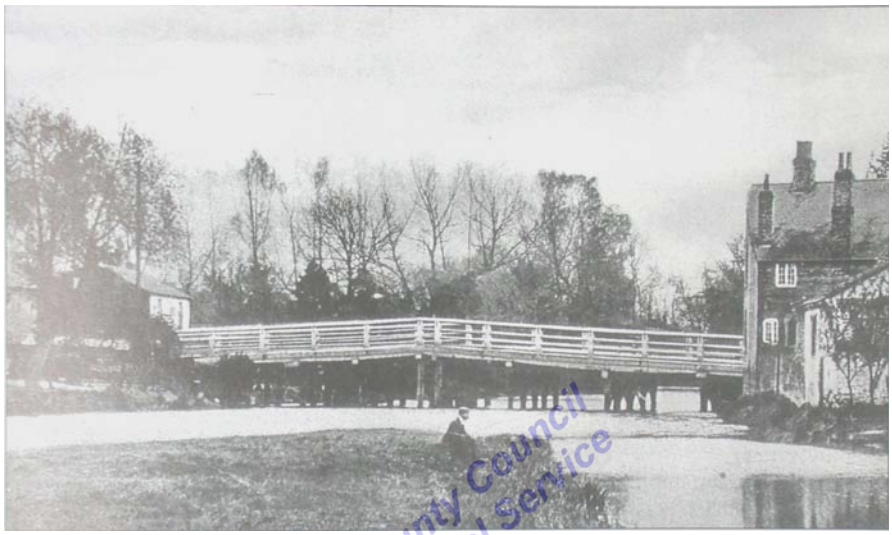
ARCHAEOLOGICAL MONITORING REPORT

Ballingdon Bridge, Sudbury. BCB 012

A REPORT ON THE ARCHAEOLOGICAL MONITORING, 2002



Ballingdon Bridge 1805-1911

Ballingdon Bridge 1911-2002

David Gill
Field Team
Suffolk C.C. Archaeological Service

Lucy Robinson, County Director of Environment and Transport
Endeavour House, Russel Road, Ipswich, IP1 2BX

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List of Contributors

All Suffolk C.C. Archaeological Service unless otherwise stated.

David Gill	Senior Project Officer
Sue Anderson	Formerly Finds Manager, now Project Manger CFA Archaeology
Kelly Powell	Project Assistant
Ian Tyers	Freelance Specialist, formerly with ARCUS Dendrochronology Laboratory, University of Sheffield

Acknowledgements

This project was funded by Suffolk Highways Contracting and was monitored by Keith Wade (Suffolk County Council Archaeological Service, Conservation Division).

The excavation was carried out by John Duffy, David Gill and Jonathan Van Jennians, all from Suffolk County Council Archaeological Service, Field Team.

The project was directed by David Gill, and managed by Tom Loader and John Newman.

Finds processing was carried out by Kelly Powell and Sue Anderson who also produced the finds report. Specialist advice and report was provided by Ian Tyers.

Summary

Monitoring of the project to demolish and replace Ballingdon Bridge produced evidence of four previous bridges dating from between the 13th century to the early years of the 20th century. The remains of a stone, brick and two wooden bridges were found along with evidence of both collapses and phases of repair, this tied in closely with documentary accounts to provide a detailed history of the crossing. Evidence of post medieval buildings adjacent to the river and the

augmentation of the Sudbury bank through revetments and dumping of household and industrial rubbish from the 15th century were also found.

SMR information

Planning application no.	B/00/01214/CDP
Date of fieldwork:	October 2002-March 2003
Grid Reference:	TL 8675 4091
Funding body:	Suffolk Highways Contracting

Introduction

A programme of archaeological work was undertaken as part of the project to replace Ballingdon Bridge, the bridge on the south-west side of Sudbury that carries the A131 across the River Stour (Fig.1). The existing bridge was constructed in 1911 and was found to be sub-standard for current traffic loads and planning permission to demolish it and construct a new one was granted in October 2000. Architects were invited to submit designs to a competition for the replacement bridge and the winning design was chosen in consultation with local people.

A programme of archaeological work was a condition of the planning consent and a brief and specification was issued by Keith Wade, Suffolk County Council's Archaeological Service Manager. Work on the whole project began in 2002 with the archaeological recording being undertaken during the demolition phase. This was achieved by close co-operation with engineers from Suffolk Highways Contracting who managed the whole project and their main contractors Costains Group PLC. The work was funded by Suffolk Highways Contracting.

The bridge is at TL 8675 4091 and links Sudbury with the neighbouring parish of Ballingdon cum Brundon. The River Stour forms the county boundary and was part of Sudbury's town defences. The bridge was, and still is, the only gateway into the town from the Essex side. The settlement of Sudbury has its origins in the Iron Age but the foundation of the town and part of the layout of the streets dates from the Middle Saxon period. There is a long history of bridges at this point and an alignment of large upright wooden posts thought to be the remains of an earlier bridge could be seen from the river's edge during low water (Fig. 2). A brief investigation by local amateur divers in advance of the project established the existence of at least 88 posts and that the timbers continued towards the centre of the river.

The new bridge was to span the river with a wide central arch springing from piers standing in the river close to each bank; the footings for which required extensive deep excavation, removing the timbers and any potential evidence of earlier crossings. The aim of the archaeological work was to record this information before it was lost.

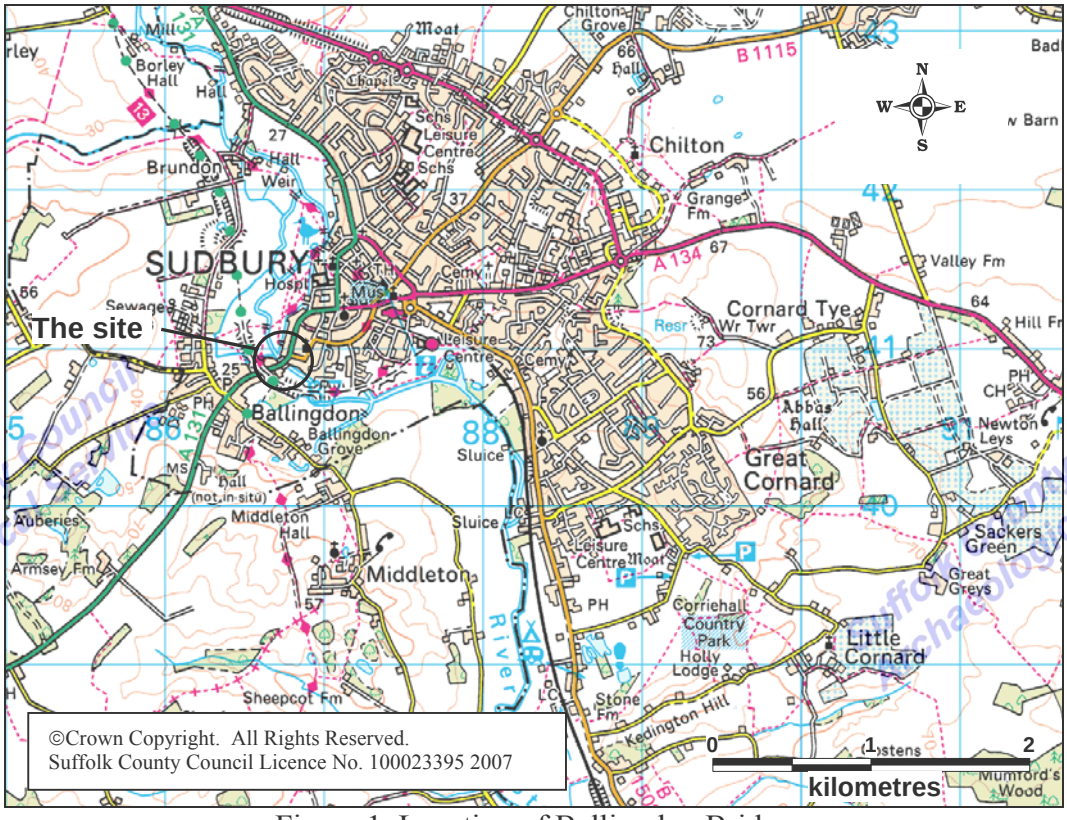


Figure 1. Location of Ballingdon Bridge

Although not affected by the construction work, at the request of the Stour River Trust, the centre of the river was also dredged, to remove obstructions in order that boats could pass upstream of the bridge. As a result of this and in combination with the construction work unfortunately little or nothing now remains of the previous crossings.

Historical background

The river

The River Stour flows from just north of Haverhill in the clay uplands of high Suffolk to the estuary at Harwich and for almost all of its length forms the boundary between Suffolk and Essex. The River has been important historically, carrying trade inland from the coast and its navigable limit was probably the determining factor when siting the Roman small town at Long Melford.

The River Stour Act was passed on 16th Feb 1705 to create the River Stour Navigation and the first mention of trade is the movement of 2,211 tons of coal from Manningtree to Sudbury in May 1709. The river was worked by 'lighters'; pairs of flat-bottomed barges chained together and drawn by horses. They carried flour, chalk and lime quarried from the pits at Ballingdon, bricks from the Allen and Boggis works, and manure. The lighters connected with the coastal sailing barges at Mistley Quay and returned carrying coal and grain. The boats did not come up past the bridge but were loaded and unloaded downstream at either the Quay, where two granary warehouses were built in 1791 and 1806, or the wharf at Ballingdon Grove Brick Works. There is a noticeable absence of commercial and industrial properties above the bridge. River trade dwindled from the mid-C19th with the introduction of the railways and had all but disappeared by the First World War.

The bridge

The site of the bridge as a crossing point is thought to be long established. It lies on the projected line of a known Roman road from Chelmsford and which has been excavated by section at Long Melford (LMD 031).

The first documented bridge was in existence at the start of the 13th century and tolls collected from this bridge were endowed by Amica, the Countess of Clare to a Hospital, St John's, that stood on the Sudbury bank on the site of the current Boat House Inn (Hodson 1892).

The next mention of a bridge is of one being swept away on 4th November 1520. It was rebuilt in 1521 and in September 1594 another flood broke the bridge and stopped all traffic (Hodson 1892).

Justices of the Peace were responsible for the administration of repairs to bridges after the passing of *The Statute of Bridges* in 1531 until the creation of West Suffolk County Council under the Local Government Act of 1888 (Breen 2004). The financial burden of maintaining the bridge at Ballingdon was divided between the Borough of Sudbury and the County of Essex with each body repairing only their half. The Justices met in the Court Quarter Sessions and the court records give an account of the bridge's condition. At the start of the 17th century the town authorities were fined at the Borough Quarter Sessions for not keeping the Sudbury side of the bridge in proper repair and in 1661 the Corporation was ordered to sell the town gates to fund more repairs. Court orders for further work were served in 1757 and again 1761, and by 1767 the bridge is again described as being in a ruinous state. In May 1805 the Essex Magistrates directed that their half of the bridge be pulled down and rebuilt, demolition and replacement of the whole bridge began in September 1805 with separate contractors working from each bank to construct a new complete wooden bridge (Hodson 1892).

In 1911 the wooden bridge was replaced with the existing bridge, this was cast in reinforced concrete using a pioneering technique of construction developed at the end of the 19th century by François Hennebique.

Methodology

All of the excavation and recording work was completed beneath the arches of the existing concrete bridge behind two coffer dams that extended out into the river. The water behind the dams was kept down by pumps that ran continuously during the working day; although the area was never free of water. All of the excavation was done by machine observed by the monitoring archaeologist with allowances made for recording and the collection of samples.

All of the timber piles were tagged with a number and their positions plotted using a total station theodolite (TST) against the Ordnance Survey grid and datum. The timbers were lassoed with a chain and pulled up using the excavating machines. The timbers were stockpiled either on the Sudbury bank or in a temporary yard on the Ballingdon side where they were stored until each timber could be recorded. Unfortunately some of the labels became detached during the lifting and transportation, as a consequence of which some of the timbers had to be re-numbered after they had been extracted with a loss of correspondence between some of the recorded timbers and the plotted ones.

Each timber was drawn at 1:10, photographed and cross sectioned. Specialist Ian Tyres visited the site and advised on the timber's suitability for dendrochronological dating and samples were taken for analysis. A selection of timbers was retained for the possible re-use in a community arts project, and were stored at the SCC depot at Great Blakenham.

The stone and brick structures were planned and recorded using the TST in the same way as the timber structure and samples of bricks, stone and mortar were collected.

Film and digital photographs were taken through out the project and level compared to an OS Datum, all pre-modern finds were retained for analysis.

The site data has been input onto an MS Access database, photographs catalogued under the film codes EYA-EYC and EYV-EYZ. The finds and site records have been archived in the small and main stores of Suffolk County Council Archaeological Service at Bury St Edmunds and with the County Sites and Monuments Record under the parish code BCB 012.

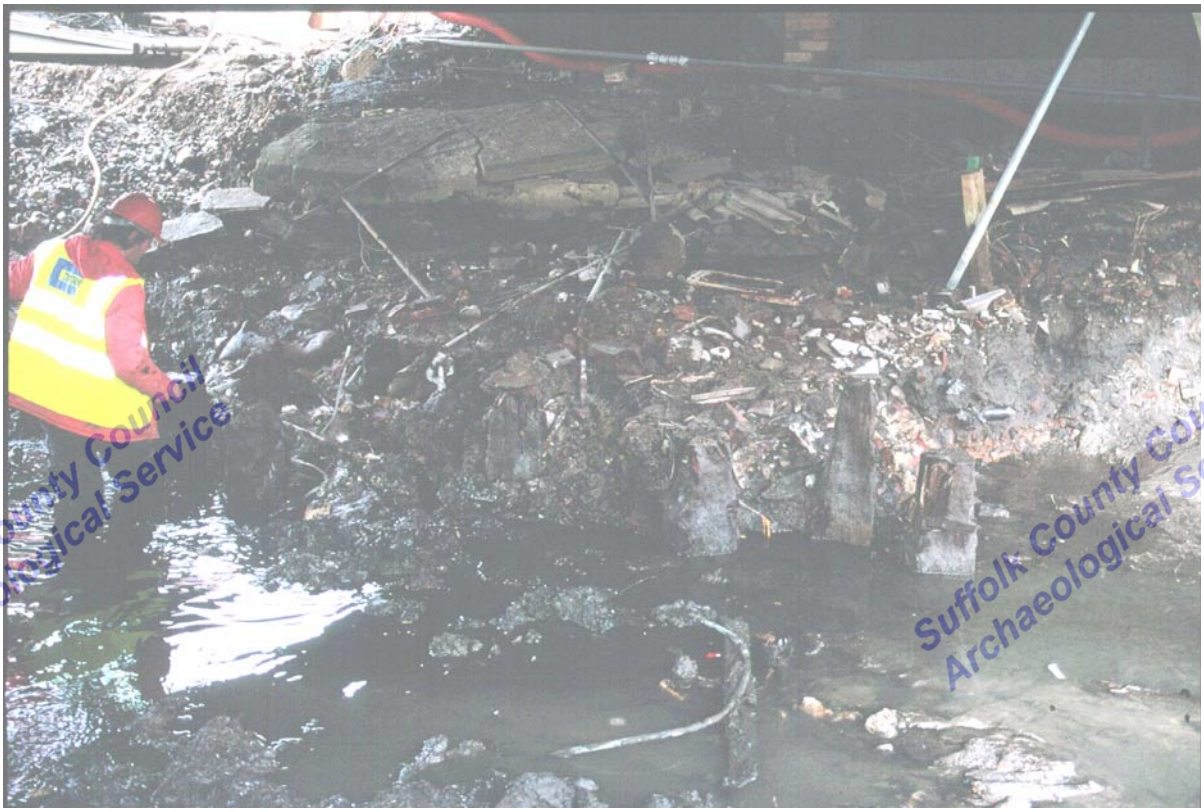


Figure 2. Timbers piles (alignment 0071) close to the Sudbury bank prior to excavation

Results

Crane Base

Four holes were excavated in the car park of the Boat House Inn on the Sudbury bank north of the bridge to create an anchor for a temporary crane (Fig. 3). The holes were set out in a square, each c. 4.5m x 4.5m and were excavated through layers of accumulated river silts and dump deposits to river gravel at c.2-4m down.

Crane holes 0010 and 0012 were excavated within 5m of the current river bank revetment. At the top of the section was a 1m deep deposits of rubble and hogging, the sub-base for the existing car park. This sealed deep homogenous deposit of black fine textured peaty silt to the full depth of the excavation and clean river gravels were encountered at 4m below the surface. A low concentration of domestic debris was collected from the silt including pottery, brick, clay pipes, animal bone and a fragment of a leather shoe. The material dated the deposition of the silt as pre-Victorian but no earlier than the mid C17th. The finds were collected from the river side of an earlier timber revetment, 7.5m back from the current water's edge and cobbled together from insubstantial re-used timber and roundwood branches (see below).

In crane hole 0016 the remains of late 17th- early 18th century brick buildings were found immediately below the car park 0016 (Fig. 3 and 4). These included wall stubs and a succession of floor surfaces made of crushed chalk, clay and brick pamments interleaved with occupation and demolition deposits to form a complex stratigraphy at the top of the section (Fig. 4). The remains were thought to be of small cottages and the later layers indicated that these had been occupied up until the late 19th century. In his article for the PSIA Hodson (Hodson 1892) describes wood and tiled hovels with winding passages, low ceilings and queer recesses standing here.

