area.

The area on the west side of the site saw considerable more activity from the Middle Saxon period onwards, with the main emphasis, once again, relating to the river. With a system of land reclamation progressively undertaken from east to west up to the eastern bank of the River Lea by the 11th century, the whole area became more accessible and development occurred through the Saxon period onwards. The bridge or jetty and structural timbers would have enabled the crossing of, or access to the Waterworks River (Figure 13). The construction of a wattle bundle and possible revetments as a means to stabilise the river bank is significant in demonstrating the management of the river bank, allowing use of the river as a resource for activities such as fishing. This activity continued into the Late Saxon period with other river-related structures identified. A Late Saxon revetment lay to the south east of the bridge/jetty and a nearby wattle panel lay disused on the edge of the channel. A Saxon settlement has been recorded at Old Ford, with a long boat at Clapton, revetments at Gibbins Yard and finds of this date at Stratford Market Depot, all of which suggests that there was increased waterside activity in the whole area during the Saxon period.

There is little evidence for medieval activity, though the area is known to have been an important corn milling centre from at least the 11th century, with fulling mills established during the 13th and 14th centuries (CLBN 1986). Stratford formed a final stop for drovers bringing cattle to London with the cattle grazing in fields and marshes outside the town, facilitating the butchery industry and

ancillary trades of tanning and leather-working in the area (Pewsey 1990). Although there is evidence for activity from historic sources, archaeological evidence for medieval field systems and boundaries is limited due to truncation by post-medieval activities.

The plentiful water supply encouraged a rapid increase in industry during the 17th and 18th centuries including the manufacture of gunpowder and textiles, the production of porcelain and printing. This boom in local industry had diminished by the 19th century; the mills were demolished to make way for other developments. The post-medieval developments on the site changed the landscape considerably; a major junction of the East Counties Railway (ECR) was constructed in 1839/40 and further developed in 1847, with ECR moving their engineering works to Stratford (CLBN 1986). The 'teardrop' of rail lines and the rail works were constructed before 1869 (OS 1869-9) and further railway infilling of the 'teardrop' obliterated any remaining elements of field systems (see Figures 9 and 12). A more substantive change occurred after 1946 when all the buildings were demolished and the internal layout of sidings was realigned with new warehouses and other support structures, some of which were built over the Channelsea River. The catalyst for this wholesale reorganisation may have been the widespread damage incurred during the Second World War, since Stratford was one of the most heavily bombed areas of the United Kingdom. Stratford railway works finally closed in 1963, with an international freightliner terminal opening in 1967. The freightliner terminal was subsequently closed in the early 21st century to make way for HS1 and the new international station.

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**Table 1: Radiocarbon determinations from Stratford Box**

*(Atmospheric data from Reimer et al (2004); OxCal v3.10 Bronk Ramsey (2005))*

| Group description | Sub-group/ Feature no. | Feature type | Context no. | ID | Result no. | δ13C ‰ | Result BP | Cal date BC/AD *(2 sigma, 95.4% unless stated)* | Phase |
|---|---|---|---|---|---|---|---|---|---|
| Hollow feature | 4271 | Natural feature | 4079 | *Sambucus* sp., roundwood | NZA 15956 | -26.74 | 3134±55 | 1520-1260 cal BC | Middle Bronze Age |
| Hollow feature | 4271 | Natural feature | 4081 | *Alnus glutinosa*, roundwood | NZA 15960 | -27.20 | 3156±50 | 1530-1300 cal BC | Middle Bronze Age |
| Hollow feature | 4271 | Natural feature | 4083 | *Fraxinus excelsior*, heartwood | NZA 15959 | -25.69 | 2284±50 | 410-190 cal BC | Middle Iron Age |
| Balancing Pond | | Stake | 4108 | *Quercus* sp., heartwood | NZA 15814 | -26.15 | 2286±45 | 410-340 (45.9%), 330-200 (49.5%) cal BC | Middle Iron Age |
| NE/SW timber alignment N side | Sub-Group no: 4346; Timber alignment 4132-4137, coppice rods 4141-4144 | Waterside structure | 4141 | Waterlogged wood: *Quercus* Sp. Sapwood | NZA 27352 | -26.4 | 1481±30 | cal AD 530-650 | Early Saxon |
| NE/SW timber alignment N side | Sub-Group no: 4346; Timber alignment 4132-4137, coppice rods 4141-4144 | Waterside structure | 4144 | Waterlogged wood: *Quercus* Sp. Roundwood | NZA 27357 | -25.9 | 1509±30 | Cal AD 430-490 (13.9%) 500-640 (81.5%) | Early Saxon |
| Bridge/jetty structure | Sub-group no: 4247 | Stake from in situ stone bridge/jetty structure | 4110 | *Quercus* sp., roundwood | NZA 15870 | -25.49 | 1350±45 | cal AD 600-780 | Early-Middle Saxon |

| **Group description** | **Sub-group/ Feature no.** | **Feature type** | **Context no.** | **ID** | **Result no.** | **δ13C ‰** | **Result BP** | **Cal date BC/AD** *(2 sigma, 95.4% unless stated)* | **Phase** |
|---|---|---|---|---|---|---|---|---|---|
| Bridge/jetty structure | Sub-group no: 4247 | Stake from in situ stone bridge/jetty structure | 4114 | *Quercus* sp., heartwood | NZA 15815 | -26.55 | 1366±50 | cal AD 590-780 | Early-Middle Saxon |
| Bridge/jetty structure | Sub-group no: 4247 | Stake from in situ stone bridge/jetty structure | 4234 | *Quercus* sp., roundwood | NZA 15869 | -26.34 | 1328±50 | cal AD 600-810 | Early-Middle Saxon |
| | | Wattle bundle | 4264 | *Salix*/ *Populus* sp., roundwood | NZA 15824 | -26.69 | 1332±45 | cal AD 610-780 | Middle Saxon |
| NE/SW timber alignment N side | Sub-Group no: 4346; Timber alignment 4132-4137, coppice rods 4141-4144 | Waterside structure | 4135 | Waterlogged wood: *Quercus* Sp. Sapwood | NZA 27374 | -25.6 | 1325±30 | cal AD 650-770 | Middle Saxon |
| NE/SW timber alignment N side | Sub-Group no: 4346; Timber alignment 4132-4137, coppice rods 4141-4144 | Waterside structure | 4132 | *Quercus* sp., sapwood | NZA 15867 | -26.79 | 1255±45 | cal AD 660-880 | Middle-Late Saxon |
| NE/SW timber alignment N side | Sub-Group no: 4346; Timber alignment 4132-4137, coppice rods 4141-4144 | Waterside structure | 4134 | *Quercus* sp., sapwood | NZA 15957 | -26.78 | 1304±50 | cal AD 640-830 (92.9%) 840-870 (2.5%) | Middle-Late Saxon |
| NW/SE Timber alignment S side | Sub-Group no: 4347; Timbers 4211-4203 | Waterside structure | 4203 | *Quercus* sp., roundwood | NZA 15908 | -26.06 | 1146±50 | cal AD 770-1020 | Middle-Late Saxon |
| NW/SE Timber alignment S side | Sub-Group no: 4347; Timbers 4125, 4211-4203 | Waterside structure | 4210 | Waterlogged wood: *Quercus* Sp. Sapwood | NZA 27355 | -24.1 | 1126±30 | cal AD 810-990 | Middle-Late Saxon |
| NW/SE Timber alignment S side | Sub-Group no: 4347; Timbers 4211-4203 | Waterside structure | 4125 | Waterlogged wood: *Salix*/ *Populus* sp. | NZA 27356 | -25.1 | 1111±30 | cal AD 870-1020 | Late Saxon |

