BRIDGING THE LEA: EXCAVATIONS AT CROWN WHARF, DACE ROAD, TOWER HAMLETS

Angus Stephenson

With a contribution by Damian Goodburn

SUMMARY

An excavation in advance of development at Crown Wharf, Dace Road, Tower Hamlets, revealed a sequence of archaeological deposits within a former channel of the River Lea. A peat layer at the base of the sequence has been radio-carbon dated to the Mesolithic period, between 8460 and 7340 cal BC.

Above this lay naturally formed deposits of alluvial clay. Approximately 40 large oak piles driven into these layers were recorded. Many of these piles showed boxed heart conversion and were trimmed to points with axes in typical Roman fashion and four have been radiocarbon-dated to the early Roman period. The timbers continued beyond the edges of the excavated area to the north and east, but were recorded over distances of c.7m in both directions. They appear to form roughly parallel lines across and within a structure running from SSW to NNE, and some are interpreted as being part of the structure of an early Roman bridge.

In the later Roman period the base of the stream channel appears to have been consolidated with gravel and sand dumped over the timbers. Finds from these layers contained 3rd- and 4th-century Roman pottery and ceramic building material. This gravel dumping may have formed a causeway through the marshy ground in the later Roman period at a time when river levels were known to have fallen. Two large post-pits, cut through these gravels 5.60m apart, may have been part of a gateway structure built to control local access. The final phase of Roman activity identified on the site comprised a group of smaller stakes across the line of the two large posts; this was possibly a fence-line closing off access to the area from this direction.

After the Romano-British period, a phase of natural alluvial deposition appears to have occurred before post-medieval industrial activity began on the site. At least one, and possibly two, timber-lined tanks and several timber conduits were exposed across the site. One of the tanks had reused sections of a London 'Western-type' barge in its lining. The tanks are thought to date from the 18th century and were overlain by brick footings, conduits and made ground.

INTRODUCTION

The excavation at Crown Wharf Ironworks, Dace Road, in the London Borough of Tower Hamlets, London EC3, was conducted by the AOC Archaeology Group (site code: DAC03), for CPM Environmental Planning and Design, acting for Pollard Thomas and Edwards, architects, on behalf of London Green Developments Ltd, the developing client.

The site lies on the west side of the River Lea as canalised by the River Lea Navigation (Hackney) Cut in the late 18th century. It is bounded on the east by the River Lea, on the north by the Swan Wharf warehouses and Dace Road, on the west by the warehouses of Percy Dalton's Company, and on the south by the raised 19th-century Northern Outfall Sewer (Fig 1). The site is located within an Archaeological Priority Area as defined in the London Borough of Tower Hamlets Unitary Development Plan.