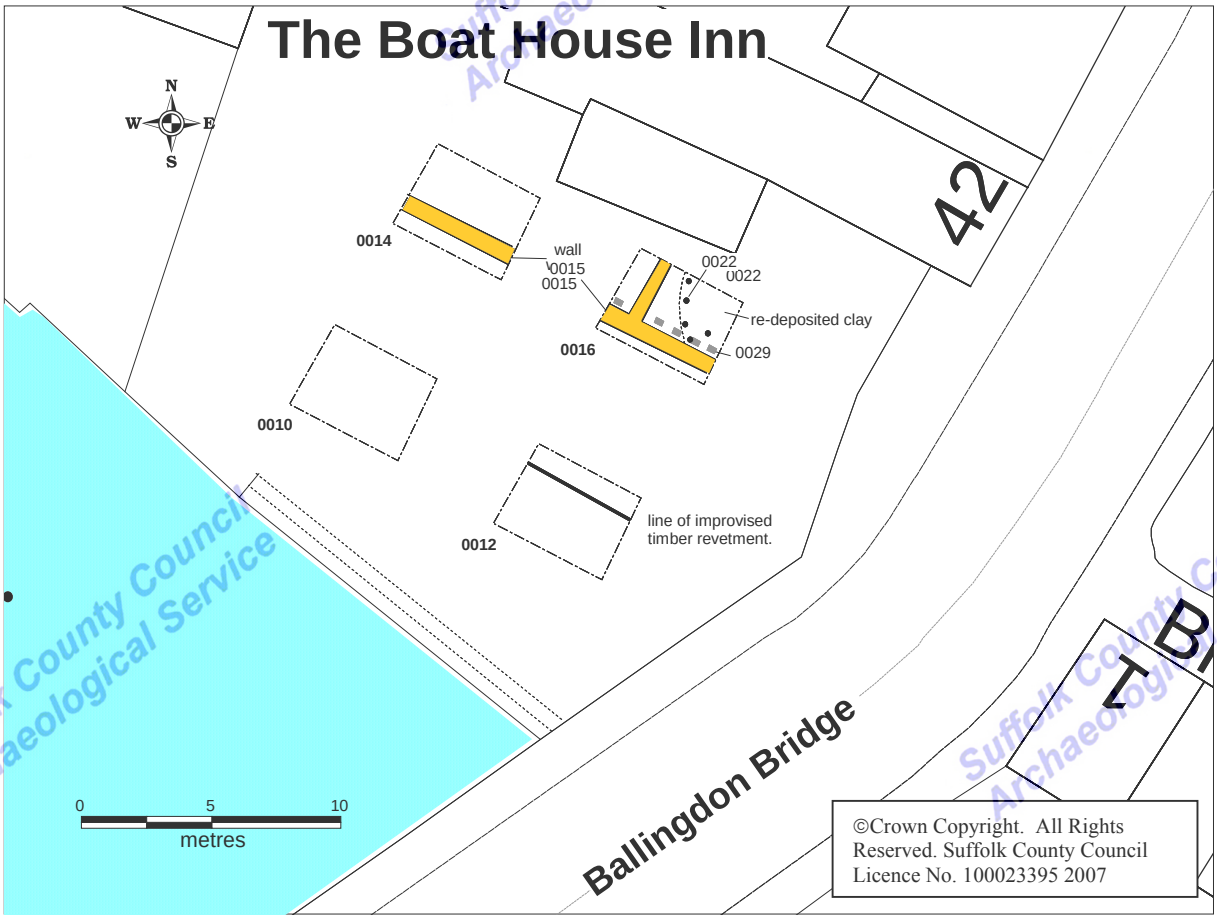


Figure 2. Plan of the crane bases on the Sudbury bank

A bonded flint wall, 0015, running NW-SE and paralleling the river bank was recorded in holes 0014 and 0016, with an associated joining flint wall extending NE (Fig. 3 and 4). These walls were below the remains of the brick built cottages and predated them. Their fabric included early post medieval brick and tile bonded with lime mortar. The tile occurred in dense horizontal bands suggesting building lifts, and was recorded both at the base of the wall and where it was truncated just below existing ground level. Wall, 0015, was built off a rubble packed footing trench and this was cut through dark peaty soil at the base of the section (Fig. 4). The wall had been buried by the subsequent deposition of clay silts 0021, and the interface between it and the underlying dark peaty soil was thought to represent the ground surface at the time of construction. The soil profile at this level was different either side of the wall; to the west there was a deposit of chalk rubble suggesting a structured river bank or tow path, whereas to the east (inside the wall) the soil was more like a garden soil.

On the east side, and paralleling the wall was a line of posts, 0020, possibly the remains of a timber revetment, predating the masonry wall and 16m back from the present river edge. The timbers were all reused components of building frames and exhibited mortise holes, tenons and other joinery, none of which (beyond being medieval) were closely datable. Some of the timbers were worked into points and driven through the lower peat soils and into the underlying river gravel but had been truncated at the interface with 0021.

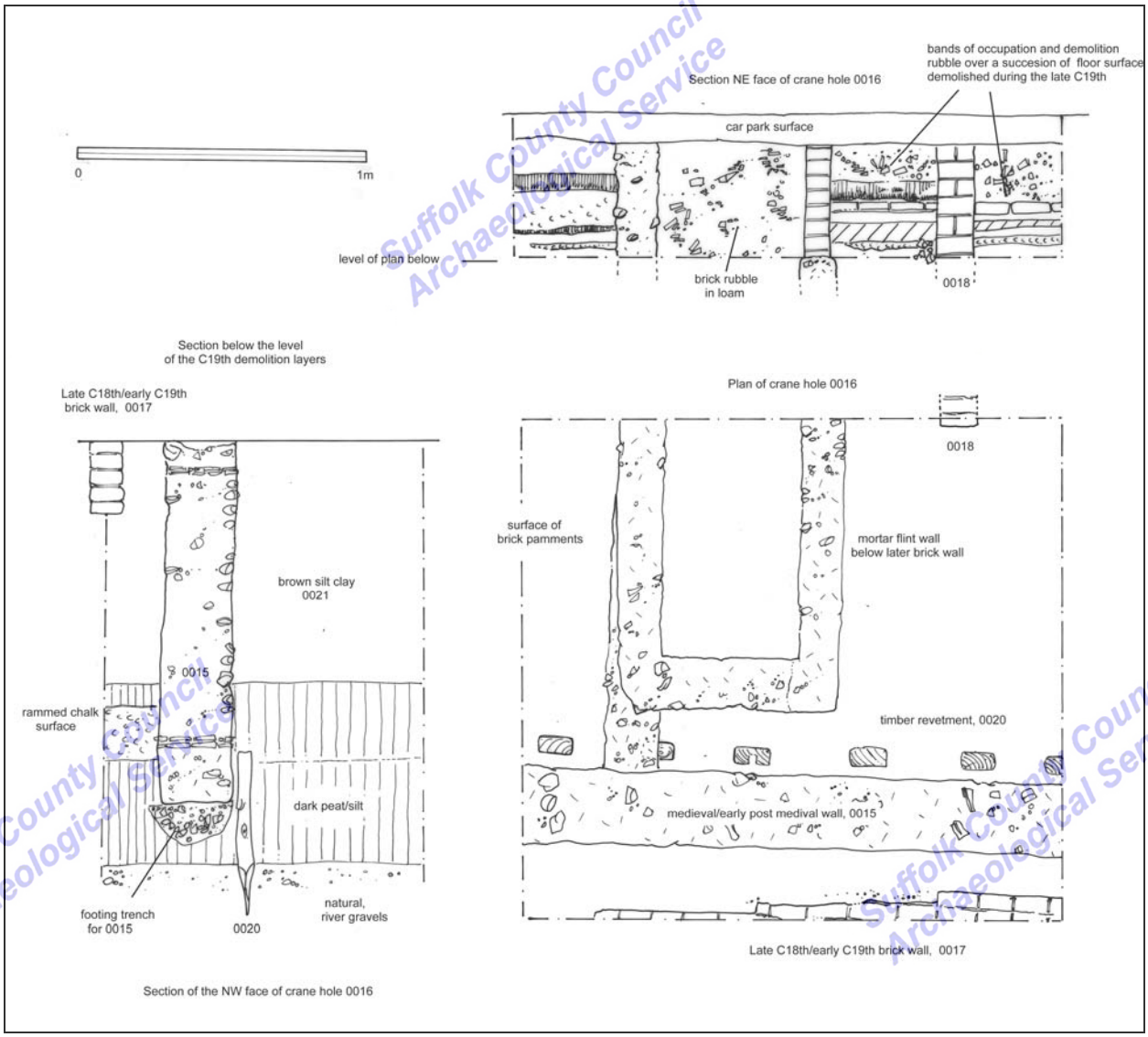


Figure 3. Plan and section of crane hole 0016

Below the peaty soil a second alignment of timbers, 0022, ran northeast–southwest and defined a spread of re-deposited clay separating it from the river gravel. The timbers were small diameter unworked roundwork stakes and brushwood. Pottery and brick dating to the 15th century was collected from the dredging of the gravel at the base of the excavation, 0019, but as this was brought up from below the water level the context was not secure.

Timber-built bridges: 1595-1903

Alignments of large timber piles were apparent at low water, the positions of 49 were plotted and 39 extracted and drawn. The piles were all oak and driven between 3-4m into the riverbed and all sawn off at approximately the same level – presumably the water level at the time of cutting.

The timbers were all shaped, but to varying degrees, and many were tipped with iron 'driving shoes' to harden and preserve the points as they were driven into the gravel. The timbers could be classified into six distinct types, characterised by the way the wood was prepared and the design of the 'driving shoe'. These are described below, quantified in Table 1 and illustrated in figure 7. Details by context are included in Appendix 1. Samples of 19 timbers, covering all of the pile types, were submitted for dendrochronological dating and species identification. All had sufficient rings to attempt dating and 12 were found to cross match with reference chronologies. These gave a felling date range of between 1590's and 1790's; the full dendrochronological report is included in the Finds chapter.

Pile Type	Number recorded	Date	Contexts
1	15	Late 18th	0062, 0114, 0115, 0121, 0134, 0135, 0136, 0137, 0512, 0514, 0517, 0519, 0602, 0602, 0603
2	9	Late 16th (1595)	0063, 0120, 0132, 0501, 0505, 0516, 0600, 0601
3	4	Undated	0110, 0503, 0511, 0515
4	7	Late C17th (1661)	0111, 0112, 0113, 0122, 0125, 0502, 0513
5	2	Mid-late C18th	0061, 0518
6	2	Undated	0133, 0510

Table 1. Timber piles by Type

The Typology of Timbers piles - (see Figure 7)

Type 1

The Type 1 timbers were quarter baulks, sawn into slender, square sectioned and straight-sided shaft between 30-35cm^2 truncated at 3-4.5m long. The end was shaped into a regular four-facetted point, this was quite short, about 60-80cm long with a wrought iron tip enclosing the point and extending in a strip along each face and fastened with nails. These were dated in a range between 1740-76 and 1798 and were the most numerous of the piles recovered.

Type 2

The woodworking on the Type 2 piles was near identical to the Type 1's, with quartered baulks sawn into a square sectioned shaft and four faced point; with similar dimensions. They were however, distinct from the Type 1's in that points were not protected by any form of driving shoe. All of the Type 2 samples submitted were dated and fitted into a tight dating range from the middle of the 1590's. Two could be dated absolutely and were felled in 1595 and the winter of 1599.

Type 3

The woodworking on the Type 3 piles was more rudimentary, they were formed from complete trunks left mainly in the round or simply quartered with a saw. They had long tapering points, in some cases the entire length buried in the riverbed was part of the point, with the tip socketed into a four-sided iron point. Three Type 3 piles were sampled but despite there being plentiful rings these could not be cross-referenced with known chronologies.

Type 4

Types 4 piles were made up of stout whole round wood trunks. Woodworking was minimal with the timbers being tidied up and shaped by axe into a long tapered multi-faceted point, not fitted with driving shoes. Two Type 4 piles were dated within a range of late 17th –early 18th century with an absolute date of winter 1661 achieved for pile 0122.

Type 5

Types 1-4 were plentiful with several examples of each type recovered and recorded. Types 5 and 6 were oddities with only two of each observed. Type 5 was a sawn, square section, straight-sided shaft similar to the Type 1 and 2 piles, but terminated with a two-sided chisel point. Ironwork was minimal and consisted of a flat plate nailed to one face of the point only. One Type 5 was sampled and dated AD1756-92.

Figure 5. Extracting timbers

Figure 6. timbers stockpiled for recording

Type 6

Two timbers were classified as Type 6, these had sawn, square sectioned shafts similar to types 1, 2 and 5 with a two-sided chisel point. The point was protected with an unusual driving shoe, an iron strip folded to form an extended 'ducks-bill'. Only one driving shoe of this type was seen but a second which had lost it shoe had attachment holes suggestive of the duck bill type. Type 6 was not dated.

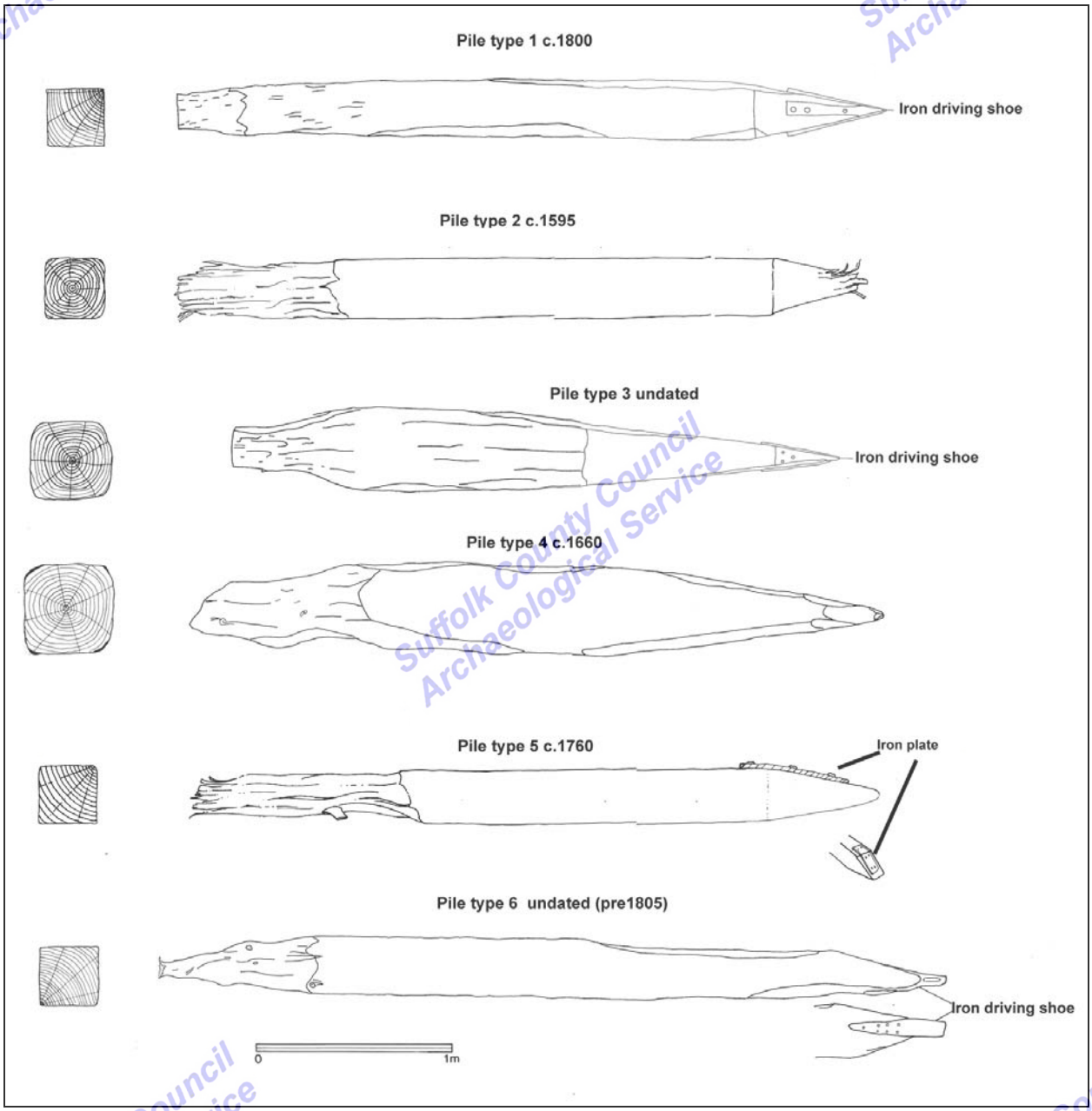


Figure 7. Pile types

The bridges

The variation in the date groups and style of the piles indicated that the timbers represented a succession of bridges or bridge repairs. Photographs and drawings of the final phase of the wooden bridge show the form of the structure with the deck carried on alignments of posts that spanned the width of the road (Fig.8). A plan of the last wooden bridge was drawn at the end of the 19th century whilst it was still standing and shows eight rows of north south-aligned piles between 2.5m and 4m apart; with a double row at mid-stream (Fig. 8). Between the timbers of the then existing bridge the position of earlier piles are also shown.

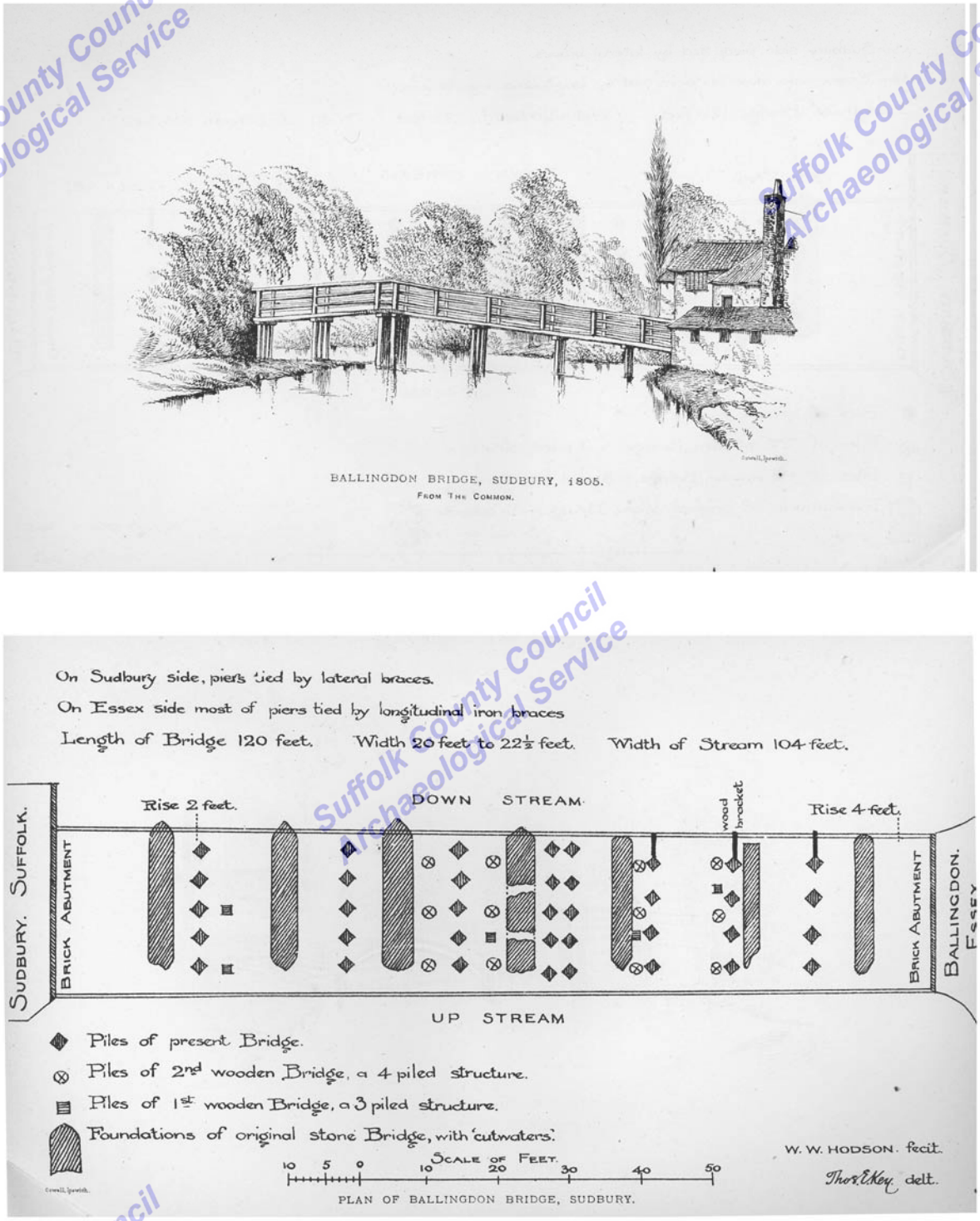


Figure 8. Bridge illustration and Hodson's plan of Ballingdon Bridge published in PSIA 1892

During the excavation six timber alignments, three on the Sudbury and three on the Ballingdon side were recorded within the excavated areas and the presence of further timber alignments that made up the central piers were confirmed by the divers in their initial 'touch' survey (Fig. 9). The excavated alignments made up closely spaced timbers with up to 12 recorded in each row and a mix of pile types indicative of several phases of build. The rows of timbers were driven in between masses of fallen masonry of an earlier brick built bridge suggesting that the interval between the rows was determined as much by the available space as engineering considerations, and because of this each of the wooden bridges had similar footprints.