| Group description | Sub-group/ Feature no. | Feature type | Context no. | ID | Result no. | δ13C ‰ | Result BP | Cal date BC/AD *(2 sigma, 95.4% unless stated)* | Phase |
|---|---|---|---|---|---|---|---|---|---|
| | Sub-Group no: 4241 | Bridge/jetty structure | 4206 | *Alnus glutinosa*, roundwood | NZA 15816 | -27.88 | 1126±45 | cal AD 770-1020 | Middle-Late Saxon |
| | Sub-Group no: 4241 | Bridge/jetty structure | 4243 | *Quercus* sp., roundwood | NZA 15868 | -27.43 | 1243±45 | cal AD 670-890 | Middle-Late Saxon |
| | 4169 | Rod from wattle panel | 4183 | *Quercus* sp., roundwood | NZA 15813 | -27.65 | 1138±45 | cal AD 770-1000 | Middle-Late Saxon |
| | 4155 | Pit | 4208 | *Cocos nucifer* (coconut) | NZA 15958 | -23.31 | 228±55 | cal AD 1510-1960 | 16th - 20th century |
| | ARC SBX00 9+900 | Horse bone | | *Equus* sp. | NZA 16241 | -21.38 | 110±50 | cal AD 1670-1780 (35.8%), 1790-1950 (59.6%) | 16th - 20th century |

**Table 2: Timber quantification by type**

| Type | Total recorded | Sampled/ Retrieved |
|---|---|---|
| Coppiced Rod/ Natural | 7 | 0 |
| Fragment | 3 | 2 |
| Half log | 1 | 0 |
| Jetty | 1 | 1 |
| Log | 1 | 1 |
| Natural | 17 | 8 |
| Plank/ possible plank | 3 | 3 |
| Stake/ possible stake | 71 | 62 |
| Tree trunk | 2 | 1 |
| Unknown | 35 | 14 |
| Unworked | 1 | 0 |
| Wattle panel | 1 | 1 |
| Wattle rods | 1 | 1 |
| Wattle uprights (sails) | 1 | 1 |
| Wattling | 2 | 2 |
| **Total** | **149** | **97** |

**Table 3: Wood Charcoal Identifications: Sample 1074, Context 4251**

| Identification | Common Name | No. of Fragments | Comments |
|---|---|---|---|
| *Quercus* sp. | Oak | 5 | |
| *Quercus* sp. roundwood | Oak | 3 | 9 years |
| *Salix*/ *Populus* sp. roundwood | Willow/ aspen | 6 | 1-5 years |
| *Fraxinus excelsior* roundwood | Ash | 1 | 8 years |
| *Corylus avellana* roundwood | Hazel | 7 | 8-9 years |
| *Corylus avellana* twigwood | Hazel | 2 | |
| *Betula pendula*/ *pubescens* roundwood | Birch | 3 | 5 years |
| *Alnus glutinosa* | Alder | 6 | |
| Charred parenchyma | - | 1 | |
| Unidentified twigwood | - | 2 | 1 year |
| Bark | - | 1 | |