In order to comply with planning condit-

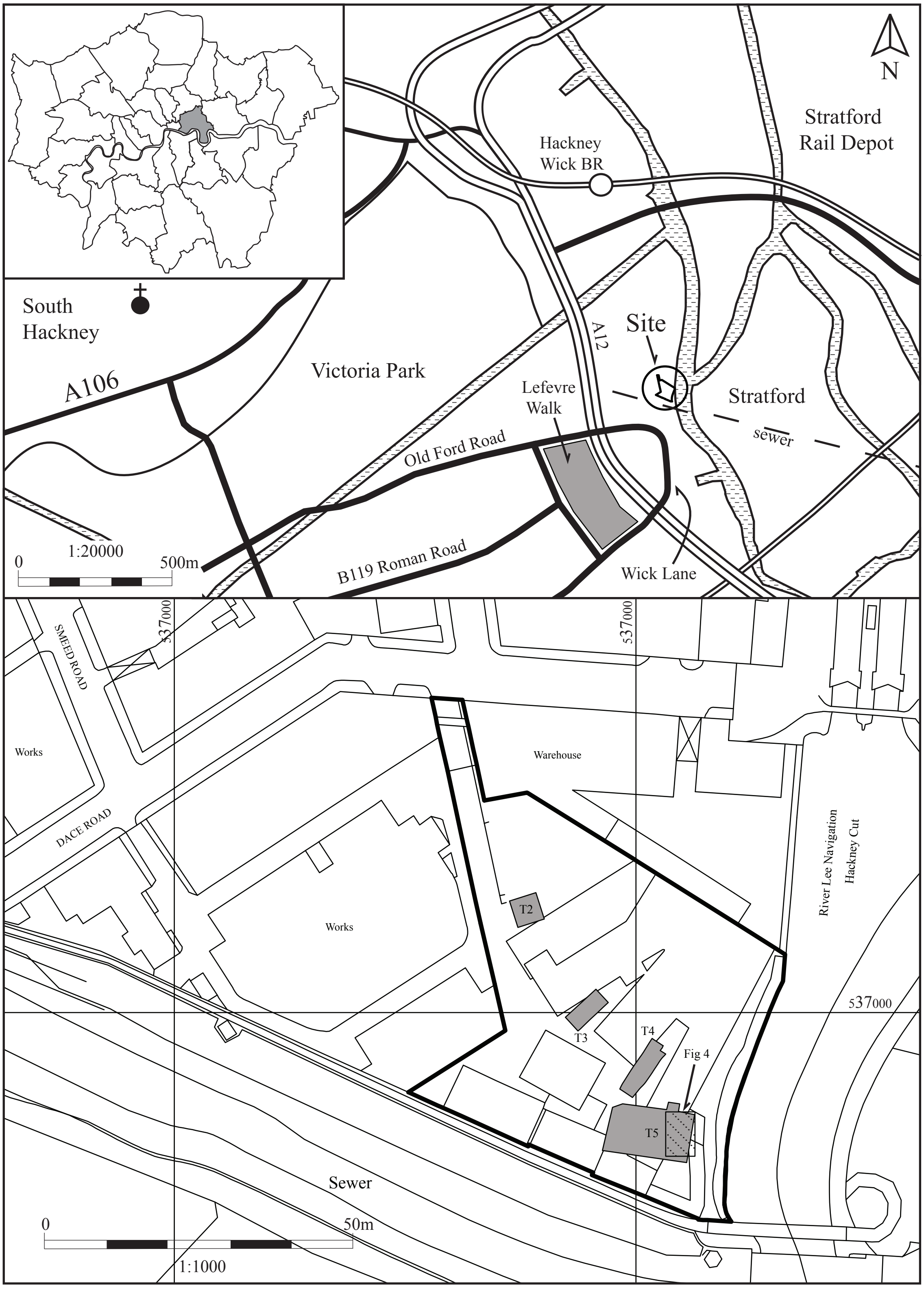

Fig 1. Site location

ions, five evaluation trenches, 2m wide and 10m long, were to be dug in locations which avoided previous investigation trenches and boreholes, and which would be affected by the foundations of the proposed development. These trenches were excavated in reverse numerical order to facilitate machine access and after inspection of the first three trenches opened, it was agreed that Trenches 1 and 2 should be replaced with a single trench 4m square at the base (Trench 2). The numbering on the trench location plan (Fig 1) is therefore in accordance with the site records. During the excavation of Trench 5 by mechanical excavator, substantial timbers were encountered and the strategy was revised so that an extended trench was dug as shown in Fig 1.

GEOLOGICAL CONTEXT

Crown Wharf Ironworks is on the floodplain of the River Lea, close to the western edge of the alluvial tract comprising deposits of sand, silt and clay (Branch *et al* 2005, 1). The floodplain here is *c*.1.6km in width and is flanked on both sides by discontinuous remnants of a low terrace, now regarded as equivalent to the Kempton Park Terrace of the River Thames. The bedrock beneath the valley floor is the Lower Tertiary London Clay or, in places, sediments of the Lower Tertiary Lambeth Group (Woolwich and Reading Beds).

ARCHAEOLOGICAL BACKGROUND

There has been little evidence found of land-use in the immediate vicinity of the site before the Roman period. A Palaeolithic axe and an unretouched flint flake were recovered from Victoria Park (GLSMR 080060) and a Mesolithic tranchet axe was found nearby (GLSMR 080080), but these were apparently isolated finds. The Neolithic and Bronze Age are also sparsely represented, with no evidence of land being exploited to any great extent in this area, although evidence of prehistoric occupation of Bronze Age date was found during the Lefevre Walk excavations of the 1990s (Brown *et al* forthcoming).

The central area of London is not believed to have held any major political importance during the Iron Age, either in the earlier part of it or in the run-up to the Roman invasion. It has been conjectured, however, that the major Roman road from Silchester to Colchester (which ran along Old Street and through Bethnal Green, close to the north side of modern Roman Road) may have had Iron Age antecedents (Black 1977), and there is limited evidence for Iron Age occupation of the general area.

The evidence for activity during the Roman period, however, is incontestable and extensive. The first signs that there may have been Roman occupation in the area were supplied by chance finds, usually in the form of coins and burials, and more recently through controlled excavation. The first of these were concentrated in an area to the south of the present site.

It has long been suggested that there might be substantial remains of the main Roman road between London and Colchester to be found (*eg* RCHM 1928) but actual physical evidence was only found in 1969 (Sheldon 1971), after which it was confirmed on several subsequent sites (*eg* Sheldon 1972). The most comprehensively recorded sighting of this road was made during the excavations by Pre-Construct Archaeology (PCA) during 1995–1996 at Lefevre Walk, approximately 400m to the south-west of the present site (Brown *et al* forthcoming). The full width of the road including the two side ditches was approximately 26m. The construction of the road apparently began within a few years of the Claudian invasion and it appears to have been in use throughout most of the Roman period, often with modifications to one or more of the three tracks. The boundary ditches defining the road zone appear to have been recut very late in the Roman period and evidence of local occupation and roadside activities was found continuing at least until the end of the 4th and possibly into the 5th century.

The exact nature of the settlement around Old Ford continues to be somewhat enigmatic and the evidence will be reviewed in a forthcoming monograph (Brown *et al* forthcoming). For present purposes it may suffice to say that the settlement, if such it is, has produced large quantities of Roman pottery, coins, burials, ditches, pits and animal bones, particularly of cattle, all in fairly close proximity to each other, if not of the same historical date.

The nature of the crossing-point for the Roman road over the Lea has never been proved. The name Old Ford is of (late) Saxon origin and does not imply that the Roman crossing-point also consisted of a ford. The river probably comprised a series of braided channels at this date and one might think that it would be at least inconvenient to have a long ford in the middle of a strategically important road. That said, although the actual road has been seen at several points both east and west of the Lea, there has never been any observation of any timber structure for a bridge connecting the known road alignments at Old Ford on the west side of the Lea and Stratford on the east.

The natural topography of the area, however, merits close scrutiny. Although Romford Road and Roman Road, the east and west parts of the known ancient road alignment, appear to be more-or-less in a straight line, when viewed at a small-scale, in fact they are not quite so, as is not uncommon with Roman roads. If one accepts that the site at 413–417 Wick Lane, Tower Hamlets (Thompson *et al* 1998, 246), is the furthest eastern observation of the Roman road on the western side of the valley and that the excavations at 30 Romford Road (Priddy 1986; GLSMR 061635) give a clear indication of the direction of the Roman road on the eastern side, where it follows the course of the modern Romford Road, the Roman road needs to change alignment very slightly to the south as it heads eastwards in the area of the modern Marshgate Lane from the Tower Hamlets alignment.

This is not very surprising, as the ground level rises from *c*.5.0m OD at the Wick Lane site to *c*.10.0m at Marshgate Lane. The horizontal distance is *c*.300m but most of this rise comes fairly sharply at the eastern end, with the flatter area to the west being defined by the modern course of one of the River Lea's main channels and the Pudding Mill River. From a high point just to the north of Knob's Hill Road, ground level drops down again to the east by *c*.5.0m to the modern City Mill River and the Waterworks River, another main channel of the Lea, over some 200m. From there, the nearest higher point on the gravel terrace on the east side of the river is at Gibbins Road on the line of Romford Road. The Knob's Hill Road area is thus effectively an island within two narrower areas of marshy land beside the river channels. It is therefore suggested that the Roman road made use of this to reduce the bridging or fording distances and made a slight adjustment of the route's alignment near the top of the hill.