The most numerous pile types and therefore the most clearly defined of the bridge structures were the Type 1 and 2's . These piles were also the earliest and the latest groups of timbers with the dendrochronolgical sampling dating the Type 2 to the end of the 16th century and the type 1's to the turn of the 19th century. These dates coincide with distinct events in the crossing's recorded history and when new bridges were known to have been constructed. Notably these pile types looked similar to each other, exhibited the greatest degree of woodworking and looked the most 'manufactured' with the timber being uniformly prepared and shaped. This consistency is perhaps a reflection that the Type 1 and 2 timbers were each part of new-built structures, when it might be expected that all of the component parts would be manufactured together.

The distribution of Type 3, 4, 5 and 6 piles seemed more random and occurred within the alignments amongst the Type 2 timbers. The dates of the timbers correlated well with court orders for repairs that occurred regularly during the 17th century. The mix of woodworking and design of these timbers suggests that their production was more *ad hoc* and the low numbers of each type indicates that these are repairs inserted when necessary rather than a wholesale rebuild of the bridge. The date of the 3, 4, 5 and 6 Types and their association with the Type 2 piles suggests that these were repairs to the original (Type 2) bridge that had stood since 1595. The unmatched sequence of the Type 3 may indicate that these came from a different (?imported) source than the other timber.

The Type 1 timbers were part of the last of the wooden bridges and survived until the start of the 20th century. Hodson's plan of the bridge in PSIA Vol VIII part 1 (1891) is a schematic drawing with written dimensions of this bridge. He shows the width of the bridge at 22½ft supported on five piles at the Sudbury end diminishing to 20ft and four piles at the Ballingdon end. The archaeological evidence conforms to his drawing but is the other way around (wider and with the greater number of piles at the Ballingdon end) suggesting that the Hodson drawing may be mislabelled. The archaeological evidence also suggests either that the alignment of the rows of timbers was not square to the line of the bridge or that the bridge had an angle change along its course.

The spread of the posts suggests that the first wooden bridge was on a very slightly different alignment to the later 1805 bridge. This earlier alignment is better reflected in the frontage of the adjacent medieval timber framed buildings on the south side of Ballingdon Road and reveals that the road has been moved slightly.

A brick retaining wall, 0042, forming the south and west side of the abutment to the 19th century wooden bridge was observed during excavation of the approach to the Sudbury side of the bridge (Fig 9). The abutment was infilled with an imported pale orange/grey clay which formed a ramp from street level to the start of the bridge. The wall was constructed using standard 9" x 2½" frogged red bricks, stamped ALLEN/ BALLINGDON, a manufacturer based in Sudbury. The top of the wall was recorded just below existing pavement level suggesting that the incline was similar to today's. The abutment on the Ballingdon side was not seen but Hudson's survey of the bridge records that the Sudbury bank was the higher by 2ft.

Masonry and Brick Bridges

The remains of a brick built bridge and evidence of an earlier mortared flint and stone bridge were found spread across the riverbed (Fig 10). The bases of six brick piers could be seen truncated just below the water surface and dense rubble, including large bonded fragments of the above water structure, was recorded in the east bank and clogging the Sudbury half of the stream. Of the six piers, four were within the areas of the cofferdams and two, well preserved, examples visible in the centre of the river just below the water surface.

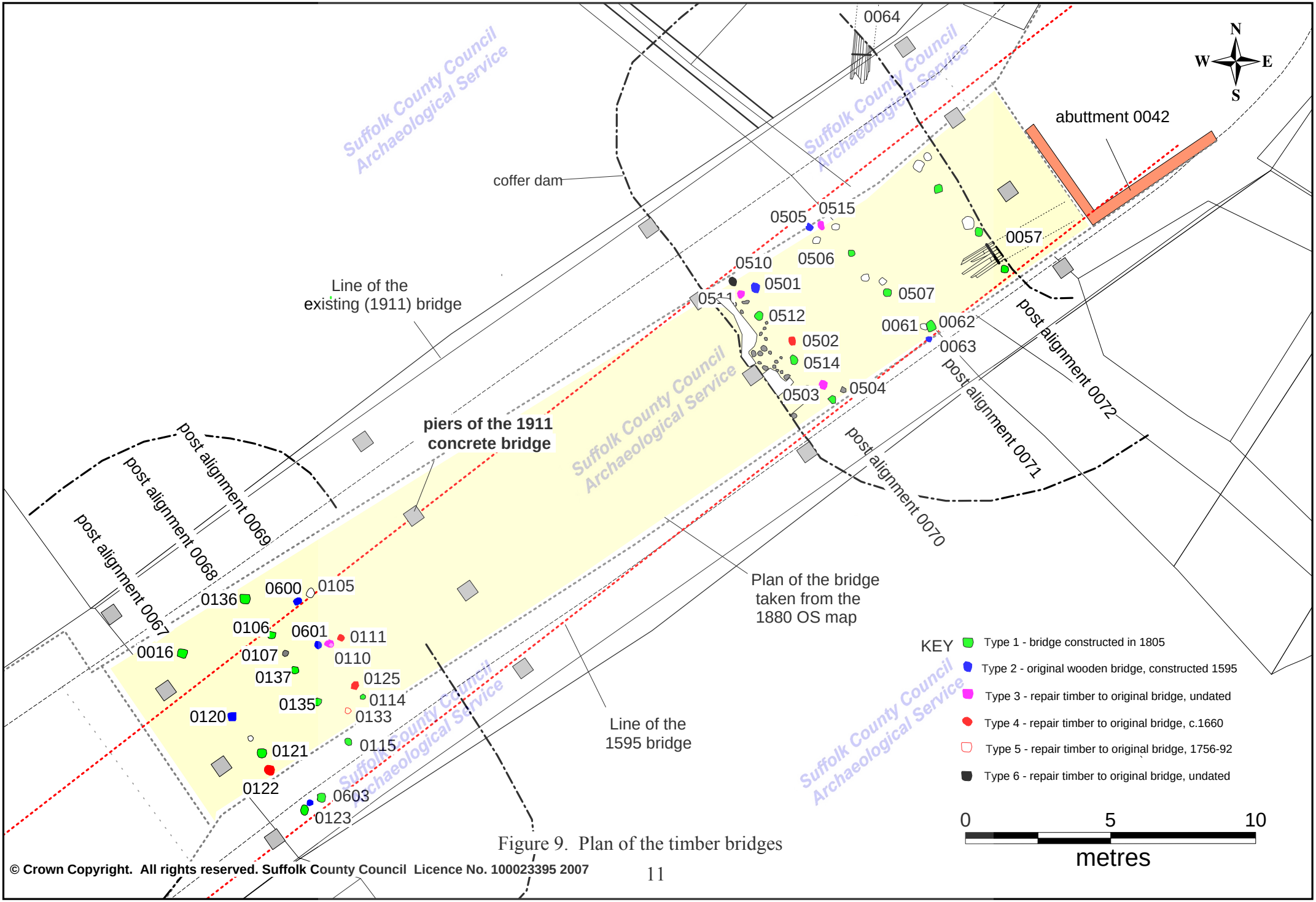


Figure 9. Plan of the timber bridges

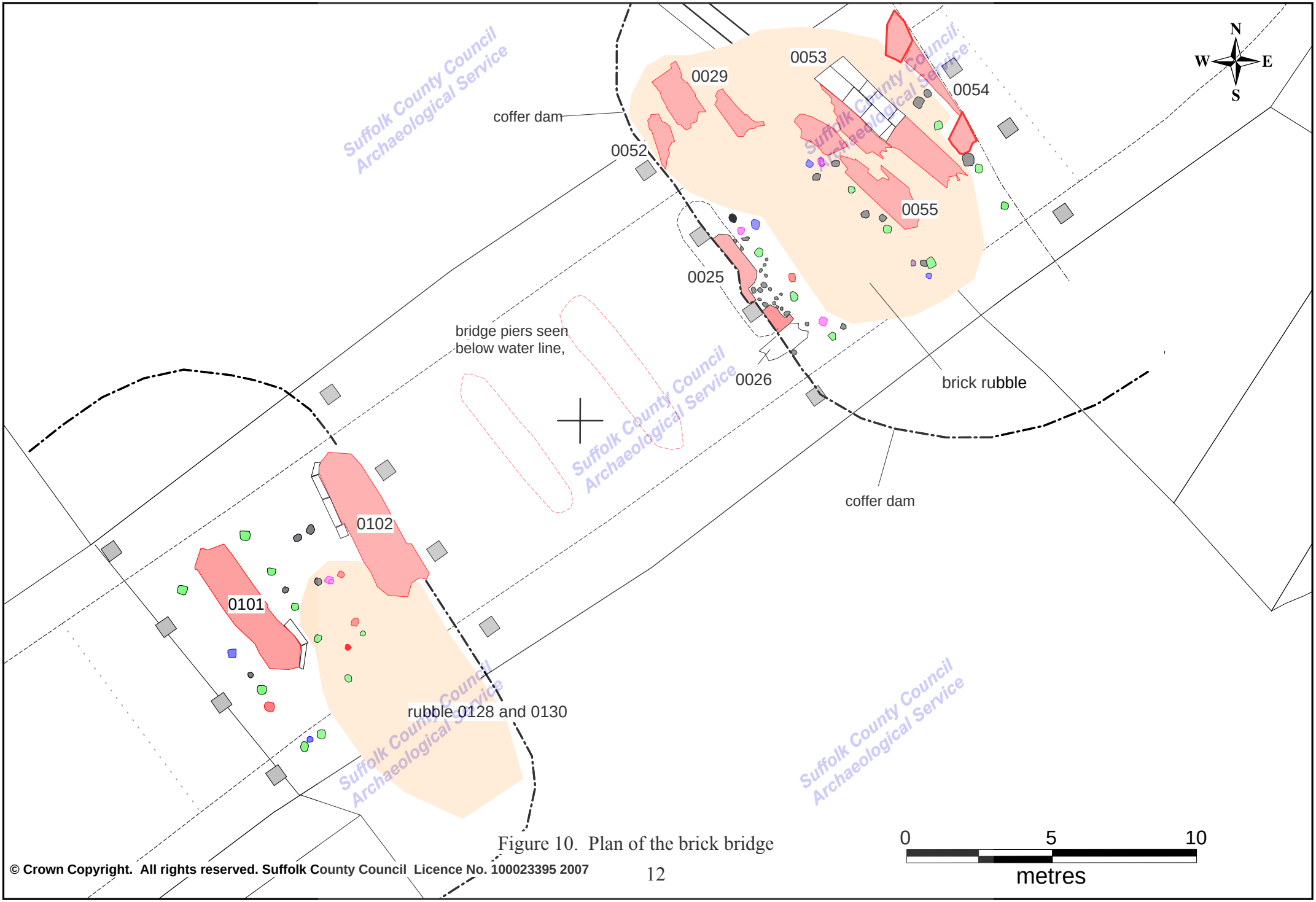


Figure 10. Plan of the brick bridge

On the Sudbury side the piers were not immediately apparent. The fabric of the collapsed bridge lay where it had fallen slowing the flow of water and causing an accumulation of silts so that what had been the first two arches of the bridge had become a muddy sloping foreshore to the bank. With the silt cleared away (see *Non bridge features*) the enormity of the debris pile was revealed.

Figure 11. Remains of the brick bridge being excavated adjacent to the Sudbury bank

The rubble extended to the centre of the river along the line of the bridge and the area up-stream from it, with little or no spread of material down stream. Amongst the loose bricks were large bonded lumps and from the direction of the bond it was possible to determine what was in situ brickwork and what was disengaged. The fragments were numbered and the significant pieces recorded and planned (Fig. 10). Much of the bonded brick was too large to be lifted and had to be broken up prior to being carted away (Fig. 11).

On the Ballingdon side, all rubble from the collapsed bridge had been removed in the past leaving only the *in situ* base of two piers 0101 and 0102, as the surviving remains of the bridge.

Description of the brick bridge: late 15th century -1594

The brick bridge spanned the river with at least seven arches and six piers that stood in the river's stream at intervals of *c.*3m, (Fig. 10). The complete length of the bridge and the number of arches is unknown as neither of the bridge's abutments was found. Excavation for the crane bases showed that the riverbank on the Sudbury side was at least 7.5m further back during the 16th century, so whether they have been lost or simply not uncovered is uncertain. The main structure was in red brick with the arches and the inside face of the piers in a fine-grained white limestone, tooled to a smooth finish. The bricks were handmade in a fine sandy textured fabric and bonded with a white lime mortar. The fabric was fired red/orange in the main but many were overfired to a purple/pink. The size of the bricks (9¼" x 4½" x 1¾-2") suggests that the bridge was built in the late 15th or early 16th century and apart from one area of repair was a single phase of work.

Each arch was made up of a projecting, chamfered rib or arch-ring on either side of the bridge with plain stones and brick in between (Figs 12 and 13). Although no arch survived, the curve of the collected voussoirs and a surviving springing point, attached to block 0054, indicate a shallow, depressed four-centred arch; a *perpendicular* style typical of the 16th century. The height of the spring point and radius of the haunches suggests that the arches were low, with little clearance over the water and a restricted passage beneath the bridge. Some, although not all, of the stones of the arch ribs were rebated on the reverse, creating a lip onto which the *intercostal* stones were laid.

Figure 12. Voussoir part of an arch ring

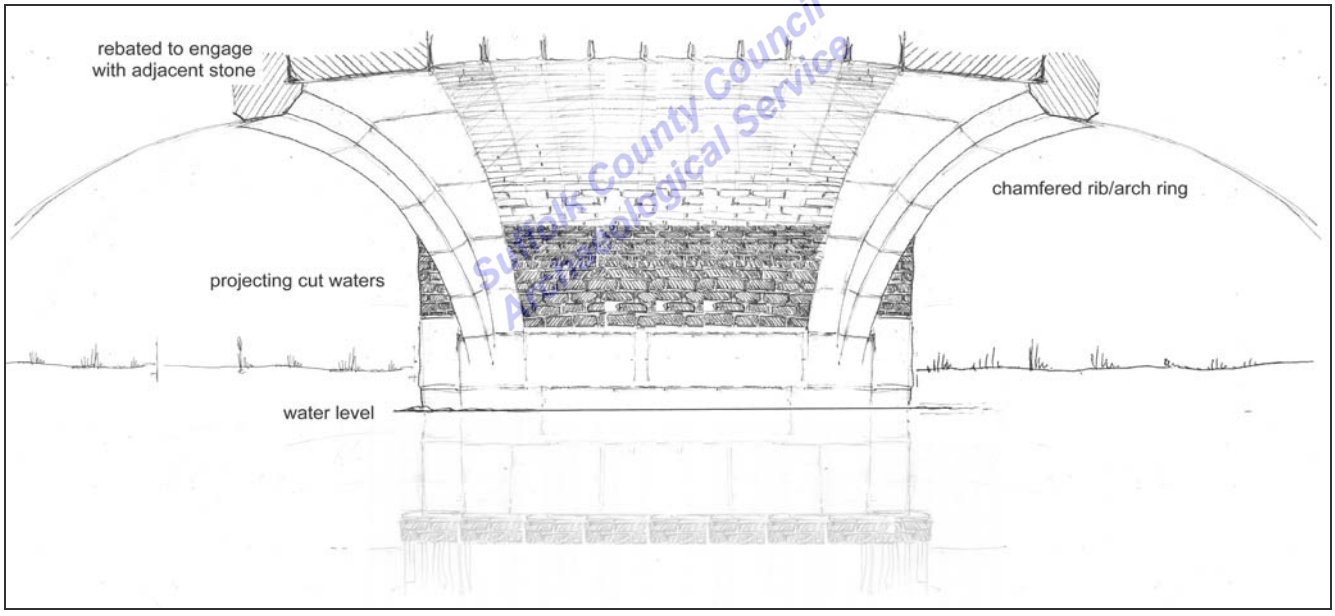


Figure 13. Sketched impression of the underside of the bridge showing arch rings and stones.

The piers tapered to a point (both on the up and downstream side of the bridge) to form cutwaters which projected forward of the line of the arches. The evidence, although limited, was that the cutwater extended to the full height of the bridge to the top of the parapet wall and these were solid blocks of masonry rather than forming refuges (although there was no evidence of the central pier, most likely place for a refuge). Above the water line the stone facing the piers and cutwaters alternated with areas of brick creating a red and white decorative scheme.