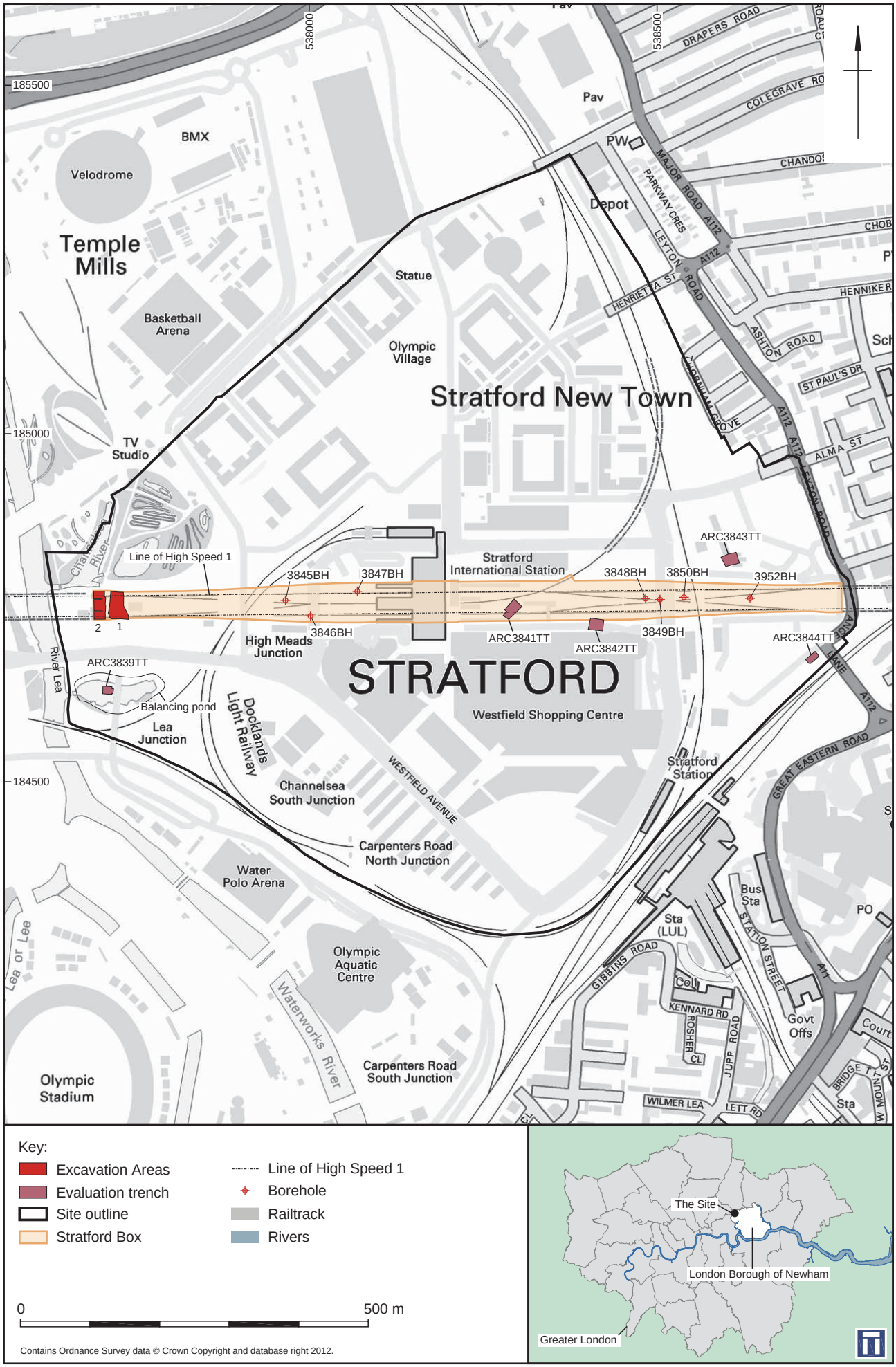



Figure 1. Site and trench location plan

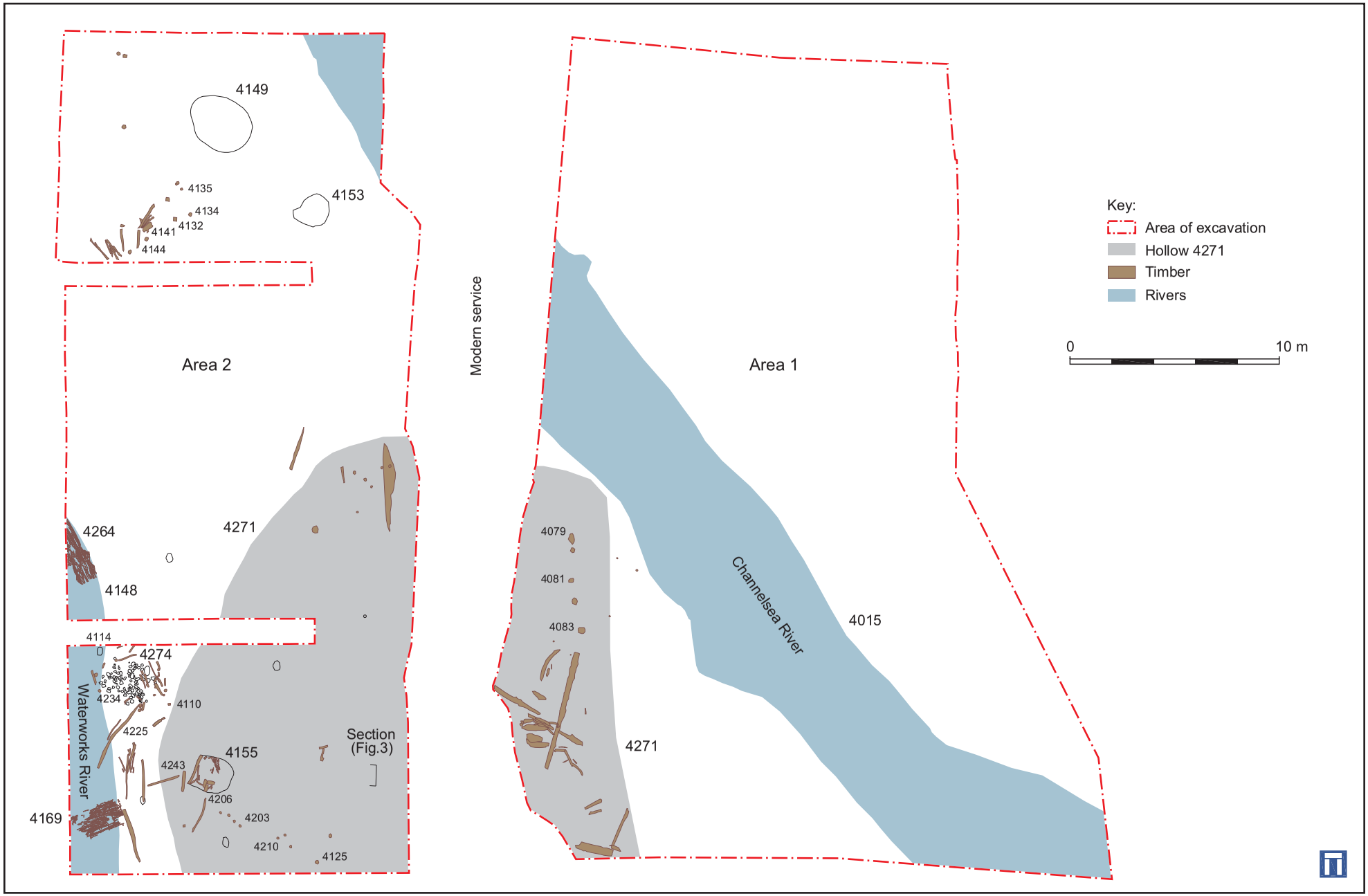



Figure 2. Plan of excavation area at west end of Stratford Box