It was hypothesized for some time that the Roman road actually crossed the western stream(s) via a ford a short distance to the south. Reginald Smith reported in 1910 that a section of herringbone pavement had been found during dredging operations in the Lea between Iceland and Bundock Wharves (Smith 1910; GLSMR 0815171) and suggested that this pavement formed part of the solid bed of the ford across the river. It would seem far more likely that such paving implies a substantial building nearby on the bank, as it is not uncommon in Roman villas and public buildings in southern England (*eg* Brown & Pye 1992). On the other hand, paved fords are not unknown, although unusual. Examples may be cited at Kempston near Bedford and between Podington and Wymington, also in Bedfordshire (Bagshawe 1979, 16; Margary 1967, Route 225). Although the case is unproven, it seems more likely to this author that the road would have been carried across the marshy river channels in Roman times on two timber bridges.

There is very little excavated evidence of early Saxon activity in the area, and it seems likely that it would have reverted to woodland. Bridge maintenance is also likely to have been neglected during this period and Roman bridges are likely to have fallen into disrepair (Bagshawe 1979, 21).

The first documentary reference to Old Ford occurs in AD 958 (*VCH* 1963, 25, 155). It seems reasonable to assume that a settlement with such a name would be close to the ford itself, probably around the bend in Wick Lane, but very little is actually known about it. The ford continued as a crossing-point until Bow Bridge was built, the construction of which was attributed to Matilda, the wife of King Henry I, in the early 12th century (*VCH* 1998, 13).

At the time of the Domesday Book in 1086, Old Ford formed part of the Manor of Stepney and it continued to do so until at least 1315. There are occasional documentary references to parts of the area through the

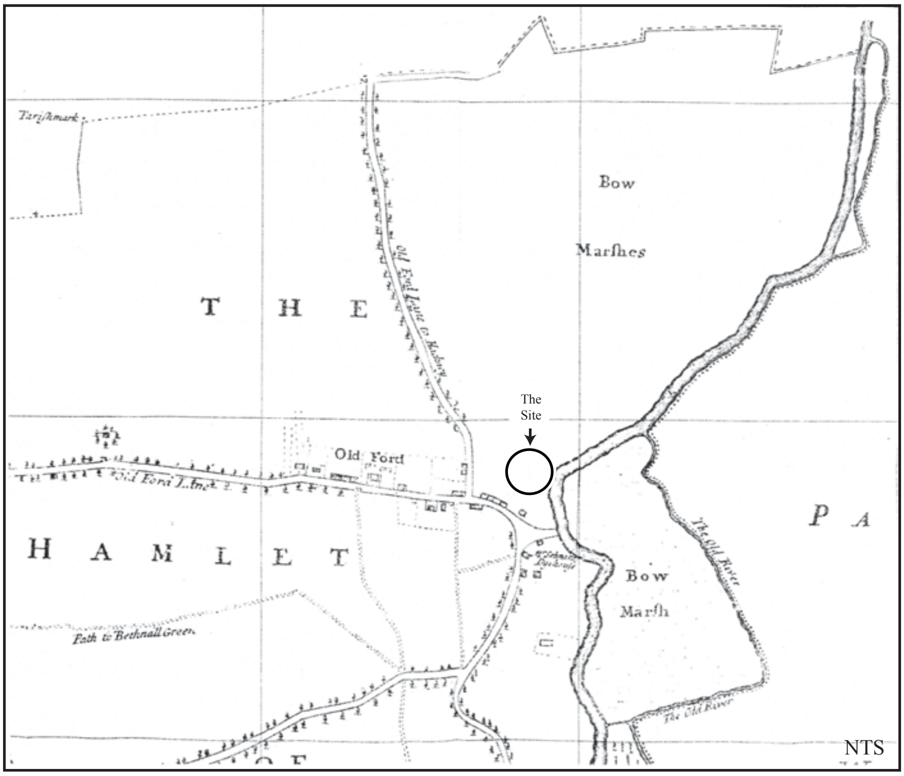

Fig 2. Gascoigne's map of Bow in 1703

medieval and post-medieval periods, but even in 1796 the topographer Daniel Lysons could still refer to Old Ford as a hamlet separate from London (Lysons 1796). All of the major buildings of the village during this time appear to have been close to the main roads, the Old Ford Road and Wick Lane.

The earliest historic maps show that the Old Ford area was essentially still rural in nature. The first known map, of 1665, and the Gascoigne plan of 1703 (Fig 2) show the area as sparsely populated, with the study site undeveloped as part of the Bow Marshes. This plan is also interesting in that it predates the construction of the Hackney Cut of the Lea River Navigation (1767), which ran approximately north–south and joined the existing river at the bend immediately to the east of the study site. The 'Old River' shown in the bottom right corner is now known as the Pudding Mill River channel of the River Lea.

The Navigation Cut appears on the 1768 plan of the parish of St Mary, Stratford, Bow, by R Cardwell (Fig 3) as the 'New River'. The area of the site is shown as 'Gardens' at the back of the houses on the north side of Wick Lane, as is the case with the John Rocque map of 1746 (not illustrated). The short lane to the river bank to the south of them would have been close to the line of the Roman road and any possible ford or bridge taking it across the river channels.

The first buildings appeared on the site in the late 18th and early 19th centuries, as shown, for example, on Greenwood's plan of 1824 (not illustrated). The basic layout of the site did not change during the second half of the 19th century, although two major additions are visible on the Ordnance Survey Map of 1894: the Northern Outfall Sewer and Dace Road itself, which was laid out to the north, leading to the lock, at about this time. The Northern Outfall Sewer was built by Sir Joseph Bazalgette in the 1860s. This stands to a height of 3–4m above ground and forms the southern boundary of the site today, running south-east to Beckton Sewage works *c.*7km away.