Of the six piers, four (0101, 0102 and two unnumbered) were part of the original structure and *in situ*, one had turned over onto it side (0053) and one (0025) was a replacement (Fig.10).

The core of the piers was constructed of coursed brickwork and faced with large limestone blocks between 350-500mm thick. The limestone was well finished with tight joints mortared to the surface of the bricks, much of the limestone was missing but the impressions of the stones, including the masons' numbering marks could be seen in the bedding mortar left behind. The limestone was structural, forming and bearing the load of the arch. The brick cores of the piers

were 1.5m wide and 5.5m long tapering to a point at each end to form the cutwaters. They were raised off a stepped footing, which gave them a 2.25m wide footprint and formed a ledge off which the facing stones were built. Tile 'pinnings' were laid between the footing and the first course of bricks at one end of the pier to correct the level and the base course of the footing were laid dry over a coarse mortar and rubble bed. The base of the brick footing sat at riverbed level but was constructed off a platform of closely spaced vertical piles (like the bristle of an up-turned toothbrush) driven into the ground. The piles were not seen *in situ* but appeared as

Figure 14. Piers 0101 and 0102. Slump of pier 0102 evidenced by the angled brick courses in foreground

circular impressions in the bedding mortar on the base of the pier and were revealed when the piers were lifted (Fig. 15). Fragments of the piles, softwood poles 60-100mm in diameter, were collected from the water after the piers were disturbed. Pier 0102, closest to the Ballingdon bank was the best preserved and is recorded in Figure 14.

Figure 15. Underside of pier 0101 showing impressions of piles

The south end of the adjacent pier 0101 had sunk, the north end was pitched above the level of the reduced water line and the coursing of the brickwork and limestone facing were steeply angled at *c.*20° from the horizontal. The pier had been truncated level with the water's surface so that the surviving top of the pier was a surface of pitched brickwork (Fig.14). At the more deeply submerged south end, the pier existed to the height of the arch springing point and showed the complex change in coursing needed to form the arch itself. Dredging of the riverbed suggested that a deep hole existed on the south side of the bridge and that the pier had subsided into it and the hole had become filled with rubble from the collapse. Brick, stone and building flint pulled up from well below the known level of the riverbed suggested that the hole was at least 2m deep.

Figure 16. Inclined pier, 0053

No original piers remained in situ on the Sudbury side. The first pier from the Sudbury bank, 0053, had rolled over 70° to vertical and was resting on its western side with the dressed limestone of the east side now uppermost (Fig.16). The pier base had lost the bottom course(s) of brick but there was enough to indicate the step footing below the limestone and that these were the bottom courses of facing stone but damage to the bricks above the stones suggested that an upper course of limestone had been lost. At its north end the tapered cutwater could be seen.

A huge block of bonded brickwork, 0054, presented a complete cross section of the bridge truncated at just beyond the line of a pier, which had fallen forward into the river from the Sudbury bank (Fig. 17). From the river this presented a plan view of the bridge showing the deck edged with two low parapet walls. The bridge was quite narrow with only 2.75m between the internal face of the parapets, wide enough for one carriage only. The parapet walls themselves were 0.8m thick widening to over 1.1m at the piers/cutwaters. The parapet walls were truncated but survived to a height of 0.6m above the surface of the deck, the walls were entirely brick and there was no indication that the limestone coping stone, found loose in the rubble had been attached to this structure. The surface of the deck was in brick, laid in stretcher bond and the bricks were the same soft hand-made type as the rest of the bridge. The bricks were worn but there was no indication of wheel rutting or that there had ever been a hardened road surface.

Figure 17. Cross-section of the brick bridge, 0054, behind timber pile of the later bridge

The north elevation showed the angled projecting cutwater extended to the full height of the parapet. The top of the cutwater had been truncated removing possibly a limestone capping stone but the indications were that the line of the leading edge of the cutwater did not extend further than the base of the parapet. The facing stones that protected the cutwaters at river level were not continuous above the water line but were alternated with areas of exposed brickwork for decorative effect.

Brick bridge phase 2, repaired section

Pier 0025 was in the correct position but was constructed using a method unlike the other piers. This difference was interpreted as an indication that pier 0025 was not built at the same time as the others and was a repair to the original structure. The pier was cast, apparently *en bloc*, in a very hard-setting hydraulic lime mortar with large chalk inclusions and tempered with brick and tile rubble. Voids within it and its general appearance suggested that it had been wet poured which left the impression of uncoursed brick, and tile stuck flat against its surface. It was cast over unbonded rubble held within a framework of narrow softwood piles (contexts 0032-40) driven into the riverbed. At its south end the pier was a single row of coursed hand-made narrow 'Tudor bricks' 0024, dated to the 16th century. Butting against the bricks and supporting the pier was a large unworked log, 0026, (probably walnut, identified by the twisted burred grain) lying horizontally east west across stream. The log sat above the softwood piles but the pier followed its contours suggesting that the pier was cast against it. The log was wedged in place either to help anchor the pier or to break up the water's flow and counteract the scouring effect – alternatively it might just have become stuck.

The pier had broken up where an oak pile passed through it. The pile was not part of the timber alignments associated with the later wooden bridge but may have been an internal frame, an impression of a similar internal timber support was seen in the adjacent block of detached brickwork 0052 and was thought to relate to the two components.

Adjacent to and just to the north of pier 0025 was a massive block of bonded masonry, 0052 (Figs. 10 and 18) which the limestone facing stones showed was part of the arch close to the springing point. It lay face down on the stream bed north of the line of the bridge with the

Figure 18. Pier 0025 showing detail of fabric and position of log 0026. In front of 0025 are the timber piles from the later wooden bridge

exposed internal core uppermost. It was thought to have been part of the adjacent lump 0029 and had become detached from pier 0025. Whilst on the riverbed the reverse of 0052 was drawn, detailing the internal structure of the bridge. The bricks within the core were not laid in a recognisable coursing pattern and include fragments of brick incorporated in what appeared to be a haphazard way. This was particularly so behind the limestone facing, where bricks were laid at every angle including on edge. The very centre was made up of bonded brick rubble, in a manner similar to the rubble core of a medieval flint wall. The core brickwork had been formed around a very large wooden post, the post had gone but an impression of it remained as a vertical hollow within the fabric (Fig.19). The bridge had failed along this point, cleaving along the mid-line of the post. The presence of the timber impression showed that this section of the bridge had been uniquely

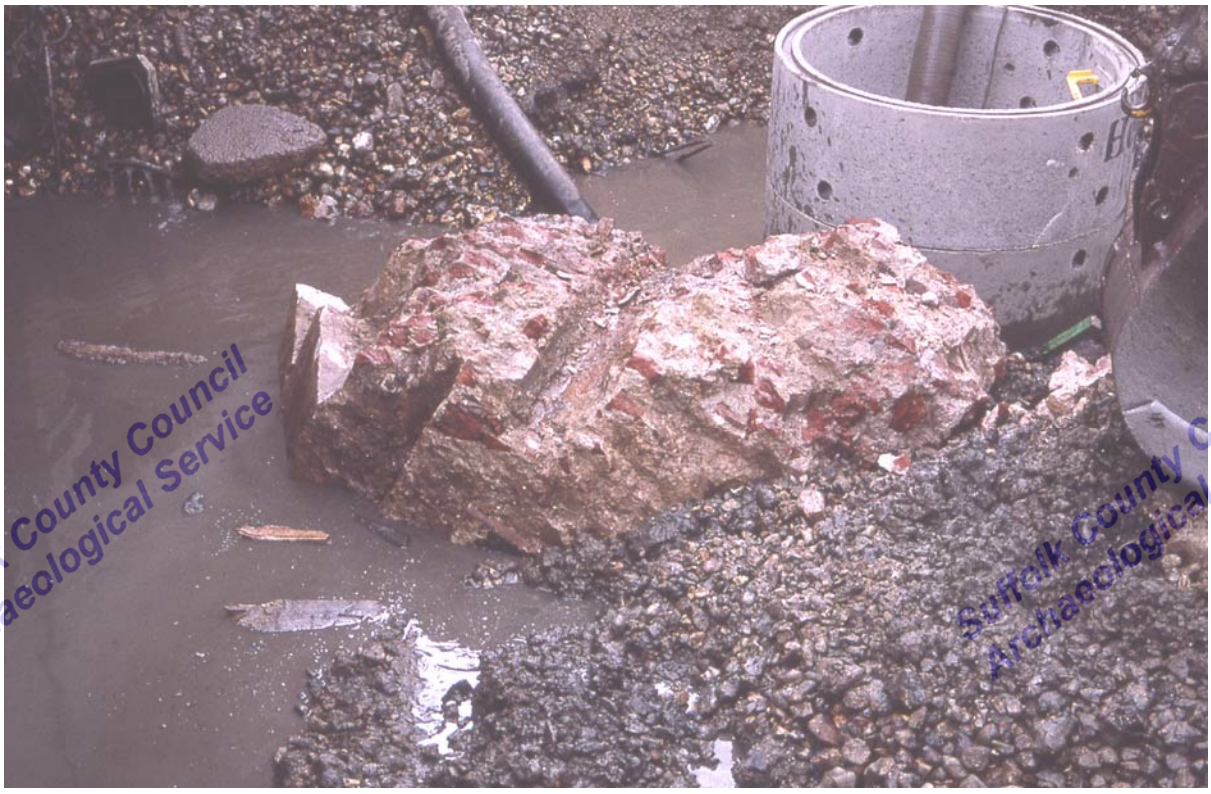


Figure 19. 0052 showing impression of internal timber

formed around an internal skeleton of wood. This tied in with evidence from the repair pier 0025 suggesting that the two were co-joined. There were two distinct mortar mixes within the core of 0052 and the change coincided with the joint between two courses of the limestone facing. The lower mix was a darker lime mortar similar to 0025, whereas the upper mix was a very hard (harder than the bricks) white mortar with distinct quartz inclusions and this was similar to the mortar that bonded 0029.

Figure 20. SHEC engineer Andy Bilby tells of the one that didn't get away

The underside and part of the front of the arch were faced with limestone. This was slightly darker and sandier textured than the white fine-grained stones covering 0053 (but 0053 had been in running water and 0052 sealed in the mud). The limestone was bonded to the brickwork that matched the lower phase of the build rather than the later hard white mortar.

The Stone Bridge: 12th-late 15th century

No part of an intact structure pre-dating the brick bridge survived but dressed stone from a previous crossing, including coping stones from the top of the parapet and voussoirs from the arch-rings were recovered from the rubble (Fig. 21). These were in a coarse-grained Barnack stone and were in contrast to the fine textured and paler stone used to face the later bridge. Many examples of both the coping stones and voussoirs were observed being lifted, and samples were drawn and retained. The voussoirs were dressed on three faces and would have formed projecting, chamfered ribs on the underside of the arch, similar to the arch of the later bridge but distinct in stone type and curve radius. The coping stones were 1400mm long and 400mm wide at the base, triangular in section with a simple turned over roll moulding along the ridge. One of the coping stones had an obtuse angle change in the line of the ridge suggesting that there may have been either a refuge or a splay to the parapet at the entrance to the bridge. As well as the more complex mouldings, large plain rectangular blocks of dressed Barnack stone, up to 1200mm x 1400mm x 600mm and thought to be from the base of the piers were also recovered. Sections of bonded flint were also found and the best preserved of these was a length of a narrow section wall. The thickness of the fabric suggested that it could only be a section of parapet and the coarse gritted sandy lime mortar and horizontal coursing to the flint suggested that this was Norman work.

The coping stones and voussoirs were distributed all along the line of the crossing but most of the bonded flint was concentrated in an area immediately south of the brick piers on the Ballingdon side and numbered 0128 and 0130 (Fig. 10). The stonework here was particularly dense and difficult to extract suggesting that it had been part of a bonded structure, but being

Figure 21. Stones from the 13th century bridge

lifted from below water level it remained unseen. Most of the stone in this area had pale brown coarse-grained lime mortar attached to it, this material would have been removed over time in moving water so it was likely to have been from closed joints. The water ran very cloudy with mortar during this operation suggesting that some degree of bonded material had been broken up.

Amongst the flint rubble were examples of very narrow (floor?)brick or tiles. They were only found here and were unlike the brickwork of the later (15th-early 16th century) bridge. A small area of bonded brickwork was built into a gentle curving arch. The proximity to the bonded flint and the comparable mortar colour and type suggested that the brick arch and flint were part of the same structure.

Non-Bridge Features

The congestion of brick rubble caused the river to silt badly adjacent to the Sudbury bank and a deep accumulation of mud sealed dumps of domestic waste, river deposits and brick rubble. This was excavated by machine and recorded in a sketch section 0060 (Fig. 22). The evidence from the crane bases shows that the Sudbury bank has been deliberately raised and encroached on the line of the river with a series of revetments. The profile of the natural bank was probably a shallow shelving slope and this has been built up by the deposition of rubbish. This occurred incrementally from the 15th century and is dated by the pottery within the deposits. The spread of the dumped layers out onto the foreshore of the river was quite extensive and was recorded at the base of section 0060.

The earliest line of the bank identified during the work was 16m further back from the current river edge and was defined by timber structure 0020 and later wall 0015. These reinstated the line of an earlier alignment of piles and occurred on a natural break of slope on the edge of a gravel bar. 0015 and 0020 probably date to the late medieval or early post-medieval period and the deposition of soil to push the bank out beyond them occurred during the 16th century, possibly as part of the development around the new brick bridge. The dumped deposits were within a black river silt, numbered 0013 and 0011 in the crane holes, which continued into the section 0060 where it was sealed beneath the bridge and building demolition debris.

A second revetment was recorded at *c*.7.5m from the current bank and the material dumped beyond it dated to the 17th century. This layer was recorded as 0051 in section 0060 and overlay the brick rubble from the 1594 bridge demolition. The dump layers produced the complete *Rhenish bartmann bottle* (Fig. 24) and a large assemblage of animal bones. The bones were deposited in single disposal events and the assemblage included large numbers of the same bone types including horn cores and was thought to be waste from commercial butchery and industry.

Vitrified bricks from a furnace and metal-working waste was also found within the rubbish deposits and perhaps related to bell founder Thomas Gardiner who had works close by at this time.

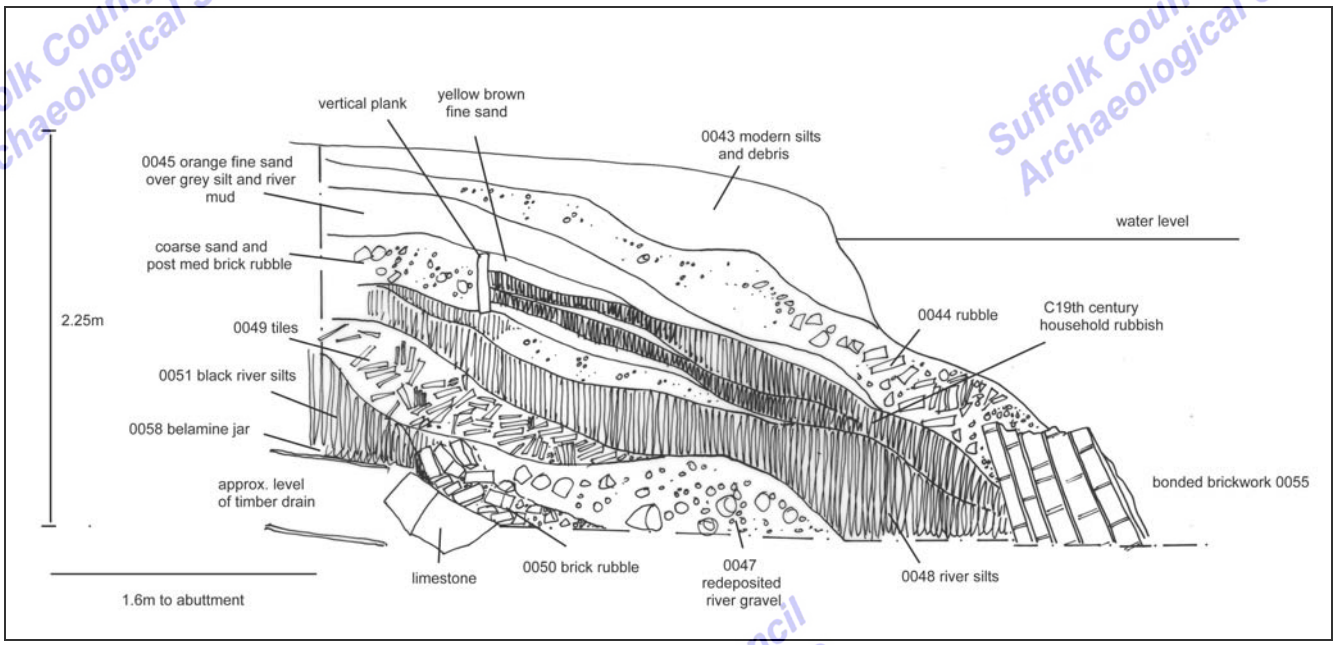


Figure 22. Section 0060

At this level, but not recorded in the section, was a wooden sewer pipe, 0057 (Figs. 10 and 23). The pipe was coopered, made up of narrow flat edged staves in soft wood and bound with an iron strap. The pipe was 600mm wide, circular in section and 2.20m and extended 2.2m from the bank. A similar pipe, 0057, was recorded on the south side of the bridge, still fed by the modern storm water drain. The southern pipe was laid in respect of the timber bridge piles which suggests that it post dated the bridge's construction. There was no cut for the pipe, which suggests that the pipe may have been an exposed out-fall pipe and that the silt layers on the bank probably accumulated over it.

Figure 23. Timber drain north of bridge

The brick abutment for the timber bridge which defines the line of the bank at the start of the 19th century is 6m back from the current bank (Fig. 9). The layers 0048 and above in section 0060 have been deposited since the construction of the abutment and include concentrations of Victorian household debris, interleaved with gravel and silts deposited during flood events. Hodson (PSIA 1892) describes the adjacent hovels as being below the level of the road and having gardens beneath the first bay of the bridge. A vertical plank near the top of the section shows the position of a late timber revetment and the layers at the top of the section were permanently above current water levels.

Finds and environmental Evidence by Sue Anderson

Introduction

Table 2 shows the quantities of finds collected during the fieldwork. A full quantification by context is included as Appendix 3.1.