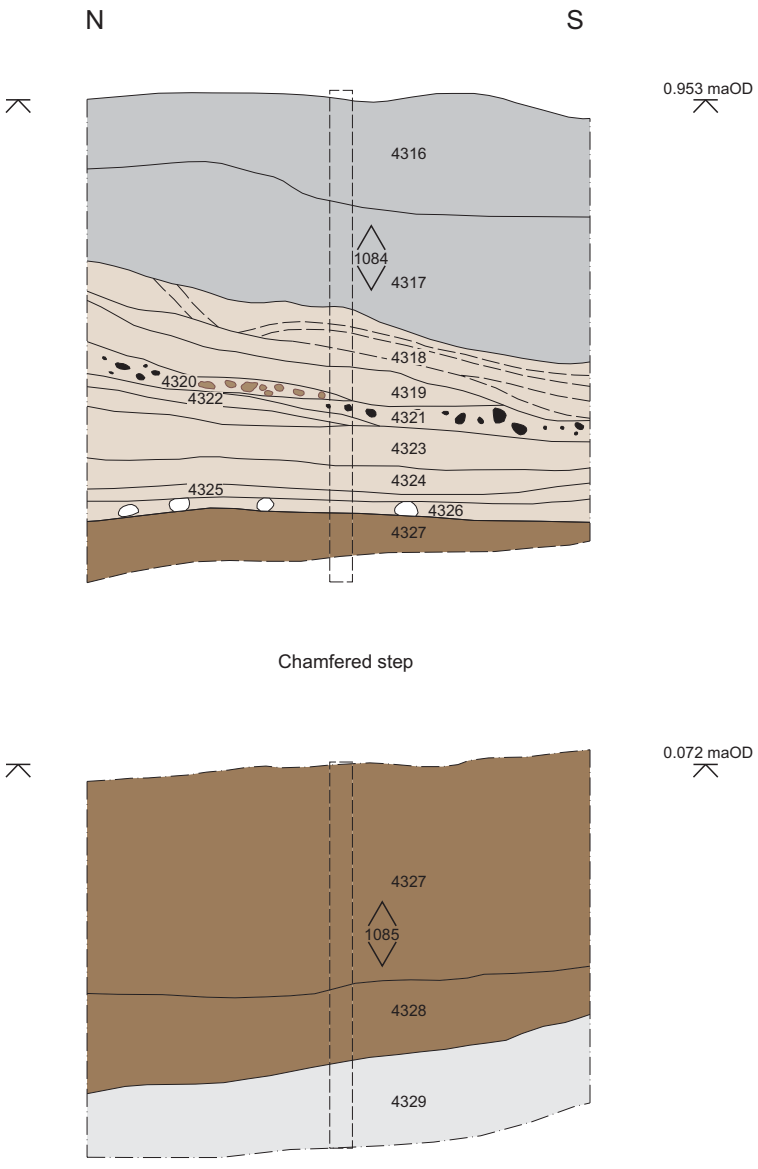



Figure 3. Section through the sedimentary sequence filling hollow 4271

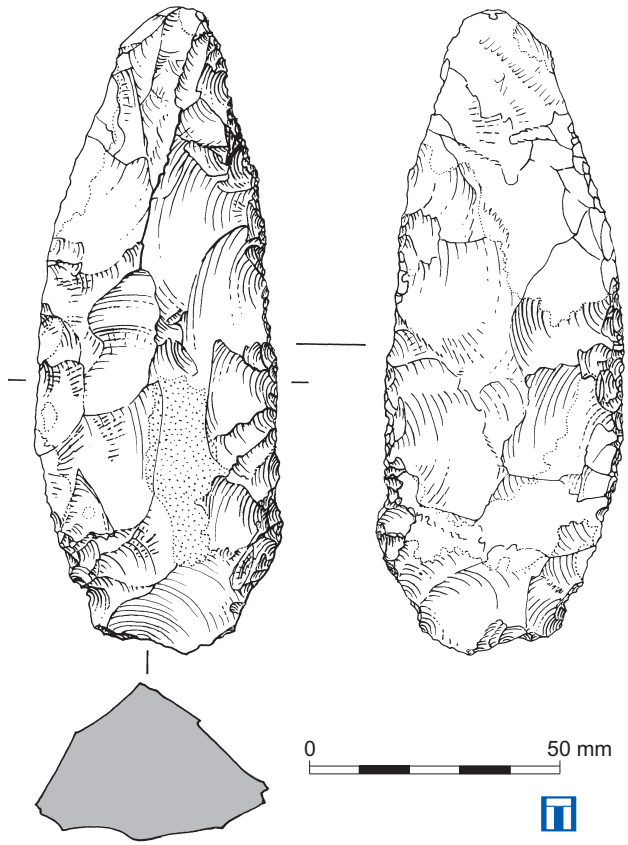