Fig 3. Cardwell's plan of the Parish of St Mary, Stratford, Bow 1768

In 1894 the site is shown as the location of the Crown Wharf Chemical Works, with a crane at the south end and an iron foundry to the north-west. The footprints of the buildings of the foundry were extended by the time of the Ordnance Survey plan of 1937.

ARCHAEOLOGICAL RESULTS OF THE EXCAVATIONS

The archaeological excavations in this project comprise four discrete sequences in the four evaluation trenches: Trenches 2, 3, 4 and 5, with Trench 5 extended to confirm the limits of the modern truncation. Although these sequences were physically separate, they were sufficiently similar to be able to draw cross-trench conclusions between them. In the narrative below information is incorporated into the text from the specialist reports commissioned for this project, as listed in the bibliography. Figures in brackets, *eg* (5164), are context numbers; those beginning with a '5-' will be from Trench 5 *etc.*

Prehistoric environment

Within Trench 5, the lowest part of the sequence of made ground was sampled for geoarchaeological analysis (west-facing section, Samples 9 and 10). The lowest layer in the sequence, (5164), was naturally-deposited pale grey alluvial sand with a top surface level at +0.72m OD. Above this, between 0.72m and 1.07m OD, lay (5163), a deposit of dark grey clayey sand with some gravel. Overlying (5163), from 1.07 to 1.23m OD, there was a complex wood peat (5162) with highly variable levels of humification (organic matter decomposition), and organic matter values reaching a maximum of 40% (1.15m OD). This peat was overlain by a dark grey clayey silt (5161), gradually changing to light grey clayey silt (5160) at 1.26m OD, with organic matter values decreasing to <15%.

The sedimentary sequence between 0.75–1.07m OD (5163) and 1.23–1.31m OD (contexts (5161) and (5160)) indicates deposition within a fluvial environment. The

Table 1. Radiocarbon dating of context (5162): results calibrated with Oxcal v.3.5 (Bronk-Ramsey 1995; 2001), using data from Stuiver et al (1998)

Laboratory Code	Material	Depth (m OD)	Un-calibrated Radiocarbon Years Before Present (yrs BP)	Calibrated age BP (2-sigma, 95.4% probability)	δ13C (‰)
Wk-16548	Peat	1.07 to 1.10	9066 ±57	10410–10150	-28.7
Wk-16549	Peat	1.20 to 1.23	8393 ±50	9520–9290	-29.4

formation of peat between 1.07m and 1.23m OD (5162) is of particular importance since this represents a significant, albeit temporary, change in the local environment, probably as a consequence of either the lateral migration of the main river channel, or the infilling of an abandoned river channel, resulting in the formation of an area of back-swamp or fen carr woodland.

The results of radiocarbon dating (Table 1) indicate that the peat is Early Holocene in age. Peat formation started between 10410–10150 cal BP (8460–8200 cal BC), during the Mesolithic, and continued until 9520–9290 cal BP (7570–7340 cal BC). The presence of fluvial sediments overlying the peat indicates flooding of the surface, possibly from the Late Mesolithic onwards (1.23–1.31m OD). However, the evidence for Roman activity overlying this horizon (described below) suggests truncation of its upper surface (Branch *et al* 2005, 11)

Similar alluvial deposit layers were found in Trench 4, (4006) and (4008), between 1.02m OD and 1.65m OD; in Trench 3, (3006), below 1.53m OD; and in Trench 2, (2010), 1.69 m OD to 1.75m OD. The slightly higher level and thinner extent of the layer in Trench 2, with natural gravel below it, suggests that it is close to the western river bank.

Roman sequence

Within the alluvial layers at the bottom of the stratigraphic sequence were a large number of driven piles and stakes (Fig 4).

One cut feature and its fills was unequivocally below the later dumped gravel layers, (5113) and (5112) (Fig 5). This feature, cut (5175), was found in the north-east corner of Trench 5 at a depth of *c*.1.70m OD and was only exposed in the limited area of a sondage because of its depth and position. The feature was dug to a depth of *c*.0.65m but not bottomed because of safety and access considerations. It appears to represent a slightly concave break in slope on the edge of the deeper stream channel seen in the north-east corner of the trench. Its alignment is roughly north-west to south-east and it follows the same alignment as one of the groups of driven stakes and was clearly traceable for *c*.6.0m. The fills within the channel comprised soft mid-brownish grey sand (5187) underlying greenish grey sandy gravel (5188) (Fig 5). The upper layer (5188) contained frequent small pieces of wood, roots and twigs rather than timber chips or fragments, although there were some larger fragments such as contexts (5133) and (5168) within it. (5133) was a roughly-halved timber, 0.44m long by 0.10m wide by 0.07m in diameter, whilst (5168) was 0.80m long by 0.08m wide by 0.05m thick and again approximately halved. These two pieces appear to have been driftwood in the stream channel and are clearly displaced.

Context (5185) was a spread of highly decayed wood fragments and fibrous organic matter, 4.0m long by 1.50–2.0m wide by up to 0.15m thick, lying along the edge of the cut (5175) and up against vertical timbers (5143) and (5144) (Fig 4). The dark fibrous matter remaining was deemed to be heavily decayed heartwood and may have been part of the collapsed upper part of the main timber structure, although a more likely interpretation might be that it was a piece of driftwood, lying up against the piles.

Apart from these few pieces of timber and the remains of the significantly later features discussed below, the majority of the timbers found on the site were vertically driven piles or stakes, 42 of which were recorded. The two largest vertical timbers, (5157) and (5158), were put into purpose-cut pits and set on thick basal planks, rather than driven.