Find type	No.	Wt/g
Pottery	53	12360
CBM	74	95890
Mortar/plaster	1	223
Glass	1	2
Clay pipe	9	130
Iron	11	7655
Animal bone	36	8151
Leather	1	-

Table 2: Finds quantities.

Pottery

All pottery collected from the site was of 16th century or later date. Table 3 shows the quantities by fabric. A full list by context can be found in Appendix 3.2.

Fabric	Code	No	Wt/g
Late Medieval and Transitional Essex type	LMTE	1	49
Glazed red earthenware	GRE	24	6799
Iron-glazed blackware	IGBW	2	398
Staffordshire-type slipware	STAF	1	75
Frechen-type stoneware	GSW4	7	2765
Westerwald stoneware	GSW5	2	186
16th-18th century		*37*	*10272*
Refined whiteware	REFW	12	1151
English stoneware (Nottingham-type)	ESWN	1	533
English stoneware (Staffordshire-type)	ESWS	1	94
Porcelain	PORC	1	46
Yellow ware	YELW	1	262
Modern pottery		*16*	*2086*

Table 3. Post-medieval pottery in approximate date order.

The earliest pottery from the site was a footring base from an LMTE jug with partial clear lead glaze (0019).

Glazed red earthenware of 16th-18th century date dominated the assemblage. Identifiable vessels included a jug (0009; cf Chelmsford form D5A), a wide-mouthed jug with applied thumbed strip decoration at the rim (0011), a large storage vessel and a chamber pot (0048), a chamber pot, dripping pan and costrel (0051), another chamber pot (0056), a large globular jug, a smaller jug and two lids (0127). Iron-glazed blackware, another glazed redware of 17th-18th century date, included a tankard and a jug (0011).

A rim sherd of a Staffordshire-type small press-moulded slipware plate was found in 0051. This is probably of 18th century date.

Frechen-type stonewares, dated 16th-17th century, included a near-complete bottle with a finely moulded face (0058), the neck of another with a cruder face (0127), and body sherds from two other vessels. Theses Rhenish stoneswares, which are also known as bellarmines are of mid-17th century or later date (Fig 21). Stoneware from Westerwald consisted of two sherds of a tankard, decorated with applied blossoms and engraved stems on a manganese purple background (0011), also of mid-17th century or later date.

Figure 24. Rhenish stoneswares bottles or 'Bellarmines'.

Modern pottery included refined whiteware cups, jars, plates, bowls and jugs. A pint tankard with a blue sponged body and an oval 'medallion' containing the lettering "M…..N & SON / IMPERIAL /SUDBURY" was an unstratified find (0066). There were also fragments of a Nottingham-type stoneware punchbowl, a Staffordshire-type stoneware brown-dipped tankard, a porcelain egg-cup, and a yellow ware mixing bowl.

Ceramic Building Material (CBM)

The CBM assemblage is simply a sample, collected for dating purposes, of the vast quantity which was present on site. Table 3 shows the quantities collected by form. A full list by context, with spotdates, is included in Appendix 3.3.

Form	Code	No	Wt
Late brick	LB	40	84422
Moulded brick	MB	1	3060
Floor tile	FT	2	4247
Roof tile	RT	28	3156
Pantile	PAN	1	821
Hip tile	HIP	1	288
Chimney	CH	1	169

Table 4. CBM forms.

The majority of pieces were red bricks, either complete or half bricks, some of them mortared together in large blocks. The earliest were found in 0127 and 0130, and were in a fine to medium sandy fabric with fine ferrous and flint inclusions, measuring 220-230mm long, 110-112mm wide and 35-37mm thick. Bricks of this approximate size can be dated to the late 15th century in East Anglia. Other bricks in a similar fabric, but thicker, were thought to be slightly later, perhaps early 16th century. These were found in 0011, 0024, 0027, 0028, 0029, 0117 and 0118, their approximate dimensions being 235-240mm long, 110-116mm wide and 45-56mm thick. However, bricks are difficult to date with any precision, and it is quite possible that the two types are contemporary but sourced from different manufacturers.

A few later bricks were found. A piece from 0017, 110mm wide by 63mm thick, was probably of late 17th to early 18th century date, and 19th century frogged bricks, stamped ALLEN/ BALLINGDON were collected from 0042 and 0047.

Three fragments of brick were mortared together and had a thick deposit of ferrous slag adhering to the headers. The bricks measured 107mm wide by 58mm thick, suggesting an early 16th century date. The headers had been vitrified to a depth of approximately 10mm. These presumably represent waste from a furnace; they are unlikely to be from a domestic fireplace.

One large moulded brick was found in 0009, made in a grog-tempered micaceous fabric. It was a piece of plinth or jamb and was probably of 16th century or later date.

Two floor tiles were identified. One, measuring 203 x 200 x 43mm, in a grog-tempered micaceous fabric, was from 0011 and was likely to be of 15th-16th century date. The other, from 0009, measured 173 x 175 x 35mm and was in a white chalk-tempered fabric, indicating an 18th-19th century date.

Roof tiles were represented by small pieces of peg tile in a variety of fine to coarse fabrics, some of which could be medieval. One fragment of pantile and one piece of hip tile were also identified, and both are probably post-medieval.

A fragment of heavily sooted chimney louvre, machine-made and 19th-20th century, was collected under context number 0127.

Metalwork

Iron objects were collected under seven context numbers, as follows:

0001	Handle	Curved ?cauldron handle with hooked ends, c.345mm long, 15mm wide.
	Stake casing	Casing for the point of a stake, three of four sides surviving, three holes at each wide end, splayed and broken.
	Hearth fitting?	Shaped cast iron hearth fitting or fire bar? 260mm long.
0009	Billhook	290mm long, blade 60mm wide.
	Fitting	Hollow curved piece, rivet at curved terminal, broken at the other end, oval section. 25mm thick.
	Axe head	Large axe head, blade width 171mm, 227mm long.
0020	Fitting	Flat tapered nail-like end with curved fitting and broken side. 172mm long.
0044	Nail?	
0056	Nail	Large nail with sub-rectangular head, piece of modern glass attached, 220mm long.
0066	Trenching hoe	175mm long, blade 120mm wide.
0127	Unidentified	Circular ‘pan’ with two central straight cuts, 110mm diameter, modern concrete inside.

All objects were of post-medieval or recent date.

Miscellaneous

One small fragment of ?modern window glass was collected from 0056.

Two 18th century clay pipe bowls were collected from 0011, and seven fragments of mainly 19th century date were unstratified (0066).

A fragment of a leather shoe was found in 0011.

Animal bone

Thirty-six fragments of animal bone were collected. The assemblage was dominated by cattle horncores (eight from 0009, eight from 0011, two from 0127), but there were also pieces of horse (tibia and metatarsal from 0011, mandible from 0047), sheep (metacarpals, radius, humerus and phalange from 0011, phalange from 0127), and other cattle bones (metacarpal, humerus from 0011). A few fragments were not identifiable to species. Most of this material was found in association with post-medieval pottery, and the size of the horncores suggests a late date. However, a few fragments were stained dark brown and may be earlier.

Discussion of the finds evidence

The finds assemblage from Ballingdon represents two main aspects of the site.

Firstly, much of the CBM recovered from the site formed part of the bridge structure, and the different brick types present could well represent the various phases of construction and demolition mentioned in the records.

Secondly, the animal bones, pottery and other finds dredged from the river represent disposal of rubbish from a variety of sources, some domestic and some industrial. The animal bones, for example, may be tannery and/or butchery waste, and the brick covered in iron slag may be from a smith's furnace or related to some other metalworking activity. Some of the pottery may be derived from sewers. Several chamber pots were found during recent work in Sudbury sewers, for example, and it seems that broken pots may have been disposed of in this way. Some of the more recent pottery could be tavern clearance waste. There is also evidence for casual loss, for example in the finds of perfectly usable tools like the axehead and hoe.

Dendrochronological spot dates by Ian Tyers

A total of 19 samples from timbers excavated on the site of Ballingdon Bridge (sitecode BCB 012, NGR *c*. TL868409) were submitted for spot-dating. The site is beneath the bridge carrying the A131 from Sudbury into Essex across the river Stour.

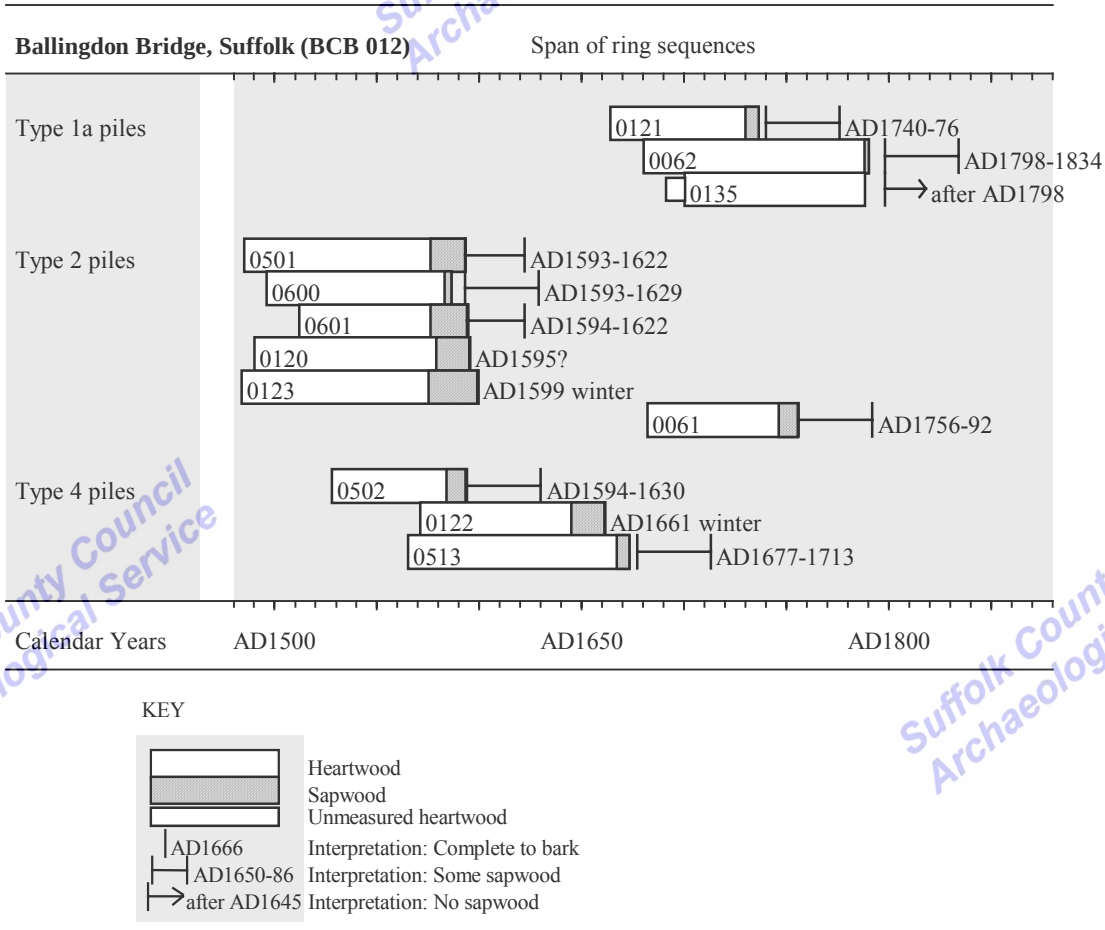
The excavations in the bed of the river observed around 50 piles used for earlier versions of the crossing. The archaeologist Dave Gill reports *'the timbers are all from a succession of probably three wooden bridges. The sequence begins immediately after the collapse of a brick bridge, which was built in the early 16th century and fell down possibly in 1594. The first wooden bridge underwent repairs or was replaced in the 17th century and a wooden bridge, possibly the final one, was built in 1804/5.'*

'Because the river bed was almost completely covered in the wreckage of the collapsed brick bridge, there were very few places where the piles could be driven in. The position of the piers are therefore common to all of the wooden bridges and on the ground the timbers were in multi-phase, closely spaced, clusters with no apparent pattern to link the timbers spatially. The timbers can, however be grouped by type. There two basic piles; roughly shaped logs made from a complete tree, and a more regular, square sectioned sawn timbers often using quartered trees. Some of the timber had iron driving shoes on the tips of the points and a 'typology' of driving shoe was used to further refine the phasing' (Dave Gill pers comm. 2002). The pile types are shown in Figure 7.

Samples were recovered from 19 of the piles, and a preliminary assessment identified that all 19 samples were oak and all had sufficient rings for attempting tree-ring analysis. Standard dendrochronological methods (see e.g. English Heritage 1998) were applied to all of these samples. The tree-ring sequences from 12 of these were found to cross-match either with each other or with reference chronologies (Tables 1 – 7, Figure 2). It is important to appreciate that although the dendrochronological dates will not change in the future, any interpretations of these results are of necessity interim and liable to change, particularly as aspects of re-use and repair are revealed by post-excavation analyses. The other 7 measured samples were not found to cross-match reference chronologies and are undated by the analysis reported here.

Three types of dating result are usually obtained by dendrochronological analysis. Firstly, where a sample is complete to bark-edge a precise year of felling is obtained directly from the date of the last ring on the sample, where there is good survival of this outer ring it is sometimes possible to assign seasons to the felling period, the principal distinctions are between early spring, early summer and winter. Where a sample has some sapwood, but is not complete to the bark-edge a felling date range is obtained by applying the maximum and minimum numbers of rings of sapwood normally seen in oaks for the relevant areas, to the relevant samples. The range 10 – 46 has been used in this report. Finally, where no sapwood survives a *terminus post quem* (*tpq*) date is obtained by adding the minimum number of sapwood rings likely to have been lost to the date of the latest surviving ring. This type of date is very much less useful than the other two types since a very great number of rings could have been lost either through ancient carpentry practise, or poor site preservation, and thus the felling date of such material may be considerably later than the tree-ring date.

The bar diagram below show the relative and absolute positions of the dated samples from the Ballingdon Bridge excavations. Each bar is annotated with an interpretation based on the date of the ring sequence and the presence of sapwood.



Sample	Species	Rings	Sapwood	Growth (mm/year)	Sequence date	Interpreted date
0061	Oak	74	9	2.72	AD1682-1755	AD1756-92
0062	Oak	111	2	1.73	AD1680-1790	AD1798-1834
0063	Oak	115	15	2.02	undated	-
0120	Oak	106	16+?B	1.57	AD1490-1595	AD1595?
0121	Oak	73	6	2.82	AD1664-1736	AD1740-76
0122	Oak	91	16+Bw	2.65	AD1571-1661	AD1661 winter
0123	Oak	116	24+Bw	1.87	AD1484-1599	AD1599 winter
0135	Oak	*9*+89	-	2.56	AD1700-1788	after AD1798
0501	Oak	109	17	2.50	AD1485-1593	AD1593-1622
0502	Oak	66	9	2.74	AD1528-1593	AD1594-1630
0503	Oak	72	9	3.76	undated	-
0505	Oak	67	h/s	2.38	undated	-
0511	Oak	106	21	1.73	undated	-
0513	Oak	109	6	1.82	AD1565-1673	AD1677-1713
0515	Oak	126	?h/s	1.92	undated	-
0516	Oak	82	-	2.90	undated	-
0517	Oak	79	?h/s	2.51	undated	-
0600	Oak	91	3	2.63	AD1496-1586	AD1593-1629
0601	Oak	83	18	1.85	AD1512-1594	AD1594-1622

Table 5. Sample details from the Ballingdon timber piles (BCB012)
KEY: h/s – heartwood/sapwood boundary, ?h/s – possible heartwood/sapwood boundary, Bw – Bark-edge winter felled,?B – possible bark-edge, *9*+ – nine additional unmeasured heartwood rings present before the start of the measured sequence

	0123	**0501**	**0502**	**0600**	**0601**
0120	7.83	4.07	3.22	4.07	4.00
0123		4.94	4.04	3.55	5.53
0501			4.72	6.47	6.82
0502				5.47	5.39
0600					5.13

Table 6. Correlation *t*-values (Baillie and Pilcher 1973) between the earliest samples from Ballingdon that are dated.

	BCB_B
Bedfordshire Flitton (Howard *et al* forthcoming b)	6.59
Cambridgeshire St Andrews Church Wimpole (Bridge 1998a)	8.84
Cambridgeshire Sutton-in-the-Isle (Tyers 1995b)	6.63
East Midlands 1988 published version (Laxton and Litton 1988)	7.86
Essex Beeleigh Abbey nr Maldon (Tyers 2002)	6.72
Essex Cressing Temple Farmhouse (Tyers 1995a)	7.90
Essex Moyns Park Birdbrook (Tyers 1999b)	7.82
Hampshire The Vyne Garden House (Miles *et al* 1997)	6.66
Hampshire Western House Warborough (Haddon-Reece *et al* 1989)	6.41
Surrey Reigate High Street (Tyers 1990)	6.34

Table 7. Correlation *t*-values (Baillie and Pilcher 1973) of the mean sequence constructed from the 6 earliest dated timbers against a series of independently dated chronologies from around Britain.

	0513
0122	4.88

Table 8. Correlation *t*-values (Baillie and Pilcher 1973) between the intermediate Ballingdon samples that are dated.

	BCB_B
Bedfordshire Flitton (Howard *et al* forthcoming b)	5.16
Derbyshire Riding School Bolsover Castle (Howard *et al* forthcoming a)	5.73
East Midlands regional master (Laxton and Litton 1988)	6.12
Essex Cressing Temple New House (Tyers 1997)	5.46
Essex Hill Hall Theydon Mount (Bridge 1999)	4.93
Herefordshire Pembridge belltower (Tyers 1999c)	4.64
Lincolnshire Lincoln Cathedral (Laxton *et al* 2001)	4.94
Lincolnshire Lincoln Vicars Court (Hillam and Groves 1996)	6.57
Staffordshire Black Ladies nr Brewood (Tyers 1999a)	4.43
Yorkshire Nostell Priory nr Wakefield (Tyers 1998b)	4.66

Table 9. Correlation *t*-values (Baillie and Pilcher 1973) of the mean sequence constructed from the 2 intermediate dated timbers against a series of independently dated chronologies from around Britain.