Figure 4. Mesolithic tranchet axe recovered during watching brief

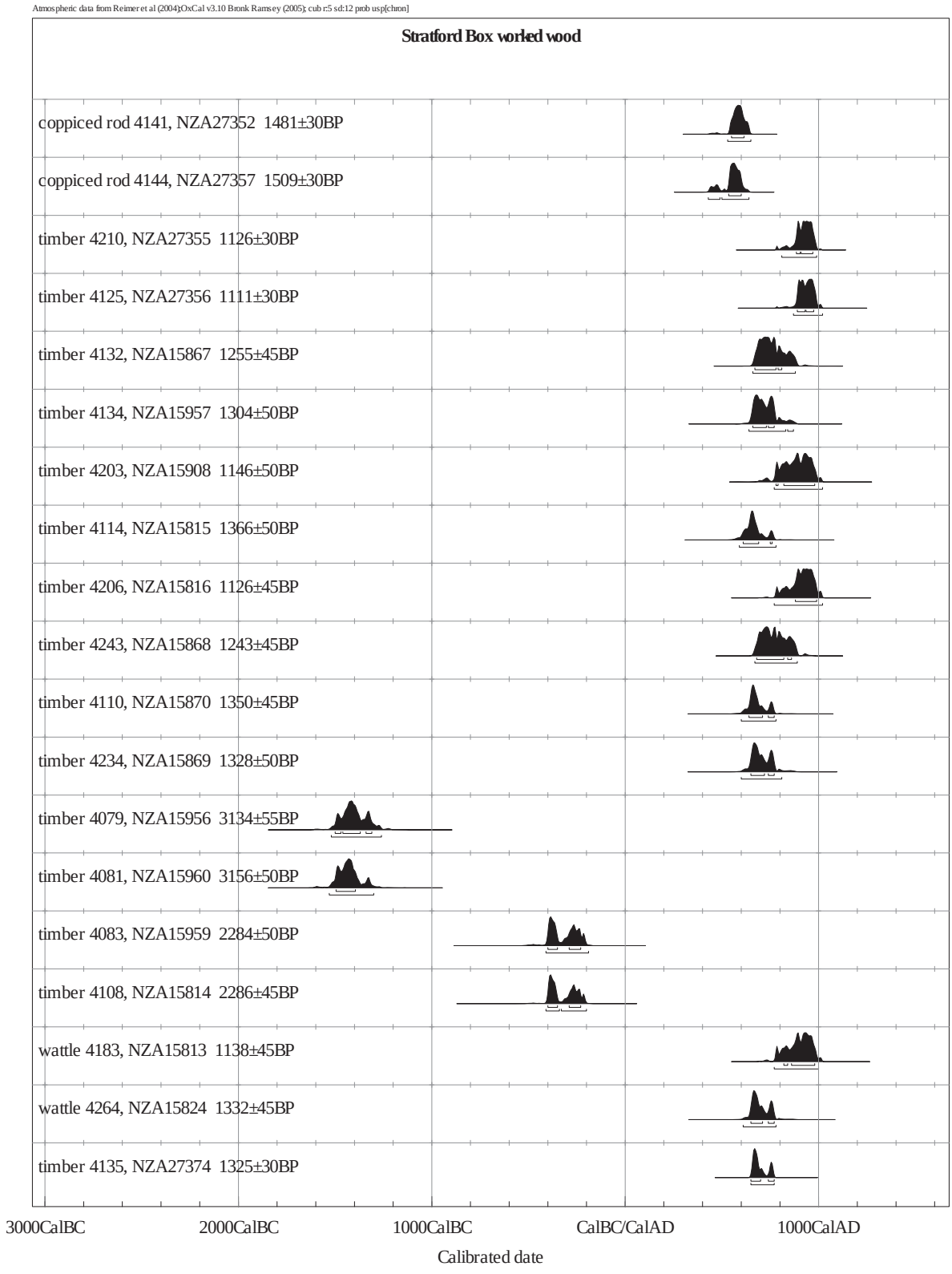
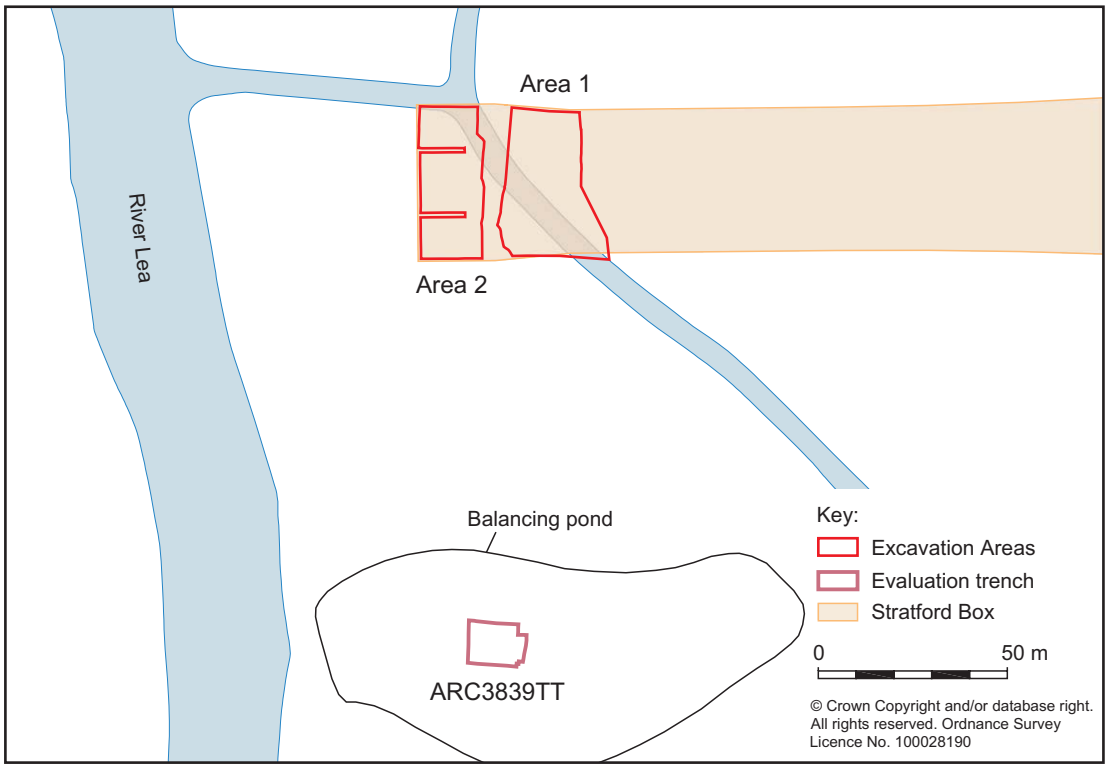