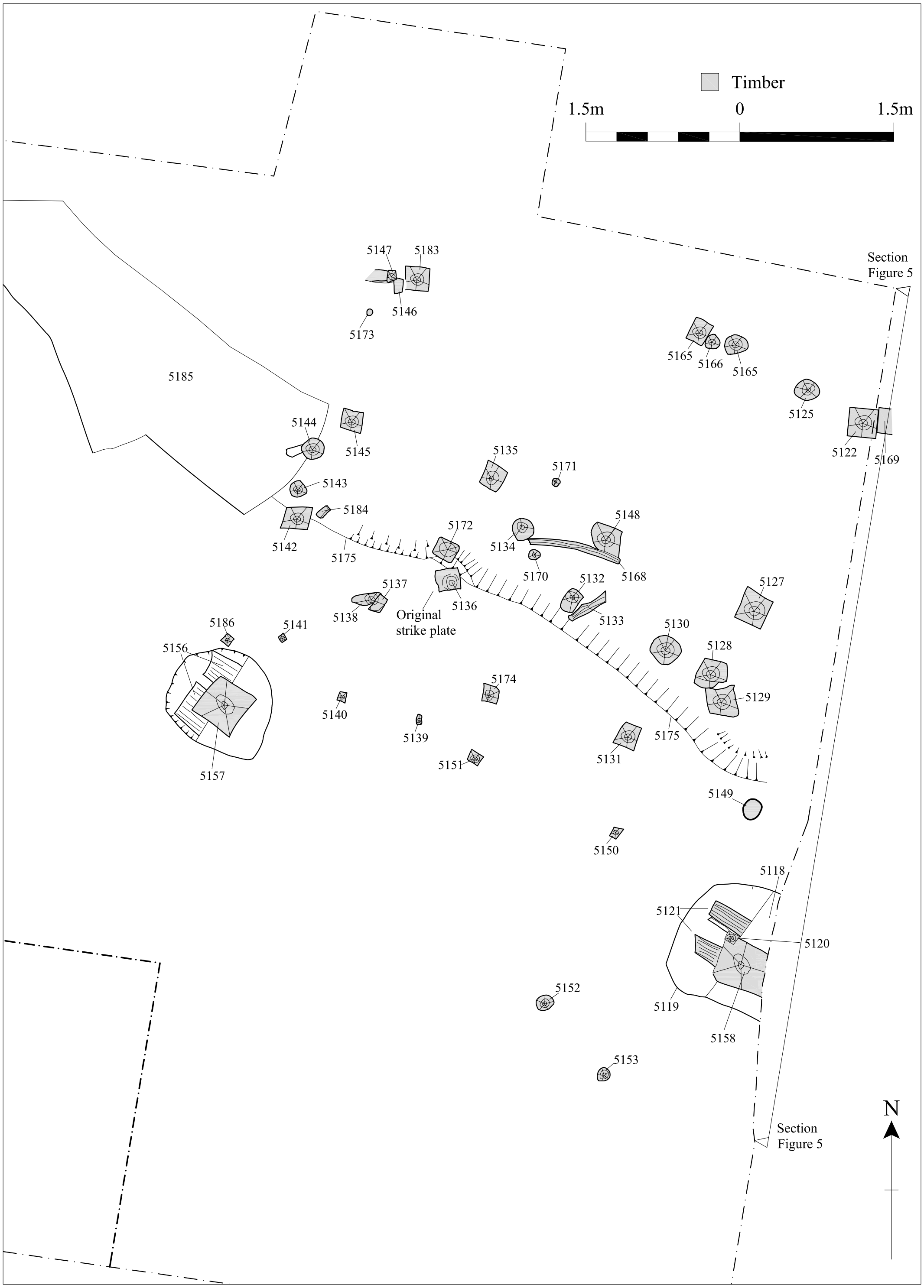

Fig 4. Plan of Roman timbers in Trench 5

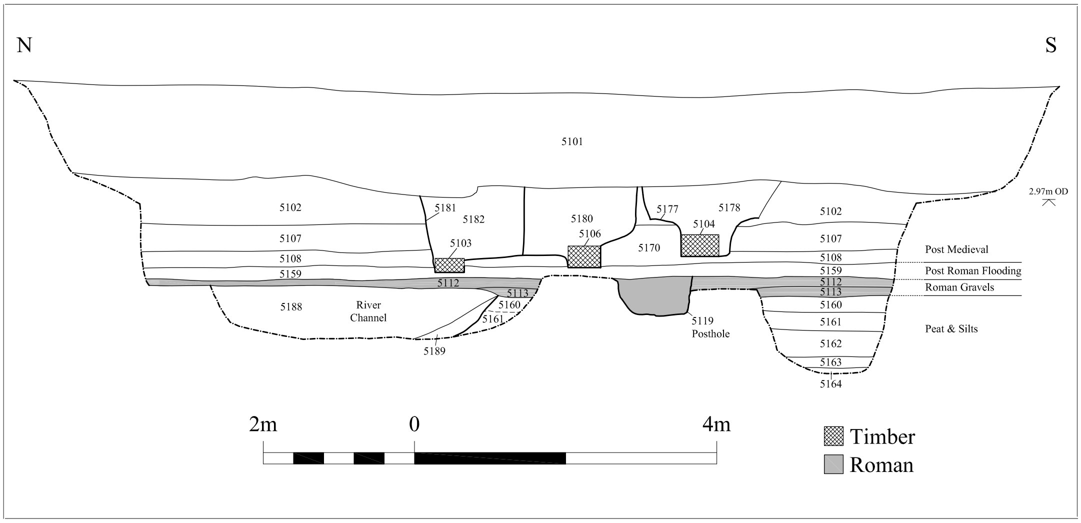

Fig 5. West-facing section of Trench 5

It is often the case with driven timbers which do not have upper timbers associated with them that the layers which represent the upper ground surface at the time they were driven cannot be identified, and this was the case at Crown Wharf Ironworks. Many of the timbers were driven into underlying alluvial silts and clays and held fast by them, although it is possible that some of these deposits built up around them after the timbers had been put in position.

The following remarks concerning levels address the stratigraphic position of the timbers and their descriptions, before a consideration of their function. The unusual occurrence of one of the smaller stakes (5120) being driven into the top of one of the larger posts (5158) was noted and has an obvious implication for the stratigraphic sequence.