	0061	0062	0121	0135
Bedfordshire Chicksands Priory (Howard *et al* 1998)	5.33	4.42	5.32	-
Berkshire Reading Abbey waterfront (Groves *et al* 1997)	-	3.99	-	6.61
East Midlands regional master (Laxton and Litton 1988)	4.42	-	3.84	4.14
Essex Coggeshall West Street Kings Mill (author unpubl.)	4.52	3.25	6.38	-
Hampshire Granary Old Basing (Bridge 1996)	3.29	5.85	-	3.58
Hertfordshire Cromer Windmill (Tyers 1998a)	4.87	5.80	-	4.26
Kent Chatham Dockyard Wheelwrights (Bridge 1998b)	6.21	-	4.50	3.23
London Royal Arsenal Woolwich (Tyers 2000)	4.03	3.29	5.22	3.34
Oxfordshire Mapledurham Mill (Haddon-Reece *et al* 1990)	3.68	3.29	3.21	3.24
Wiltshire Savernake Forest (Briffa *et al* 1986)	3.76	4.78	5.98	3.53

Table 10. Correlation *t*-values (Baillie and Pilcher 1973) between the latest Ballingdon samples and a series of independent reference data sets (- t value less than 3.0).

	BCB_T12
Bedfordshire Chicksands Priory (Howard *et al* 1998)	7.58
Bedfordshire Flitton (Howard *et al* forthcoming b)	8.14
Cambridgeshire St Andrews Church Wimpole (Bridge 1998a)	10.03
Derbyshire Bretby Hall Bretby (Howard *et al* 1999)	7.32
Derbyshire Riding School Bolsover Castle (Howard *et al* forthcoming a)	8.20
East Midlands regional master (Laxton and Litton 1988)	11.29
Essex Beeleigh Abbey nr Maldon (Tyers 2002)	7.58
Essex Moyns Park Birdbrook (Tyers 1999b)	8.25
Wiltshire Savernake Forest (Briffa *et al* 1986)	7.11
Yorkshire Nostell Priory nr Wakefield (Tyers 1998b)	8.56

Table 11. Correlation *t*-values (Baillie and Pilcher 1973) of the overall Ballingdon mean sequence constructed from all 12 dated timbers against a series of independently dated chronologies from around Britain.

Dendrochronolgical dating: Results and Discussion

A summary of the findings is presented in Table 1, and Figure 2, all the material was identified as oak (*Quercus* spp).

The absence of bark-edge on all but two of the dated sequences prevents any serious assessment of the use of material felled over any period for use in major campaigns of construction and

repair. Comparing the documentary historical evidence for the bridges with the dates identified for individual piles shows that half of the datable material is derived from piles probably related to the first of the timber bridges, built after the collapse of the earlier brick bridge in *c.* 1594. These earliest piles are derived from at least two of the types identified on site, but the majority are of the squared and distinctive iron shoe type 2 piles. The single timber with surviving bark in this group was felled some five years after the collapse of the brick bridge and may indicate the crossing took a considerable period to re-instate. The two latest piles probably derived from the final timber bridge built *c.* 1804, these are both of the type 1a piles – squared and with pointed iron shoes. The four piles that are intermediate in date between these groups may be derived from as many as four other phases of intermediate repairs and/or modifications, this is also supported by them being derived from three different types of piles. However the dendrochronology cannot eliminate the possibility that they are re-used timbers used in the last documented phase of work.

The dated timbers form a composite chronology that is of unusual length and that covers a relatively uncommon period for tree-ring data, it thus provides a useful addition to the local tree-ring series. The geographical spread of the best correlations of the Ballingdon data to pre-existing reference data (Tables 3, 5-7) implies, but cannot prove, that the timbers were most probably derived from somewhere local to the area. The earliest material has a particularly high level of internal correlation (Table 2) perhaps implying these timbers were derived from a restricted area, possibly one individual woodland. In contrast the latest material exhibits almost no internal matching and this perhaps indicates a much more diverse range of resources was exploited for these phases of construction.

Discussion

The archaeological work produced evidence of the existence of four distinct bridges prior to the start of the 20th century and this combined with the documentary record provides a detailed history of the crossing. It is certain that a bridge has been on this spot for a very long time and has in part shaped the commercial development of the town. It is unlikely that trade haulage boats would have been able to pass up stream of the bridge, initially because of the restriction of the narrow and low arches of the stone and brick bricks and latterly due to river being congested with the rubble from their demolition. It is noticeable that all of the riverside industry is downstream of the bridge and starting at the Priory Wharf which probably has medieval origins.

The earliest reference to a bridge is to one standing at the start of the 13th century and although none of this structure definitely remained, carved stones compatible with this date were found amongst rubble on the riverbed. Of the two distinct types of stone recovered one was coarse oolitic limestone from Barnack. These quarries produced a durable stone that was widely used in the region during the early medieval period in the construction of churches and religious houses, and these are indicative of an early structure as the quarries had been worked out by *c.*1500AD. The shape of the coping stones followed a medieval decorative style and the ribbed arch indicated by the voussoirs, whilst also occurring in later bridges, was consistent with 12th-13th century. The curve of the voussoirs was greater than those from the later bridge and it is likely that these formed a narrow taller two-centred arch. Similarly dated bridges displaying this early shape of arch and projecting ribs exist in Bury St Edmunds under Southgate Street crossing the River Linnet and the Abbot's bridge on Eastgate Street over the River Lark (Fig 25).

Figure 25. Southgate Street bridge

Abbot's Bridge, Eastgate Street

The brick bridge could be dated to the late 15th/early 16th century by the size and character of the bricks and is likely to be the bridge, described in the documentary accounts, as collapsing in the floods of 1520 and 1594. It was unclear from the documentary material whether the floods had impacted on two separate bridges, as the accounts tell of a bridge being "swept away" during the first flood. This appears to be reporting hyperbole as the archaeological evidence indicates that whilst the bridge did suffer two separate and dramatic failures these were both partial and it was repaired after the first and following the second, pulled down.

Enough of the bridge survives to conjecture on its appearance, which is described in the report, and it probably resembled the similarly dated bridges at Hadleigh and Bakewell (Fig. 26).

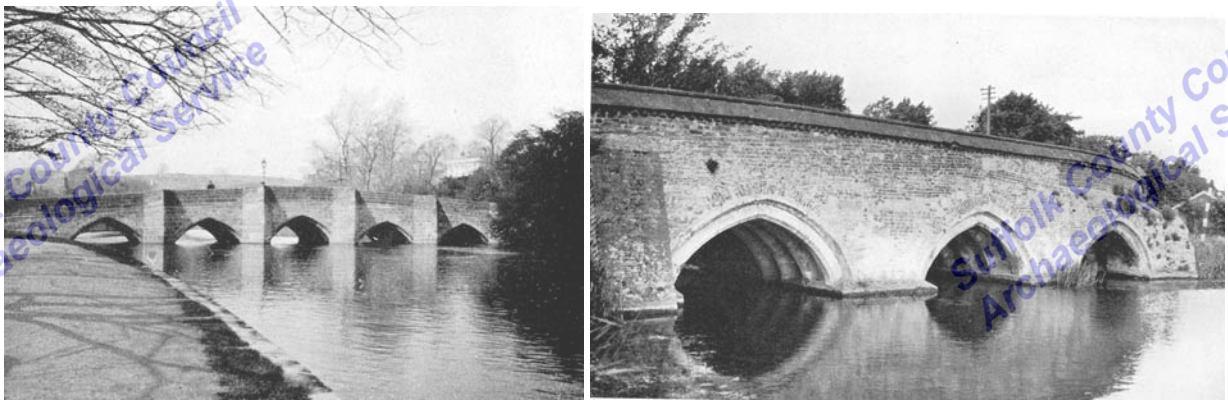


Figure 26. Bakewell bridge over The Wye and Hadleigh bridge over The Stour

The evidence for repair is in the unique construction of the second pier from the Sudbury bank and it is suggested that this is a replacement for one lost in the first flood. It appears to have been cast in a single block, within a timber former, in a hard hydraulic lime mortar tempered with brick and tile rubble - a form of proto-concrete that was capable of setting in water. It was not faced with dressed stone or well-finished and gives the appearance of being a patched job. It does however demonstrate an ingenuity in the bridge builders to repair the structure mid-stream and underwater albeit inelegantly. A large block of brickwork, which had become disengaged from the pier was probably also part of the repair section and shows that the core of this part of the bridge was built around a rudimentary wooden skeleton. This would have acted as an internal reinforcement and served to stitch the repair into the surrounding standing structure. A cut-off timber set within the repaired pier was also possibly part of this sub-frame, tying the bridge above water to the pier below. No internal timber frame existed within the coursed brick piers or arch structure suggesting that this was not a feature of the original design. The repair section proved to be at least as strong as the original structure as it survived the second collapse.

The bridge was broken for a second time during a flood in September 1594 and the effect on the structure put it beyond repair. The archaeological evidence demonstrates that this failure centred on the second pier from the Ballingdon bank, which subsided into a deep hole that had developed on the riverbed. The hole was thought to be the result of eddying water scouring away the riverbed gravels immediately downstream of the pier and the cause of the collapse may have been exacerbated by the bridge's construction. The piers were built off narrow sectioned piles driven into the riverbed (Fig. 27). This created a level base for laying the bricks and keyed the bridge into the ground without the need to excavate foundations under the water. It is possible that little or no brickwork was actually set into the riverbed. The bridge engineers may have used the increasing load of the bridge, as the bricks were laid, to push the piles into place and allowed the bridge to 'find its own feet'. The depth of brickwork below the water level would then be

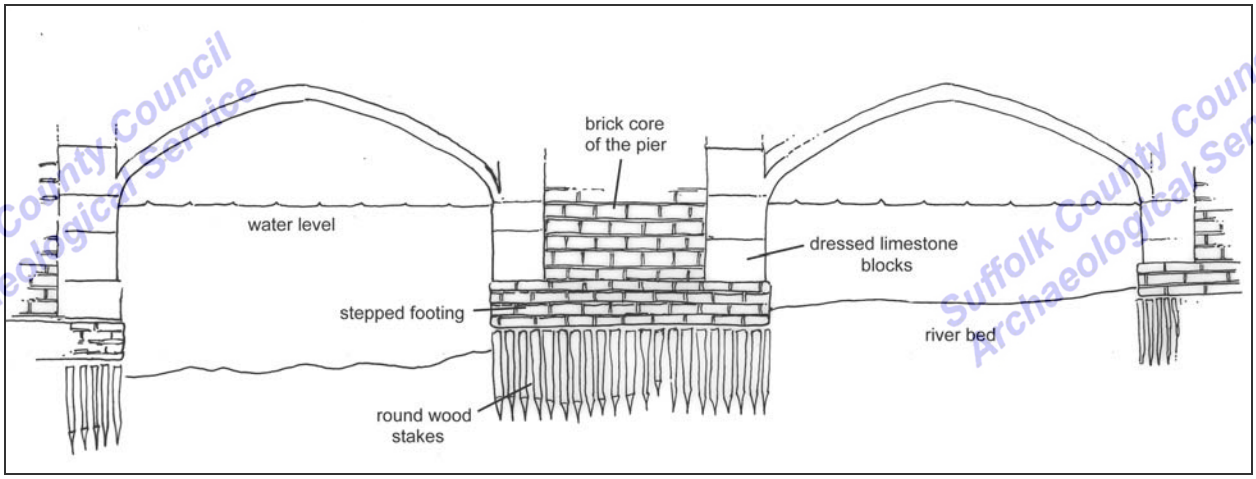


Figure 27. Illustrative section through the bridge pier showing wooden stakes footing

dependent on the bearing capacity of the soil beneath the riverbed and could be different from pier to pier. It is even possible that the bricklayers started the brickwork on the piles above the watermark, giving the mortars time to go off before the weight of the bridge sank the piles home. This system of foundation would allow the passage of water around, and possibly even under the piers, eroding the gravel from around and between the piles resulting in the piles becoming unsecured and eventually lost leaving the pier over a void.

The earliest sequence of dendrochronological dates places the felling of the trees for the first of the wooden bridge to1595; the year following the second collapse of the brick bridge. The piles for the bridge were put in alongside the remains of the piers of the earlier bridge brick. The impossibility of driving the wooden piles through brick rubble may indicate that the piles were inserted while the brick bridge was still partly standing, then collapsed once the piles were in. A controlled demolition would also explain why the only spread of the rubble outside the line of the bridge has fallen upstream against flow of water. Inserting the piles after removing the heads of the arches but leaving the piers would also have the benefit of giving the engineers a platform above the river from which to work. Amongst the finds collected from the river were a wrecking bar, stamped with the emblem of Sudbury Corporation, an axe head and a hammer all probably tools dropped into the water by the workman either demolishing the bridge or constructing its successor.

The wooden bridges stood between 1595 –1805 and 1805-1911. The life of the first bridge was extended to twice that of the later one by a lot of repair work; work that was documented in the court and archaeological records and included the complete replacement of some piles. Work to the later structure seems to be to the upper parts only and although it was reported that new timbers were spliced into the old bridge from *c.*1870 this has left little archaeological trace.

The footprint of the two timber bridges was the same and it seems likely that the images of the later bridge are representative of the appearance of both (Fig. 8 and report cover). The comparison of the pile types shows that although the two bridges are separated by 200 years the woodworking technology is the same and all creative thought has gone into the development of the metal tip to protect the point. The variation in piles between the first bridge (1595 pile type 2) and the second (1805 pile type 1) are examples of inserted timbers to repair the first bridge and it was found that the dates of these correlated very closely with the dates of the court orders for repairs.

Building in wood meant that the structure itself was less massive and this may have been a consideration. The narrow railed balustrade and lack of the deep cutwaters of the wooden bridge allowed the road deck to be 6.8m wide, about 4m wider than the brick one even though the overall footprint was about the same. The court records report that the crossing was a busy one taking the stage-coach traffic from London up through Suffolk and on to Norwich with more than a dozen coaches passing through a day. With carriages unable to pass on the old bridge it is easy to imagine the crossing created a bottle-neck. The slender legs of the bridge also meant that it would offer less resistance to the passage of the river and whilst this would not be a problem when the Stour is its normal benign self, after heavy rain the water quickly rises and the current becomes very strong. With its low, flat arches the brick bridge would have soon become swamped, exerting a lot of pressure on the bridge. The constriction on the river's flow would also have been worsened by the narrowing of the stream through the building up of the river banks. However, although there was now more room beneath the new bridge, the rubble and the truncated piers of the previous one would have meant that it was still impossible to get boats passed it.

The final wooden bridge was replaced by the Hennebique-type concrete bridge; François Hennebique developed and patented a system of building in concrete reinforced with iron rods at the end of the 19th century. This greatly expanded the application of concrete and revolutionised

the construction of large buildings and structures. Early applications of his system include the Liver Building in Liverpool and Brooklands racetrack in Surrey. The Sudbury bridge is entirely concrete built, made up of individual elements, piers, arches, cross members, deck and balustrade but each cast *in situ* on site (I think). This allowed for components to be tailored to the site and irregularities were observed in, for instance the shape and position of the piers. On the large arches, the shuttering marks, the impression of wooden planking, could be seen on the surface of the concrete. During the excavation it was found that holes had been rough cut through the abutment to the Sudbury bank alongside the piers (Fig.25). These were thought to be for setting explosive charges to destroy the bridge in the event of invasion (Andy Bilby pers comms). This was probably done during the First World War inspired by the same enthusiasm and prescience that scuttled the 18 lighter barges in the nearby Ballingdon Grove Cut to prevent them also being used by the Germans.

Figure 28. Explosive holes behind the piers

Date	Documentary record	Archaeological record
1200+	The first documented bridge standing at the start C13th. Tolls collected from the bridge used to endow a Hospital on the Sudbury bank	Dressed stone from Barnack Quarries indicated presence of structure pre 1500
1450-1500		Brick bridge-brick date late15th-early 16th
1521	4th May: Bridge swept away	
		Evidence of repair to pier 0025 of brick bridge
1531	Statute of Bridges Act passed	
1594	September: Flood destroys bridge	Evidence of irreparable subsidence to brick bridge pier 0102
1595		Earliest felling date for Type 2 piles, Spring 1595
1705	Stour Navigation created	
1661	Sudbury Corporation ordered to sell town gates to fund repairs	Felling date for Type 4 timbers winter 1661
1757	Court orders for repairs served	Felling date type 5 piles 1756-92
1761	Court orders for repairs served	Felling date type 5 piles 1756-92
1767	Court orders for repairs served	Felling date type 5 piles 1756-92
1805	May: Essex Magistrates orders that bridge demolished and replaced	
1805	September: construction of new wooden bridge begins	Felling date for type 1 piles late C18th early C19th
1870	New oaks spliced into the existing piles	
1911	Construction of the Hennebique concrete bridge	
1914-18	The Great War	Hole for packing explosives cut into the bridge, Lighter barges scuttled in Ballingdon Grove
2000	Planning permission for replacement of bridge granted	
2002	Demolition of Hennebique' concrete bridge	
2003	Construction of the new bridge	

Table 12. Significant dates in the history of the crossing

Conclusion

The bridge built in 2002-3 is the sixth known to cross at this point and probably unintentionally follows in the tradition of Ballingdon Bridge. As far as it is possible to tell, each has been constructed close to the start of a century and apart from the oft-repaired first wooden bridge, which made it to 200, each has lasted a 100 years. Unfortunately the specification of modern engineering has dictated that the new bridge could not be layered over its predecessors as has occurred in the past and now nearly all evidence of the early bridges has gone. The archaeological work therefore although impractical and limited because of the environment has provided new information and an important record of the site.