**Figure 5: Oxcal Multiplot to show worked wood radiocarbon dates**



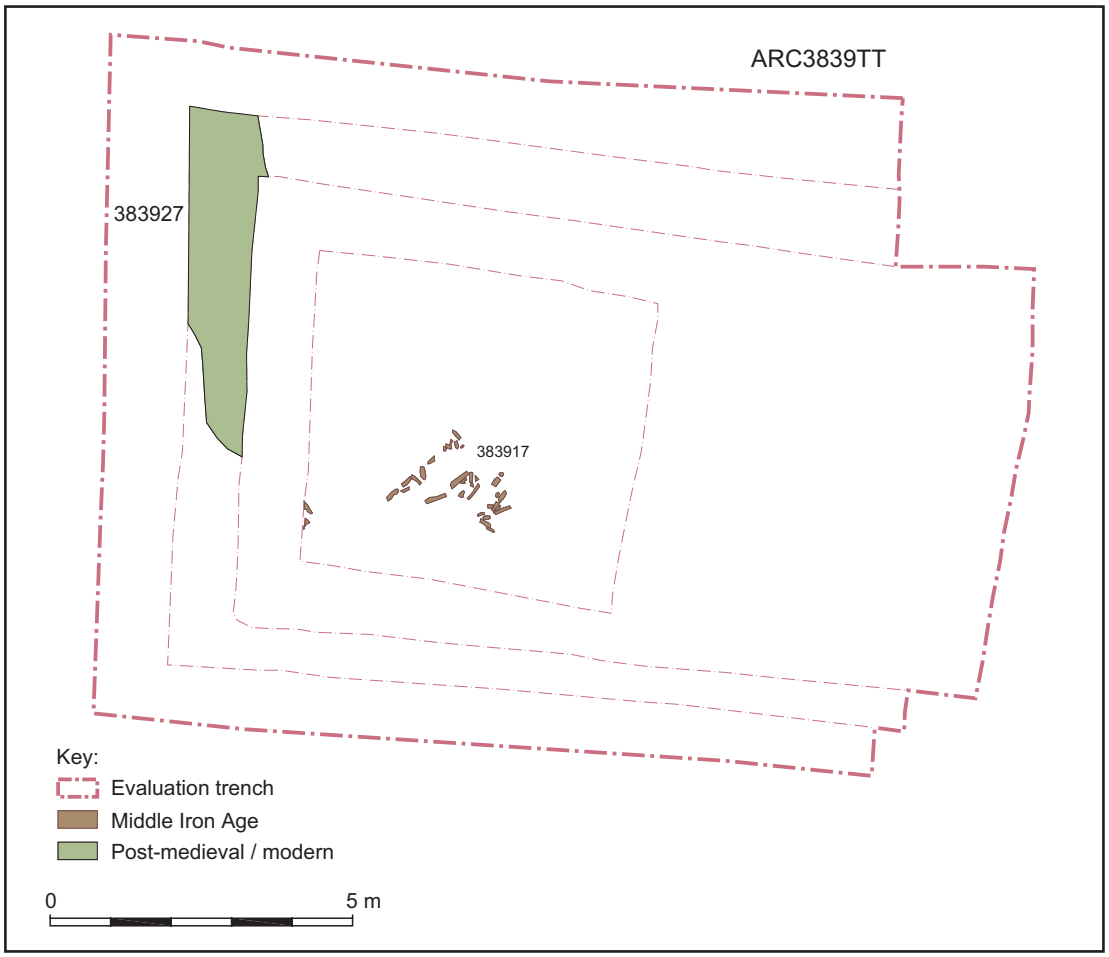




Figure 6. Location and plan of trial trench 3839TT at west end of Stratford Box

Figure 7
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Extract from A Plan of the Cities of London etc. (Rocque 1746)
(available in archive)