Levels at the tops of the timbers all fell within a range of 1.50m to 1.83m OD. This is a fairly wide range for such a small area, but it will have been distorted by several factors. For example, some timbers were described in field records as being visibly decayed at the top, such as (5145) and (5173). However, a substantial number, particularly those at the south of the group, were described as being in 'fair' condition, *eg* (5136), (5139–5142) and (5149–5153). Four of these are of particular significance: the two squared posts on the edge of cut (5175), *ie* (5136) and (5142), and the two larger posts in the pit cuts, *ie* (5157) and (5158). Timber (5136) has been identified as showing the survival of the original striking plate at the top at a level of 1.68m OD, whilst (5142) had a top level of 1.69m OD. These two timbers are of similar type and size and are on the same alignment. It may therefore be the case that timber (5142) survived to nearly its full height without decay, as apparently did (5136), above which the superstructure would have been built.

Along the west-facing section, the top of dumped gravel layer (5112) was at almost exactly 2.0m OD. The layer was consistently 0.10m thick in this section. Layer (5113) was also generally 0.10m thick with a top level at 1.90m OD. In the east-facing section these layers were somewhat thicker, with (5112) being recorded at *c*.2.30m OD, where it is 0.30m thick, and (5113) with a top level of 2.0m OD, also with a maximum thickness of 0.30m. Thus the lowest level of these gravel layers is at *c*.1.80m OD. There is a degree of unevenness in these layers and the depth of (5113) was not fully recorded at all points but it is clear that the excavator's observation that 'some [of the piles] were sealed by (5113), most by deposit (5112) but a few projected a little through this and were sealed by layer (5159)' is correct (Alexander & Stephenson 2004, 9).

Closer analysis of the recorded levels

of the tops of the timbers shows that all of those to the north of the cut line (5175), and those very close to it, including (5131), (5136), (5137), (5138), (5142) and (5174), would have been at levels of between 1.60 and 1.70m OD, whilst the group to the south of this line would have been very slightly higher, with the highest (5153), which is also the southernmost, reaching a height of 1.83m OD.

The southernmost group is composed of fairly small-sized stakes, of which the largest was 0.16m by 0.12m and the smallest was 0.08m square. Seven of these were in a fairly straight line — (5120), (5139), (5140), (5141), (5150), (5151) and (5186) — whilst two others — (5152) and (5153) — were *c*.1.50m to the south. The former timbers were grouped together as they were all in the same general size range and displayed the same type of conversion, boxed heart. The two outliers were made from complete roundwood branches with 0.14m diameters, so they may not have belonged to the same phase of activity.

A significant point about these southern stakes is that one of them, (5120), was driven into the top of another timber, (5158). This presumably happened by accident, as the upper timber was so close to the corner of the lower. As the lower timbers were apparently cut though the gravel layers, as discussed below, this obviously implies that the upper stakes were also driven through them. The same is probably true of the two outliers, although not demonstrably so.

The two largest timbers, (5157) and (5158), were also those which extended to the highest levels (apart from (5153)), 1.81m and 1.82m OD respectively, with the surviving part of (5120) in the top of (5158) also surviving to the same height. Both of the timbers are recorded as being decayed at the top and surviving to lengths/heights of 0.42m and 0.48m. They were both roughly square in plan, 0.42m by 0.44m and 0.42m by 0.46m respectively, and both set in large circular pits, 1.00m and 0.95m wide. These measurements show that they were cut to the size of one Roman *cubitum* square, a common dimension in Roman carpentry. Using the same standard measurements, the pit-cuts were two *cubita* wide and 10 *cubita* apart. The distance between the hearts of the vertical timbers was 5.60m, or half the maximum width of the central carriageway of the road recorded at Lefevre Walk (Brown *et al* forthcoming).

Both vertical timbers were supported on two pieces of sawn plank, each 0.07m thick and laid flat in the bottom of the pits. The two pieces recorded as (5156) under (5157) were 0.42m wide (from the same plank), and 0.60m and 0.64m long. One of the pieces of (5121) under (5158) was buckled and split in two under the weight of the upper timber. The planks were 0.66m and 0.70m long. The combined width of the split timber would have been 0.42m, whilst the width of the other irregularly-shaped piece would not have exceeded 0.20m. All of the pieces had straight sawn ends. Section drawings show the post-pits cutting through the lower gravel dump (5113) and apparently cutting through the upper dump (5112).

Layer (5113) was recorded in the field as grey clay with coarse gravel, whilst layer (5112) was recorded as greenish grey gravel and sand, with frequent pebbles. Both were noted as having occasional fragments of ceramic building material (see below) and were interpreted as having been deliberately dumped over wet ground to consolidate the surface. Environmental analysis of samples from (5113) supported this interpretation (Branch *et al* 2005, 2–3). Most of the building material consisted of abraded fragments found in (5113). This spread contained *tegula* and *imbrex* roofing tile in fabric group 2815 and individual fragments in fabrics 2453 and 2459C. Tiles in fabric 2453, which can normally be identified by yellowish-white inclusions up to 6mm across, were imported from outside the London area from the mid to late 2nd century to at least the end of the 3rd century AD (Betts 2005, 1).

With respect to whether the large post-pits were cut through the gravel layers, hand-excavation of the backfilling of the pits confirmed that they had indeed been dug through the dumped layers, rather than into the underlying clay. This would seem to confirm that the large post-pits were among the later timber elements to be put in place in this group, and were cut through at least one of the later gravel dumps, with only the smaller stakes post-dating them.

Although peat deposits and timbers were

not found in the other trenches, the lower stratigraphic sequences in them were similar to that found in Trench 5. Within Trench 4, naturally deposited alluvial sands and gravels were found between 0.77m and 1.22m OD, (4009) and (4010), which were deemed to be the equivalent of (5163) and (5164) in Trench 5. Between 1.27m and 1.65m OD was a layer of grey sandy alluvial clay with a few fragments of Roman pottery (4006), the equivalent of layers (5160) and (5161) in Trench 5. Above this lay a deposit of dark brown hard sandy gravel (4005) in the northern half of the trench between 1.65m and 1.75m OD and another hard compacted layer of lighter sandy gravel (4004) in the southern half of the trench above it and up to a level of 1.80m OD. These are interpreted as the stratigraphic equivalents of the dumped gravel layers (5112) and (5113) in Trench 5.