David Gill
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References

Baillie, M G L and Pilcher, J R, 1973 A simple crossdating program for tree-ring research, *Tree Ring Bulletin*, **33**, 7-14

Breen, A., 2004, 'Documentary Search' in Duffy, J. *Semer Bridge SMR 024, Report on the archaeological excavation 2003,* SCCAS report no 2004/59

Bridge, M C, 1996 Tree-ring dates from London Guildhall University: List 69, *Vernacular Architect*, **27**, 91-2

Bridge, M C, 1998a *Tree-ring analysis of timbers from the Chicheley Chapel, St Andrew's Church, Wimpole, Cambridgeshire*, Anc Mon Lab Rep, **59/98**

Bridge, M C, 1998b Tree-ring dates for buildings: List 86, *Vernacular Architect*, **29**, 104-5

Bridge, M C, 1999 *Tree-ring analysis of timbers from Hill Hall, Theydon Mount, Essex*, Anc Mon Lab Rep, **55/1999**

Briffa, K R, Wigley, T M L, Jones, P D, Pilcher, J R and Hughes, M K, 1986 *The reconstruction of past circulation patterns over Europe using tree-ring data, final report to the Commission of European Communities, contract no CL.111.UK(H)*, unpubl rep, -

English Heritage, 1998 *Dendrochronology: guidelines on producing and interpreting dendrochronological dates*, English Heritage

Groves, C, Hillam, J and Pelling-Fulford, F 1997 Dendrochronology in *Excavations on Reading Waterfront sites, 1979-1988* (J W Hawkes and P J Fasham), Wessex Archaeological Reports, **5**, 64-70

Haddon-Reece, D, Miles, D and Munby, J, 1990 Tree-ring dates from the Ancient Monuments Laboratory: List 38, *Vernacular Architect*, **21**, 46-50

Haddon-Reece, D, Miles, D and Munby, J T, 1989 Tree-ring dates from the Ancient Monuments Laboratory: List 32, *Vernacular Architect*, **20**, 46-9

Hillam, J and Groves, C, 1996 *Tree-ring analysis of oak timbers from the roof of 3-3A Vicars' Court, Lincoln*, Anc Mon Lab Rep, **21/96**

Hodson, W.W., 1892, Ballingdon Bridge and the Sudbury Stour, *Suffolk Institute of Archaeology and Natural History Vol III part I, 1892*

Howard, R E, Laxton, R R and Litton, C D, 1998 *Tree-ring analysis of timbers from Chicksands Priory, Chicksands, Bedfordshire*, Anc Mon Lab Rep, **30/98**

Howard, R E, Laxton, R R and Litton, C D, forthcoming a *Tree-Ring Analysis of Timbers from The Riding School, Bolsover Castle, Bolsover, Derbyshire*, Centre for Archaeol Rep, -

Howard, R E, Laxton, R R and Litton, C D, forthcoming b *Tree-Ring Analysis of Timbers from The De Grey Mausoleum, St John the Baptist Church, Flitton, Bedfordshire*, Centre for Archaeol Rep, -

Howard, R E, Litton, C D and Laxton, R R, 1999 *Tree-ring analysis of timbers from Bretby Hall, Bretby, Derbyshire*, Anc Mon Lab Rep, **43/99**

Laxton, R R and Litton, C D, 1988 *An East Midlands master tree-ring chronology and its use for dating vernacular buildings*, University of Nottingham, Dept of Classical and Archaeological Studies, Monograph Series, **III**

Laxton, R R, Litton, C D and Howard, R E, 2001 *Dendrochronology of Roof Timbers at Lincoln Cathedral*, English Heritage Research Transactions 7, James and James (Science Publishers) Ltd

Miles, D, Worthington, M J and Roberts, E, 1997 Tree-ring dates for Hampshire 3: List 85, *Vernacular Architect*, **28**, 175-81

Tyers, I, 1990 Tree-ring dates from Museum of London: List 37, *Vernacular Architect*, **21**, 45-6

Tyers, I, 1995a *Report on the Tree-ring Analysis of Buildings in Essex 1994*, MoLAS Dendro Rep, **02/95**

Tyers, I, 1995b *Tree-ring analysis of the bellframe at St Andrews, Sutton-in-the-Isle, Cambs*, Anc Mon Lab Rep, **15/95**

Tyers, I, 1997 *Tree-ring analysis of seven buildings in Essex*, ARCUS Rep, **292**

Tyers, I, 1998a *Dendrochronological analysis of timbers from Cromer Windmill, Hertfordshire*, ARCUS Rep, **394**

Tyers, I, 1998b *Tree-ring analysis of oak timbers from the "Brewhouse" and "Refectory" at Nostell Priory, near Wakefield, West Yorkshire*, Anc Mon Lab Rep, **20/98**

Tyers, I, 1999a *Dendrochronological analysis of timbers from Black Ladies, near Brewood, Staffordshire*, ARCUS Rep, **484**

Tyers, I, 1999b *Dendrochronological Analysis of Timbers from Moyns Park, Birdbrook, Essex*, ARCUS Rep, **471**

Tyers, I, 1999c *Tree-ring analysis of the bell tower of the Church of St Mary, Pembridge, Herefordshire*, Anc Mon Lab Rep, **1/99**

Tyers, I, 2000 *Tree-ring spot-dates and wood identifications from the Royal Arsenal, Woolwich*, ARCUS Rep, **559**

Tyers, I, 2002 *Dendrochronological analysis of timbers from Beeleigh Abbey, near Maldon, Essex*, ARCUS Rep, **574f**

Appendix 1: BCB 012 Ballingdon Bridge context list

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0009		Sudbury N		Dredging from the centre of the river channel north of the bridge	☐		☐	y	
0010		Sudbury N	excavation	Hole for crane base northmost adjacent to the river	☐		☐		
0011	0010	Sudbury N	layer	Black silt/peat within excavation 0010. Black fine textured matter, eight metres deep over riverine clay/gravel. Peat sealed beneath one metre hogging overlying peat layer	☐		☐		
0012		Sudbury N	excavation	Hole for crane base south of 0010 adjacent to the river	☐		☐		
0013		Sudbury N	layer	Black silt/peat. Fine matter. Eight metres deep over clay/gravel and one metre hogging overlying peat layer	☐		☐		
0014		Sudbury N	excavation	Hole for crane base east of 0010	☐		☐		
0015	0016	Sudbury N	wall	Flint mortar bonded wall runs north-south through test hole 0016, build includes occasional medieval brick and roof tile incorporated into build. Tile occurs in dense bands close to the top of the section and at the base of the wall. The bonded section sits on top of a rubble of loose flints and tiles. Wall extends down to the river terrace gravels	☐		☐		
0016	0016	Sudbury N	excavation	Crane footing hole closest to boathouse	☐		☐		
0017	0016	Sudbury N	wall	Brick wall running north-south on river side of 0016. Bricks start just below car park and survive for ten to twelve courses. Full extent unknown, white mortar. Sample brick	☐		☐		
0018	0016	Sudbury N	brick pier	Brick pier appears in the east face of 0016. Cut through horizons of burnt clay and charcoal suggest this structure post dates 0017. Brick old mortar not set. Bonded layer including chalk horizon (possible floor) associated with 0017.	☐		☐		
0019	0016	Sudbury N	layer	Finds collected while dredging the shingles at the bottom of the hole. Finds retrieved by machine - contaminated?	☐		☐		

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0020	0016	Sudbury N	structure	Timber revetment built alongside the 0015 wall filling 0015 eastern edge. The tops of the timbers not apparent until the removal of 0021. Timbers driven through clay and mud/peat and just into river gravels. All timbers appear to be square section and some certainly re-used timber framed building components	☐		☐		
0021		Sudbury N	layer	Horizon of muddy clay. Mid orange/brown, occasional building rubble but fairly clean. Immediately below build debris 0017 and 0018 redeposited as building horizon	☐		☐		
0022		Sudbury N	pile	Round wood piles. These ran NE-SW and defined an area of slightly thick clay at the base of the hole. Almost an edge between clay and river gravels. Wood unworked and included branches and finer brushwood (coarse) elements	☐		☐		
0023	0016	Sudbury N	timber	Square sectioned timbers. Reused from timber building? Within 0016	☐		☐		
0024	0025	Sudbury	wall	Coursed bricks laid in a single row at the south end of 0025. Brick laid N-S. Sample taken. Narrow Tudor bricks	☐		☐		
0025	0025	Sudbury	brick pier	Mortar (?) concrete mortared rubble core cast up against something includes bricks, not coursed, brick fragments and tile. Mortar pale brown with large chalk inclusions. Odd tile stuck to outer face, broken in two by later wooden pile and concrete brick pier. Built over loose rubble within framework of pile (running N-S) and log 0026	☐		☐		
0026	0025	Sudbury	wood	Large unworked log lying horizontally at the south end of pier. Orientated E-W across stream. Sits above small round wood piles and pier is built against it. Doesn't appear to be oak - ? Walnut	☐		☐		
0027		Sudbury	masonry	Brick and limestone blocks removed from central channel of the river immediately adjacent to the north edge of the bridge. The bricks bonded to large limestone blocks	☐		☐		
0028		Sudbury	masonry	Brick sample from rubble. Low down within silt on riverbed. Removed from under the bridge between pile rows. Orange brick different mortar to 0029. Seems the same as bricks within pier 0025	☐		☐		
0029		Sudbury	masonry	Two great blocks of bonded rubble collapsed into the river, bricks part of the same phase of build. The bricks lying on edge - definitely not in situ - see plan for location. Sudbury side north of bridge	☐		☐		
0030		Sudbury	section	Photograph and section showing relationship between flint and mortar pier - 0025 and large horizontal log - 0026	☐		☐		

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0031		Sudbury	masonry	Very large block of bonded brick collapsed into river bed. On bank on Subury side adjacent to pile row 57 - 63. The brickwork was in three blocks, is steeply angled 80 degrees from build angle and above the water line, suggest lying on the river edge at time of collapse - first identified in photo section next to wooden drain. Earlier 1520 brick (orange with sandier mortar) distinct from 0029 brickwork	☐		☐		
0032	0025	Sudbury	pile	Round wood driven into top of large wooden pile - (A) - soft wood branches	☐		☐		
0033	0025	Sudbury	pile	(B). Round wood soft wood part of substructure of brick pier. Adjacent to 0032	☐		☐		
0034	0025	Sudbury	pile	(C). Round wood soft wood part of substructure of brick pier. Adjacent to 0032	☐		☐		
0035	0025	Sudbury	pile	(D). Round wood soft wood part of substructure of brick pier. Adjacent to 0032	☐		☐		
0036	0025	Sudbury	pile	(E). Square section piles in front of round woods. Same phase as 0038 and 0039 and sq. section driven into pile	☐		☐		
0037	0025	Sudbury	pile	(F). Square section timber on same alignment as 0036, 0038 and 0039	☐		☐		
0038	0025	Sudbury	pile	(G). Square section timber. Support main part of north end of 0025	☐		☐		
0039	0025	Sudbury	pile	(H). Square section timber. Support main part of north end of 0025	☐		☐		
0040	0025	Sudbury	pile	(J). Rough square section timber. Bark still on one face. Spliced into large square post 0041. On same alignment as 0036, 0037,0038 and 0039	☐		☐		
0041	0025	Sudbury	pile	Large square section pile split by 0040. 0024 built off this pile very fundamental timber in the substructure of pile.	☐		☐		
0042		Sudbury	abuttment	Abuttment/ramp up to the bridge from Sudbury road side. Bricks from vertical retaining wall on south edge. This holds up infill of pale orange/brown clay. Wall up to pavement level	☐		☐		
0043		Sudbury	layer	Layer within section 0060. Brown silt. Post Victorian debris	☐		☐		
0044		Sudbury	layer	Layer within section 0060. Brick and mortar rubble	☐		☐		

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0045		Sudbury	layer	Layer within section 0060. Orange iron stain sand over grey silt river mud	☐		☐		
0046		Sudbury	layer	Layer within section 0060. Five alternating bands of dark river peats and banded gravels	☐		☐		
0047		Sudbury	layer	Layer within section 0060. Gravel. Orange fine coarse river gravel small brick fragments	☐		☐		
0048		Sudbury	layer	Layer within section 0060. Clay silt river mud. Black silt	☐		☐		
0049		Sudbury	layer	Layer within section 0060. Tiles	☐		☐		
0050		Sudbury	layer	Layer within section 0060. Brick and rubble. Orange 1520 brick	☐		☐		
0051		Sudbury	layer	Layer within section 0060. Black river silts. Dark silty layer with occupational debris extended along bank edge in front of crane base 0012. Same layer as 0013 within crane hole? Vertical rough wood piles 0.5m west of edge of crane base	☐		☐		
0052		Sudbury	masonry	Massive bonded block of the brick bridge. Limestone facing stones attached showing suggest close to the base of the throw of the arch. 0052 lifted from front of north face of Sudbury side of pier between rows of wooden piles. 0052 same build as 0029 sections. 0052 was laying face down on stream bed orientated as sketch. Reverse of 0052 drawn on bed - exposed core of the bridge.The core of the bridge although the bricks laid flat they are not laid in proper courses and fragment are included in a hap hazard way. This is particularily so behind the limestone blocks, where bricks are laid at every angle including on edge. The core almost is a brick rubble like the core of Med. flint walls. There is a vertical hollow the impression of a very large post which the section has been formed around. Has this section of brick cleared along the mid-line of the post and dropped into the water. Was this part built against shuttering supported on the post. The drawn elevation looked to be intact. There were two distinct mortar mixes the change occuring at the devision of a limestone block. The lower mortar is browner and more sandy. The upper a very hard (harder than the bricks) white mortar with distinct ?quartz inclusions. This is the same as the mortar and bricks which make up 0029. The underside of the arch and the face were treated with limstone, this was a browner and sandier limestone than previously seen. This was not bonded to the brick work with the same mortar as the later bricks but superficially matched that of the lower build	☐		☐		

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0053		Sudbury	brick pier	Cut water and bridge pier lying at 70 degrees to vertical on western side. Part of 0029. Brick above and below adhered to limestone. Limestone 2 blocks deep	☐		☐		
0054		Sudbury	brick pier	Arch base springing from the Sudbury side. Low arch which starts below the vertical of 0025	☐		☐		
0055		Sudbury	masonry	Large block of brick work photographed on the bank with their staff. Section of brickwork photographed by Jo whilst being broken up. Sample bricks taken. Limestone facing attached. Pier and cut water	☐		☐		
0056		Sudbury	layer	Layer of brown mud with tile. Brown glazed chamber pot from this layer	☐		☐		
0057		Sudbury	drain pipe	Wooden coopered drain running into the river south side of bridge. Made up of narrow flat edged staves made out of soft wood and bound with an iron strap. Wooden pipe extended off a brick storm water drain with the road. Pipe existed between piles and suggests it postdates the timber bridge. There was no cut for the pipe and the layers on the bank probably accumulated over the pipe post-construction	☐		☐		
0058		Sudbury	finds	Bellamine Jug from the same horizon as the base of the redeposited layer on the surface of the river silt. Old river bed. Below timber drain. From base of layer 0051	☐		☐		
0059		Sudbury	section	Section running N-S along the Sudbury bank. Includes cross section of the bridge 0054	☐		☐		
0060		Sudbury	section	Section drawn in exercise book. Major section running E-W north facing through build up of debris over 0054 from Sudbury bank	☐		☐		
0061		Sudbury	timber pile	Also Diver Number 61. Grouped with 0062 and 0063. 28x28cm section. Square section sawn pile. Chisel point. Point 0.71m long. Length of timber 3.07m. point protected with flat plate on one face only. Same as 518 Plan 14 and 1	☑	5	☑		
0062		Sudbury	timber pile	Also Diver Number 62. Grouped with 0061 and 0063. 30x30cm section. Square section sawn pile. Pencil point. Point 1.20m long. Length of timber 3.36m. Type 1A shoe. Plan 14 and 1	☑	1	☑		
0063		Sudbury	timber pile	Also Diver Number 63. Grouped with 0061 and 0062. 43cm diameter. Rough round wood body. Point is flat face sawn pencil point. Point 1.25m long. Length of timber 3.10m. Type 2 shoe. Plan 14 and 1	☑	2	☑		
0064				Not used	☐		☐		

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0065		Sudbury		Modern? Post set in concrete. Shallow within top disturbed layers. Not sampled	☐		☐		
0066		Sudbury	finds	Collected by the contracters. General dredging Sudbury side. North of bridge. Dark grey mud	☐		☐		
0101		Ballingdon	brick pier	Pier closest to Ballingdon Bank. Brick pier in situ. See sketch plan in exercise book.	☐		☐		
0102		Ballingdon	brick pier	Pier subsided into scoured hole behind/south of pier. Brickwork and masonry at about 20 degrees from horizontal	☐		☐		
0103		Ballingdon	timber pile	No other Numbers. Planned on Plan 2. No other records	☐		☐		
0104		Ballingdon	timber pile	No other Numbers. Planned on Plan 2. No other records	☐	?	☑		
0105		Ballingdon	timber pile	No other Numbers. Planned on Plan 2. No other records	☐	?	☑		
0106		Ballingdon	timber pile	No other Numbers. Planned on Plan 2. No other records	☐	?	☑		
0107		Ballingdon	timber pile	No other Numbers. Planned on Plan 2. No other records	☐	?	☑		
0108		Ballingdon	timber pile	No other Numbers. Planned on Plan 2. No other records	☐		☐		
0109		Ballingdon	timber pile	No other Numbers. Planned on Plan 2. No other records	☐	?	☑		
0110		Ballingdon	timber pile	No other numbers. 38x30cm section. Square section sawn pile. Pencil point. Point 1.28m long. Length of timber 5.04m. Plan 10 and 2 (but not necessarily same as 0110 on plan 2)	☐	3	☐		
0111		Ballingdon	timber pile	No other numbers. 28x36cm section. Rough round wood body with some flattening. Pencil point. Point c.0.90m long though damaged. Length of timber 3.84m. No shoe (Type 4). Plan 10 and 2 (but not necessarily same as 0110 on plan 2)	☐	4	☐		
0112		Ballingdon	timber pile	No other numbers. 30x28cm section. Rough round wood body. Pencil point roughly worked. Point c.0.60m long. Length of timber 3.59m. No shoe (Type 4). Plan 10 and 2 (but not necessarily same as 0110 on plan 2)	☐	4	☐		