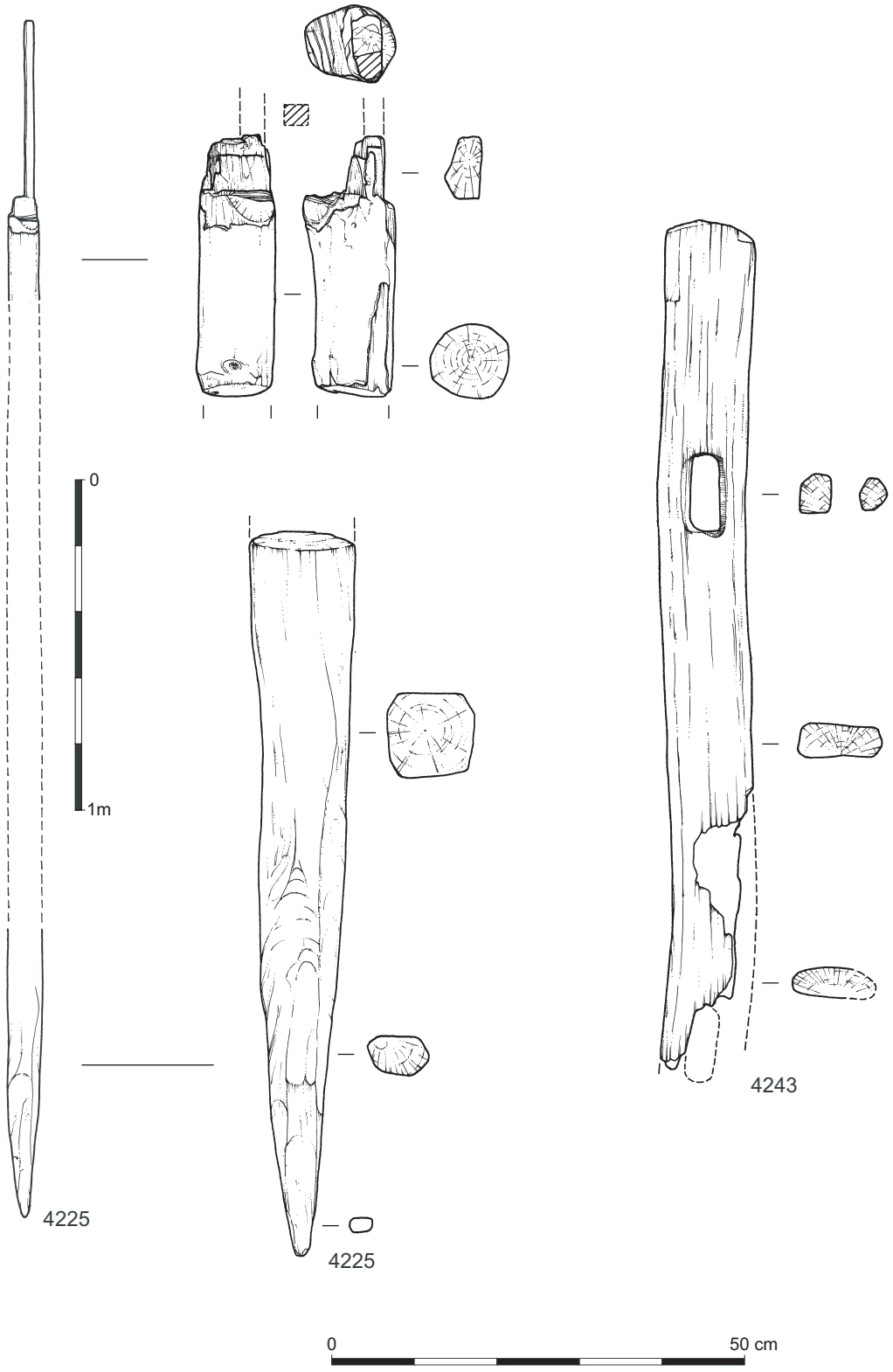


Figure 8. Timbers 4225 and 4243

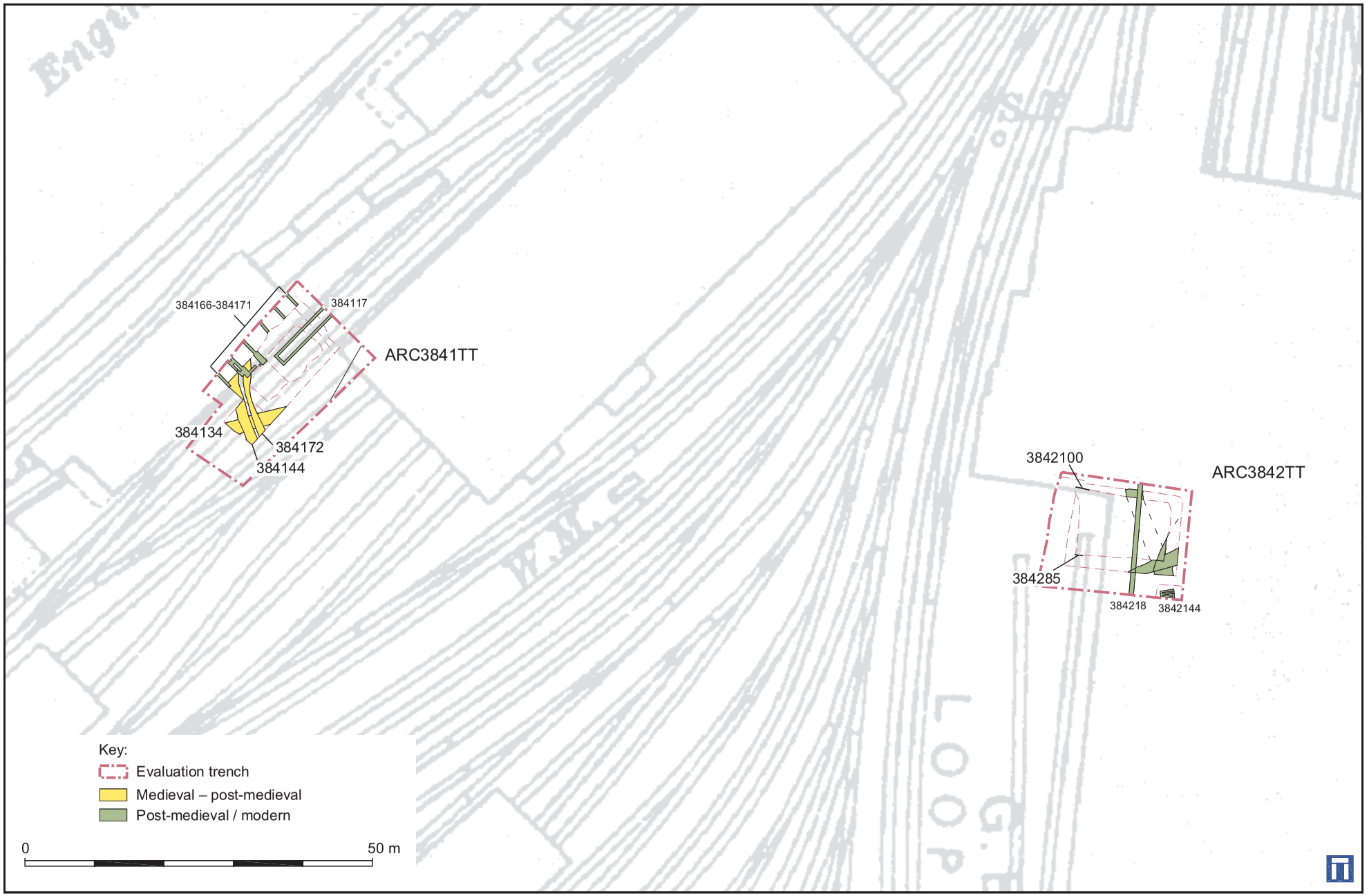


Figure 9. Trial trench result, in relation to the Ordnance Survey map of 1916

Figure 10
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Extract from A Map of Essex
(Chapman and Andre 1777)
(available in archive)

Figure 11
Removed Due to Copyright Issues
Extract from Library Map of London
and its Suburbs (Stanford 1877)
(available in archive)