The sequence in Trench 3 was very similar, with naturally deposited gravel at the bottom (3007), alluvial deposits above, this time to the level of 1.53m OD (3006), and two further hard-packed darker (3005) and lighter (3004) grey gravel deposits above to a height of 1.73m OD. Again, these deposits are considered to be the equivalents of (5112) and (5113).

In Trench 2, the gravel at the base of the sequence rose to a level of 1.69m OD (2011), the alluvial clay layer rose to 1.75m OD (2010), whilst the dumped gravel layer (2009) lay between 1.75m and 1.84m OD. The dumping in this trench faded from west to east and was only visible in the north-west corner of the trench. This might seem surprising but Trench 2 was 20m north of Trench 3 and the dumping may just have been a thinner outlying spread on the edge of the western riverbank, with the eastern part washed away, as contrasted with the more even dumps in the other trenches.

All of the Roman pottery from the site was recovered from these lower layers (2009), (3005), (4005), (5112) and (5113) — a small assemblage of 23 sherds, weighing a total of 784g. All of these contexts are small, the largest being (4005), which contains 14 sherds. The sherds are fairly abraded, some, such as the amphora rim in (5112), more than others, but their overall condition and reasonable size allowed for analysis of fabric, form and decoration.

The assemblage does not contain any early Roman material. There are a number of Late Roman fabrics and forms: (4005) contains sherds of 3rd- and 4th-century fabrics, including an Oxfordshire whiteware (Young form M22) mortarium and an Alice Holt/Farnham ware black-burnished-type flanged bowl; (5112) contains a 2nd-to-3rd-century Baetican late Dressel 20 fabric rim; (3005) contains 3rd-century Oxfordshire red/brown colour-coated ware and 4th-century Roman late calcite-tempered ware. Although there is a sherd of black-burnished ware 1 and black-burnished-style ware (fabrics which are dated to AD 120 onwards), these fabrics are generally associated with the Late Roman period (Lyne & Jefferies 1979). Context (2009) contains a Gillam 239 fish/pie dish, a black-burnished ware shallow dish, often oval in shape, and usually dated *c.*AD 120–250 (Fig 6). There is a small sherd of a red colour-coated beaker from (4005), which is decorated with cut-glass decoration. This decorative trait is generally associated with samian ware and so the combination of cut-glass decoration and the red colour-coat suggests that it may have been a samian imitation.

The Roman pottery assemblage is dated to the later 3rd and 4th centuries AD. Despite the absence of samian ware proper, the presence of an amphora rim, dishes, bowls

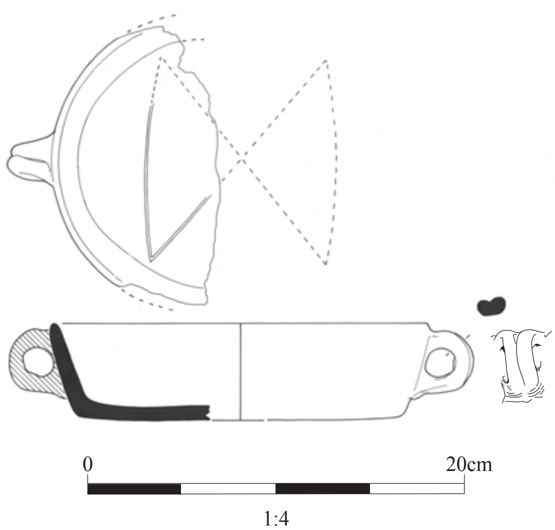

Fig 6. Roman pie/fish dish from context (2009)

and coarseware jars suggests that it is likely to be of a domestic nature. However, as the assemblage is small, this profile is tentative (Thompson 2004, 1–2).

Six fragments of Roman roofing tile (*tegula*) and brick were recovered from the possible surface spread (3005) in Trench 3. The *tegulae* are in fabric group 2815, which in central London is dated to *c.*AD 50–160. Tiles of this type were made at a number of locations, principally along Watling Street between London and Verulamium (Betts 1987), although there is evidence for manufacture in the vicinity of St Paul's Cathedral during the 1st century AD (Betts 2003). One of the *tegulae* is quite thin (14–18mm), which suggests a mid-2nd-century AD date, as by this period *tegulae* tended to be smaller and thinner than their 1st- and early 2nd-century counterparts. The latter may be contemporary with the brick in fabric 2459B, a type characterised by the use of very fine moulding sand, which may be from north-east London or Essex. They were first used in London sometime after the Hadrianic fire of AD 120–125, and production continued into the 3rd century. The building material from Trench 3 is clearly earlier than the associated pottery (AD 300–400), suggesting that it was brought in from a demolished 2nd-century building, or buildings, situated elsewhere.

In Trench 4, the building material derives from a surface spread (4005), possibly the same as that seen in Trench 1. Roman *tegula* and *imbrex* roofing tile is present, together with two bricks. One brick has been burnt to a grey colour on one end, suggesting that it may have formed part of a kiln or furnace structure. All the bricks and tiles in Trench 4 would again appear to be earlier than the associated pottery (Betts 2005, 1–2).

The dating of the Roman timbers

An assemblage of 23 timber samples was submitted for dendrochronological assessment, of which 17 were selected for analysis. The bulk of the assemblage consisted of young, very fast-grown, roundwood, much of which appeared to be branch material, with double piths and branch scars distorting the ring-pattern. Only three samples, (5122), (5127) and (5165), yielded long sensitive sequences over 100 years in length.

The ring-sequences were cross-matched against each other and against all dated master chronologies from England, but no significant correlations were found. It is unusual not to be able to date sequences as long as (5122), (5127) and (5165) from a London context. The samples were therefore resurfaced and remeasured to check if errors had been made during measurement. No errors were found. The most likely explanation for the lack of correlation between any of the timbers is that they represent a multiplicity of building phases, so that there may be only a few timbers from any one phase present in the assemblage. This, combined with the poor quality of the timbers, would hinder replication and the construction of a site chronology (Crone 2004, 47–8)

Four wood samples were submitted for radiocarbon dating to the AMS Facility at the Scottish Universities Environmental Research Centre. The results are shown in Table 2, calibrated using OxCal3 (University of Oxford Radiocarbon Accelerator calibration program).