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0113		Ballingdon	timber pile	No other numbers. 33x25cm section. Roughly flattened pile. Point badly damaged exists for a length of 0.98m. Length of timber 2.58m. No shoe visible due to damage. Plan 10 and 2 (but not necessarily same as 0110 on plan 2)	☐	4	☐		
0114		Ballingdon	timber pile	No other numbers. 30x30cm section. Square section sawn pile. Pencil point. Point 0.69m long. Length of timber 3.62m. Type 1 shoe. Plan 10 and 2 (but not necessarily same as 0110 on plan 2)	☐	1	☐		
0115		Ballingdon	timber pile	No other numbers. 30x30cm section. Square section sawn pile. Pencil point. Point 0.69m long. Length of timber 3.43m. Type 1 shoe. Plan 10 and 2	☐	1	☑		
0116		Ballingdon	timber pile	No other numbers. 32x32cm section. Square section sawn pile. Pencil point. Point 0.59m long. Length of timber 4.09m. Type 1 shoe. Plan 8 and 2	☐	1	☑		
0117	0101	Ballingdon	bridge pier	Pier footings for 0101. See plan sheet 2	☐		☐		
0118		Ballingdon	layer	Grey mud/silt with round wood sticks. Occasional finds. Located around pier 0101 and footings 0117	☐		☐		
0119		Ballingdon		?	☐		☐		
0120		Ballingdon	timber pile	No other numbers. 34x34cm section. Square section sawn pile. Pencil point. Point 0.96m long. Length of timber 4.43m. No shoe (Type 4). Plan 9 and 2	☑	2	☑		
0121		Ballingdon	timber pile	No other numbers. 31x31cm section. Square section sawn pile. Pencil point. Point 0.74m long. Length of timber 4.19m. Type 1A shoe. Plan 9 and 2	☑	1	☑		
0122		Ballingdon	timber pile	No other numbers. 36x34cm section. Badly damaged timber. Point not visible. Length of timber 2.81m. No shoe visible due to damage. Plan 9 and 2	☑	4	☑		
0123		Ballingdon	timber pile	No other numbers. 36x34cm section. Roughly squared pile. Damaged pencil point. Point 0.82m long. Length of timber 4.23m. No shoe visible due to damaged point. Plan 9 and 2	☑	2	☑		
0124		Ballingdon	timber pile	No other numbers. Planned on plan 2. See 0132	☐	?	☐		

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0125		Ballingdon	timber pile	No other numbers. 43cm section. Roughly squared pile. Pencil point. Point 1.33m long. Length of timber 3.57m. No shoe (Type 4). Plan 9 and 2	☐	4	☑		
0126	0101	Ballingdon	pile	Small round wood piles onto which pier 0101 is constructed. Sample taken three pieces these were not seen in situ but appeared in a circular impression closely spaced on the the base of the pier. The samples were collected whilst dreging the river bed.	☐		☐		
0127		Ballingdon	layer	Dredging Ballingdon side south of timber piles south of brick piers. China/glass totally mixed context	☐		☐		
0128		Ballingdon	masonry	Bridge fabric. Dredged just west of centre line of pier interval level with house angle. Blocks of limestone mainly large square blocks of the base of the piers incldes curved pieces - drawn and copping stones. The stone work difficult to lift and many/most coming up with pale brown coarse/fine stoney mortar attached. This material is generally soluble in moving water so suggest that this is from until now closed joints. Water also running very cloudy with mortar suggests that there is an horizon of bonded collapsed bridge being broken up. Blocks coming from watched areas very dense on bed and close to pier. Also very deep, more than 1.5m from base of 0101. Suggest deep scouring behind the bridge	☐		☐		
0129		Ballingdon	masonry	Herring bone brick. Some bricks as 0101 and 0102 lying adjacent to the south west corner of 0102 cut water	☐		☐		
0130		Ballingdon	masory	Dredging of very narrow tiles/bricks from west end of 0128. Previously unseen type of brick. Brick built into gentle curving arch. Dredged same area but above bonded flint work	☐		☐		
0131		Ballingdon	layer	Chalky proto- mortar seen in basal dredgings south of tip of 0102 cut water. Seen adhered to clean (?) riverine gravels. Samples taken	☐		☐		
0501		Sudbury	timber pile	No other numbers. Grouped with 0510 and 0511. 30x35cm section. Square section sawn pile. Pencil point. Point 1.25m long. Length of timber 4.55m. No shoe (Type 4). Plan 11 and 1	☑	2	☑		
0502		Sudbury	timber pile	No other numbers. Grouped with 0513 and 0514. 33cm diameter. Rough round wood body. Point is rough cut not sawn. Point 0.65m long. Length of timber 1.98m. No shoe (Type 4). Plan 13 and 1	☑	4	☑		

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0503		Sudbury	timber pile	No other numbers. Grouped with 0504. 32x35cm section. Rough round wood body with two flat sawn surfaces. Quarter log section. Point 0.78m long. Length of timber 2.37m. Type 2 shoe. Plan 12 and 1	☑	3	☑		
0504		Sudbury	timber pile	No other numbers. Grouped with 0503. Planned on plan 1 but no other records	☐		☑		
0505		Sudbury	timber pile	No other numbers. Grouped with 0506 and 0515. 25x26cm section. Square section sawn pile. Point damaged. Length of timber 2.62m. No shoe visible due to damaged point. Plan 12 and 1	☑	2	☑		
0506		Sudbury	timber pile	No other numbers. Grouped with 0505 and 0515. Planned on plan 1 but no other records.	☐	?	☑		
0507		Sudbury	timber pile	No other numbers. Planned on plan 1 but no other records.	☐	?	☑		
0508		Sudbury		No records/Not used	☐		☐		
0509		Sudbury		No records/Not used	☐		☐		
0510		Sudbury	timber pile	No other numbers. Grouped with 0501 and 0511. 26x29cm section. Square section sawn pile. Chisel point. Point 0.41m long. Length of timber 3.23m. Shoe not visible but a series of nail holes suggest there used to be one but type unknown. Plan 11 and 1	☐	6	☑		
0132		Ballingdon	timber pile	Also 0124E and probably same as 0124. 31x29cm section. Squared section pile. Point 0.46m long. Length of timber 3.08m. No shoe (Type 4). Plan 9 but no location plan.	☐	2	☐		
0133		Ballingdon	timber pile	Also 0113A. 28x30cm section. Squared section pile. Chisel point. Point 0.6m long. Length of timber 4.13m. Point protected by duck bill type shoe (unique) Type 2 shoe. Plan 9 and 2 (located as 0113)	☐	6	☑		
0134		Ballingdon	timber pile	Also 0114A. 31cm section. Squared section pile. Pencil point. Point 0.49m long. Length of timber 3.42m. Type 1A shoe. Plan 9 and 2 (located as 0114)	☐	1	☑		
0135		Ballingdon	timber pile	Also Diver Number 15. 30cm section. Squared section pile. Pencil point. Point 0.71m long. Only point drawn. Type 1A shoe. Plan 9 and 2 (located as 0112)	☑	1	☑		
0136		Ballingdon	timber pile	Also Diver Number 12. 29x29cm section. Squared section pile. Pencil point. Point 0.75m long. Length of timber 3.78m. Type 1A shoe. Plan 8	☐	1	☐		

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0137		Ballingdon	timber pile	Also Diver Number 14. 29x32cm section. Squared section pile. Pencil point. Point 0.92m long. Length of timber 4.08m. Type 1A shoe. Plan 8 and 2 (located as 0108)	☐	1	☑		
0511		Sudbury	timber pile	Also Diver Number 55. Grouped with 0501 and 0510. 30x31cm section. Roughly squared section pile. Pencil point. Point 1.30m long. Length of timber 3.09m. Type 2 shoe. Plan 11 and 1	☑	3	☑		
0512		Sudbury	timber pile	Also Diver Number 54. 30x28cm section. Square section sawn pile. Pencil point. Point 0.71m long. Length of timber 3.12m. Type 1A shoe. Plan 11 and 1	☐	1	☑		
0513		Sudbury	timber pile	Also Diver Number 53. Grouped with 0502 and 0514. 33cm diameter. Rough round wood body with at least one side roughly flattened. Some bark still on body of pile. Point damaged. Length of timber 2.48m. No shoe visible due to damaged point. Plan 12 and 1	☑	4	☑		
0514		Sudbury	timber pile	Also Diver Number 52. Grouped with 0502 and 0513. 30cm section. Square section sawn pile. Pencil point. Point 0.86m long. Length of timber 2.70m. Type 1A shoe. Plan 13 and 1	☐	1	☑		
0515		Sudbury	timber pile	Also Diver Number 57. Grouped with 0505 and 0506. 35cm diameter. Rough round wood body with two roughly flattened sides. Some bark still attached. Point 0.80m long. Length of timber 2.85m. Type 2 shoe. Plan 13 and 1	☑	3	☑		
0516		Sudbury	timber pile	Also Number [1000]. 31x30cm section. Square section sawn pile. Point 0.45m long. Length of timber 2.72m. No shoe (Type 4). Plan 12 but no location plan	☑	2	☐		
0517		Sudbury	timber pile	Also Number [1001]. 29x29cm section. Square section sawn pile except for one side which is roughly squared. Pencil point. Point 0.88m long. Length of timber 3.42m. Type 1A. Plan 13 but no location plan	☑	1	☐		
0518		Sudbury	timber pile	No other numbers. 24cm section. Square section sawn pile. Pencil point(?). Point 0.58m long. Length of timber 3.08m. Point protected by flat plate on one face only. Same as 0061. Plan 13 but no location plan	☐	5	☐		
0519		Sudbury	timber pile	No other numbers. 31cm section. Square section sawn pile. Pencil point. Point 0.57m long. Length of timber 3.10m. Type 1A shoe. Plan 12 but no location plan	☐	1	☐		
0600			timber pile	Square section sawn pile 25cmsq, 4.03m long pencil point, point 55cm long, no shoe. Ballingdon side	☑	2	☐		

opno	component	location	identifier	description	sample/dendro?	point type	located?	finds	date
0601			timber pile	Square section sawn pile , 4.18m long pencil point, point 1.44m long, no shoe. Ballingdon side	☑	2	☐		
0602			timber pile	Square section sawn pile , 29cm sq, 3.45 m long pencil point, point 57cm long, metal driving shoe type 1A. Ballingdon side	☑	1	☐		
0603			timber pile	Square section sawn pile , 3.32 m long pencil point, point 70cm long, metal driving shoe type 1A. Ballingdon side	☑	1	☐		

Appendix 2: finds quantities (BCB 012)

OP No	Pottery		CBM		Mortar		Glass		Clay pipe		Animal bone		Iron		Miscellaneous	Spotdate
	No	Wt/g	No	Wt/g	No	Wt/g	No	Wt/g	No	Wt/g	No	Wt/g	No	Wt/g		
0001			1	0.821									3	4.165		U/S
0009	1	0.05	2	4.332							8	2.99	3	2.449		18th c.
0011	7	1.207	18	7.121					2	0.031	24	4.1			1 frag leather shoe	M.17th+
0015			1	14.78												L.15th-E.16
0017			1	1.691												L.17th-E.18
0018			1	1.851												15th c.?
0019	1	0.049	3	0.355												15th-16th c.
0020													1	0.174		PMed?
0024			1	2.56												E.16th c.
0027			3	4.286												E.16th c.
0028			5	13.98												E.16th c.
0029			6	7.19												E.16th c.
0031			2	6.02												15th c.
0042			1	3.145												19th c.
0044	3	0.464	5	0.157									1	0.008		16th-17th c.
0047	1	0.302	2	3.235							1	0.65				19th c.
0048	13	1.144														19th-20th c.
0049			4	0.857												LMed+
0051	5	1.176														18th c.
0055			2	5.24												L.15th-E.16
0056	7	1.024					1	0.002					1	0.214		E.20th c.
0058	4	1.99														M.17th+
0066	3	0.843							7	0.099			1	0.576		19th-E.20th
0117			8	9.3												16th c.

OP No	Pottery		CBM		Mortar		Glass		Clay pipe		Animal bone		Iron		Miscellaneous	Spotdate
	No	Wt/g	No	Wt/g	No	Wt/g	No	Wt/g	No	Wt/g	No	Wt/g	No	Wt/g		
0118			3	2.14												E.16th c.
0127	8	4.108	2	1.914							3	0.411	1	0.069		19th c.
0130			3	4.918												L.15th c.
0131					1	0.223										Med?
Total	**53**	**12.36**	**74**	**95.89**	**1**	**0.223**	**1**	**0.002**	**9**	**0.13**	**36**	**8.151**	**11**	**7.655**		

Appendix 3: pottery (BCB 012)

Context	Fabric	No.	Wt/g	Ab.	Notes	Spotdate
0009	GRE	1	50		Essex rim type A1 cf Chelmsford D5A, grog and sand temp fabric.	16th c.?
0011	GRE	1	218		base, BG int.	
	GRE	1	33		body, OG int.	
	IGBW	1	23		TK neck, ?burnt.	
	IGBW	1	375		base of large globular vessel, ?jug.	
	GRE	1	372		wide-mouthed jug, ATS at rim, wide strap handle, BG.	16-17
	GSW5	2	186		TK base and rim, prob 1 vessel, purple background, applied blossoms and engraved stems.	M.17+
0019	LMTE	1	49		footring base of jug, splashes CG, fine fabric.	15-16
0044	GRE	3	464		flat base and body sherds, OBG int/ext, slightly rounded body.	16-17
0047	GSW4	1	302		plain jug rim/neck/handle.	
0048	PORC	1	46		small plain egg cup with pedestal base.	20?
	GRE	2	109		LSV body sherds, thick, OBG int/ext.	
	REFW	2	55		blue spongeware jug, carinated.	19
	REFW	2	64		green TP cup, footring base, TP shows castle and boats.	
	REFW	1	42		moulded rim with letters of alphabet (P-U) and black TP design in centre, small plate.	
	REFW	1	48		small bowl, overglaze lustre/enamel.	
	REFW	1	20		spongeware, small jug?	
	GRE	1	682		chamber pot, OBG int/ext, small strap handle, simple upright rim.	17
	REFW	1	24		blue TP river scene, globular vessel.	
	REFW	1	54		small jar, unmarked, crazed and stained.	
0051	GRE	1	104		chamber pot rim, BG int/ext, beaded rim.	17-18?
	GRE	1	780		fish/dripping dish, OG int, ?oval dish.	
	GRE	1	123		?costrel neck, thickened applied thumbed area on neck, OG.	
	ESWS	1	94		TK body, partly BG upper half.	
	STAF	1	75		PMF rim, small. 1 band of brown slip close to the rim, YG.	
0056	YELW	1	262		wide base, stamped "12" on underside.	19-20
	GRE	6	762		chamber pot, FTEV rim, strap handle, OBG int/ext.	17-18
0058	GSW4	4	1990		near-complete Bellarmine, fine face with small 6-petal medallion.	M.17+
0066	REFW	1	329		straight-sided tall narrow jar "PURE /CLOTTED CREAM /FROM /DEVONSHIRE /DAILY"	
	REFW	1	387		TK blue sponged body, oval medallion "M……N & SON /IMPERIAL /SUDBURY" Pint.	
	REFW	1	128		coffee cup, straight-sided, brown TP showing death of cock robin with part of verse, and bull.	
0127	ESWN	1	533		footring base of punchbowl or similar.	19
	GRE	1	2400		DBG int/ext, large globular vessel, flat base, 1 strap handle.	18-19?
	GRE	2	218		lid knobs.	16-18
	GRE	1	290		thin greenish glaze int.	16-18
	GRE	1	194		jug handle/rim, globular body, UPPL rim.	17-18
	GSW4	2	473		Bellarmine bottle neck with face, and body from globular tankard.	17
Total		**53**	**12358**			

Appendix 4: Ceramic Building Material (BCB 012)

Ctxt	Fabr	Form	No	Wt/g	Width	Length	Thick	Mortar	Ab	Peg shape	Notes	Date
0001	ch	PAN	1	821				y				17th c.+
0009	wch	FT	1	1272	173	175	35				worn surface	18th c.+
	gm	MB	1	3060	252	112	113+				plinth or jamb	16th c.+
0011	fsm	RT	3	282						1 X S	1 burnt	LMed?
	ms	RT	3	297						1 X S	1 sooted underneath	PMed?
	cs	RT	6	591							1 burnt?	Med/LMed?
	fs	HIP	1	288								PMed
	gm	FT	1	2975	203	200	43	y				15th-16th c.?
	gm	LB	1	997		104	51				heavily burnt	15th-16th c.
	gm	LB	1	357			51				heavily burnt	15th-16th c.
	fe	LB	1	542		117	48				partly burnt	16th c.
	fe	LB	1	792		105	51				?worn edge/surface	15th-16th c.
0015	mixe	LB	1	14780	208	115	41-45	y			7 pieces LB and 1 RT cemented together	L.15th-E.16th c.
0017	fsg	LB	1	1691		110	63	y				L.17th-E.18th c.
0018	fsg	LB	1	1851		103	49	y			cement-like mortar, >190mm long	15th c.?
0019	ms	RT	2	296								PMed?
	cs	RT	1	59						1 X S		Med?
0024	gm	LB	1	2560	226	112	50	y			cement-like mortar	E.16th c.
0027	fe	LB	1	1264		116	50	y				E.16th c.
	fe	LB	1	1206		116	53	y				E.16th c.
	fe	LB	1	1816		116	54	y				E.16th c.
0028	fe	LB	1	2890	231	112	54	y				E.16th c.
	fe	LB	4	11090	240	110	49	y			4 brick pieces mortared together, 1 complete, 1 slightly different?	E.16th c.
0029	fsg	LB	6	7190		115	50	y			6 frags mortared together	E.16th c.
0031	ffe	LB	1	2870	230	110	54	y				15th c.
	ffe	LB	1	3150	240	115	51	y				15th c.
0042	fsm	LB	1	3145	237	115	65	y			frog with stamp ALLEN BALLINGDON	19th c.
0044	ms	RT	5	157						1 X S		PMed
0047	wg	LB	1	2930	236	113	68				frog with stamp ALLEN BALLINGDON	19th c.

Ctxt	Fabr	Form	No	Wt/g	Width	Length	Thick	Mortar	Ab	Peg shape	Notes	Date
0047	fsm	RT	1	305								
0049	fs	RT	2	435						1 X S, 1 X		LMed+
	fe	RT	1	372		160						PMed?
	csg	RT	1	50								Med?
0055	ffe	LB	1	2460	236	112	48	y				L.15th-E.16th c.
	ffe	LB	1	2780	234	113	50	y				L.15th-E.16th c.
0117	ffe	LB	3	6410	237	115	52	y			3 frags mortared together, 1 complete	E.16th c.
	ffe	LB	1	2740	235	115	56	y				E.16th c.
	cs	RT	3	312						1 X R		Med?
	ffe	LB	1	108				y				
0118	gm	LB	3	2140		107	58	y			3 frags mortared together, slag on top, part of furnace?	E.16th c.
0127	ffe	LB	1	1745	223	110	36	y				L.15th c.
	calc	CH	1	169							chimney fitting/louvre? heavily sooted	19th c.+
0130	ffe	LB	1	1555		110	37	y				L.15th c.
	ffe	LB	1	1665	230	112	35					L.15th c.
	ffe	LB	1	1698	220	110	37	y				L.15th c.
Grand Total			**74**	**96163**								