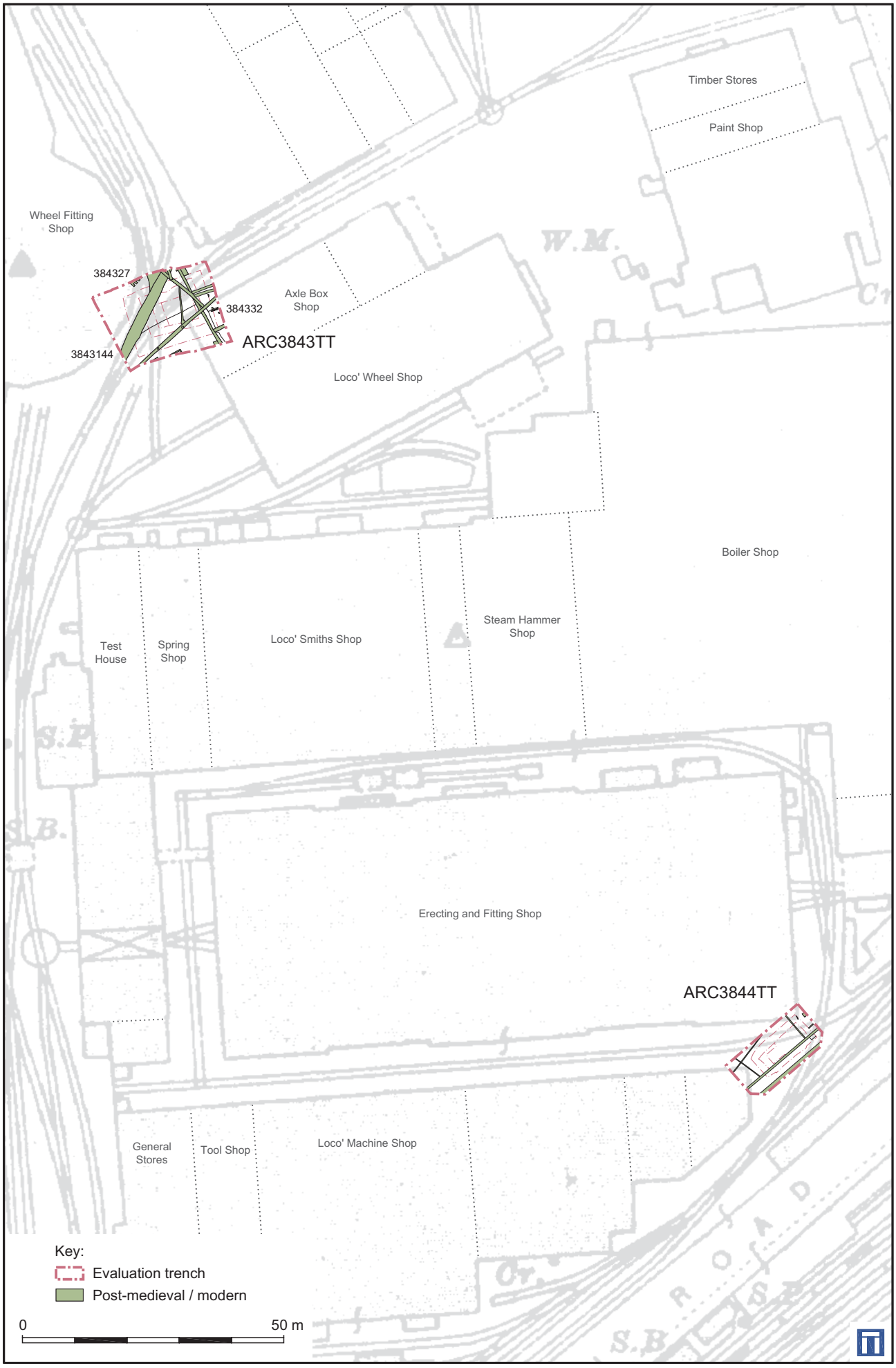


Figure 12. Trial trench results, in relation to the Ordnance Survey map of 1916

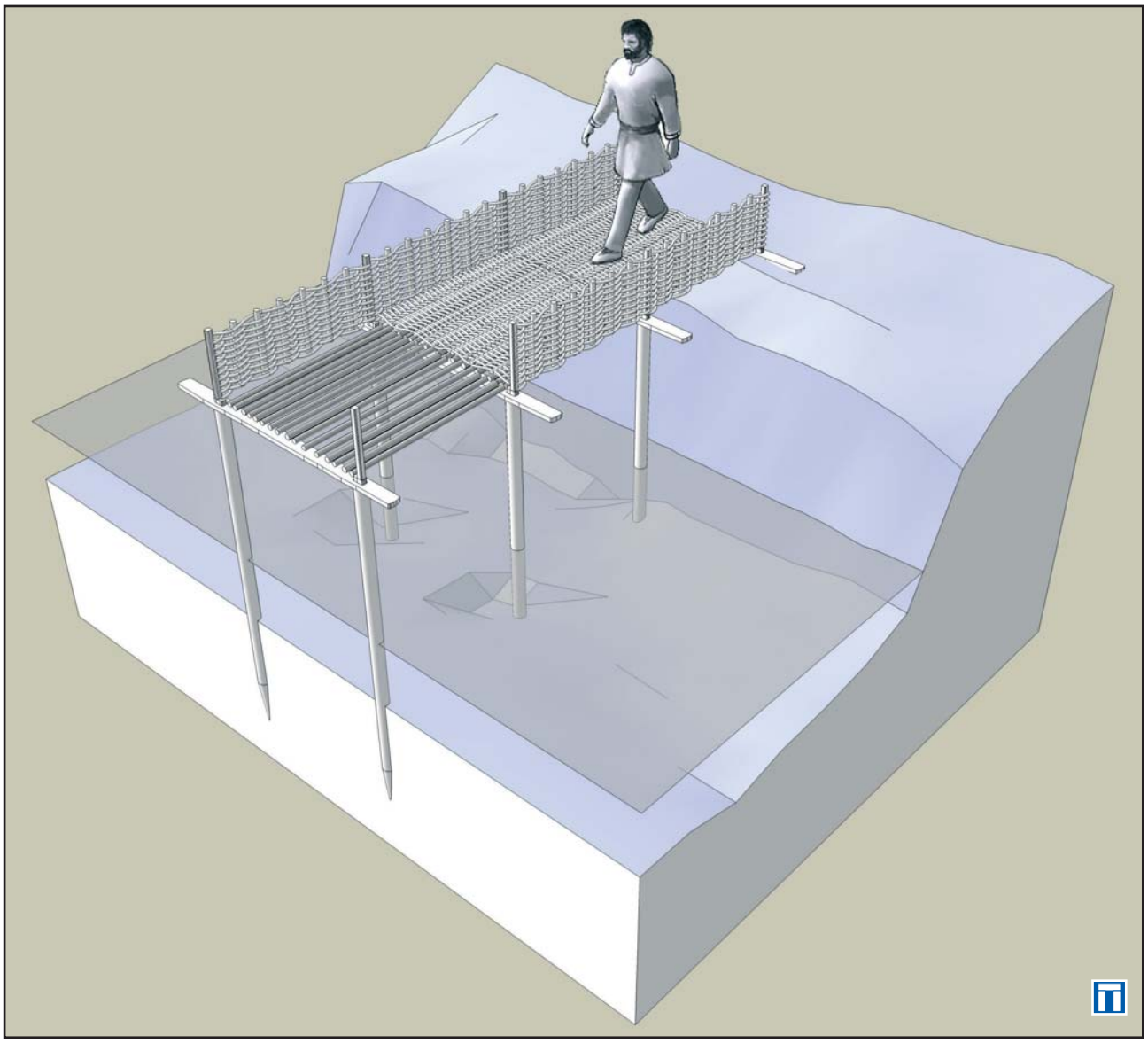

Figure 13. Reconstruction of the Saxon jetty/bridge

Plate 1. Antler Object


Plate 2. Remnants of the bridge/jetty abutment


Plate 3. Wattle panel 4169 in situ showing footprints

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