The Crown Wharf piles fall broadly into groups within the parallel lines mentioned above. They were mostly boxed heart in conversion, although some were circular full limb stakes.

The first group, the southernmost, lay to the south of the former stream channel

Table 2. Radiocarbon dates of wood samples

Timber Context Number	Laboratory Code	Δ 13 C	Radiocarbon Date BP	Calibrated Age 68.2% Probability	Calibrated Age 95.4% Probability
5122	GU-13011	-26.6%	1930 +/- 35	25-130 AD	20 BC – 210 AD
5127	GU-13012	-27.4%	1955 +/- 35	(0) AD – 85 AD	40 BC – 130 AD
5136	GU-13013	-26.0%	1900 +/- 35	30-140 AD	20-220 AD
5142	GU-13014	-26.1%	1870 +/- 35	80-220 AD	70–240 AD

(5139–41), (5150–1). The next line of five timbers lay 0.50m to the north-east, parallel to the southern edge of the stream cut (5175), *c*.0.30m to the south of it, and were slightly larger. One timber, (5149), was circular in cross-section with a diameter of 0.20m, whilst the four squared timbers, (5137), (5138), (5174) and (5131), had cross-section edges measuring 0.23m, 0.23m, 0.18m and 0.24m respectively.

The next alignments of piles were two lines with a gap of roughly 0.50m between them along the edge of the former stream cut (5175), comprising thirteen timbers within a size range of 0.20–0.30m, and four smaller stakes with maximum diameters within the 0.10–0.20m range. Of the larger timbers, three were circular in cross-section, (5130), (5143) and (5144), whilst the others were squared. The squared timbers were numbers (5127), (5128), (5129), (5135), (5136), (5142), (5148) and (5172); it should be noted that three of the radiocarbon-dated timbers fall within this group.

The final alignment comprised ten more timbers lying roughly parallel to the last between 1.30m and 1.90m to the north-east. These comprised six squared timbers with cross-section dimensions within the 0.22–0.28m range, (5122), (5169), (5146), (5147), (5165) and (5183), from which (5122) was radiocarbon-dated. Timbers (5146) and (5147) were adjacent to each other and tilted obliquely to the east on the west side of (5183) and may have been put in to brace it. Three other rounded stakes had (irregular) diameters of 0.15–0.25m, whilst a smaller one (5173) had a diameter of 0.06m.

There may have been further piles to the north-east and it is possible that some may survive beneath the new buildings on the site. The maximum width recorded for these pile alignments was 6.0m, but this dimension will have been distorted by their oblique angle within the excavated area and the limits of excavation. The maximum width between the outer edges of the later post-pits was *c*.7.0m and it is probably safe to assume that the earlier alignments were of at least similar width.

Post-Roman flooding

Above the Roman timbers lay a series of silt and clay deposits representing wide-scale inundation. In the initial evaluation in Trench 5, this was recorded as one alluvial layer lying between levels of 1.88m and 2.82m OD, layer (5012). When a wider area was opened for excavation, the alluvial deposits were subdivided and upper and lower groups of layers were recognised both in Trench 5 and in the other evaluation trenches. All of the deposits comprised variants of blue/grey to brown clay and silty clay. The lower group included vestigial traces of organic matter and was recorded in all the trenches as (5011) and (5159), (4003), (3003), (2008). This group had an upper level of between 2.20 and 2.30m OD, although the horizons were noted as being graded. The upper alluvial deposits between, such as (5108) and (5107), contained 18th- and 19th-century pottery and other finds.

Sampling of the lower alluvial deposits in Trenches 4 and 5 that included frequent plant macrofossils and mollusc shell fragments demonstrated the most abundant species were indicative of still water, or very slowly moving water, with a high content of macrophytic vegetation, such as would occur in an inactive or abandoned channel of the river (Branch *et al* 2005, 7).

It thus appears that, following the abandonment of the timber structures at the end of the Roman period, the area was allowed to become submerged in marshy mud. Immediately above (5159) in Trench 5 lay further similar layers of waterlain silty clay, (5108), (5192) and (5193). Although the horizon between (5159) and (5192) was described as being indistinct, the dating range of the cultural material jumps sharply between them with no artefacts being recovered dateable to any period between the 4th and 18th centuries.

Post-medieval structures and dating evidence

As described above, horizontally-lain alluvial layers were seen above the Roman levels in all trenches. In Trench 5 these were cut by a series of timber conduits and wooden tanks. The lowest clay and silt layers of this group were (5108), (5107) and (5102), through which the tank (T1) was cut. A further layer of silt was banked up against this, through which several timber conduits were cut, and above these were further clay deposits, (5110) and (5111), sometimes mixed with demolition debris and apparently heavily disturbed.

It is clear that all of the later timbers are later than the lower layers of the post-Roman sequence, but the apparent dating range between the layers above the timbers and those below them is not great. The lower waterlain layers were conclusively dated to the late 18th to early 19th centuries (Whittingham 2005). It may be that the structures are broadly, if clearly not exactly, contemporary, although the individual elements within them may have been repaired and replaced. The timber tank (T1) was the earliest of this group of structures and was dug into the post-Roman flooding layer (5159). The timber conduits followed several minor flooding and dumping events, possibly over a relatively short timescale.

The timber tank was made up of horizontally-laid planks in a framework of driven posts, with internal cross-strutting. The full extent of the tank was not seen, as it was truncated on the north and west by modern foundations, but sufficient of it survived to give an impression of its shape. The maximum surviving height of the posts seen was 1.20m and six vertical posts survived holding up the plank sides of the box, whilst another inside it held one of the cross-struts in place. Parts of two of the sides survived. These met at a corner with an obtuse angle between them. One side was 1.60m long between two posts. Three horizontally-lain planks, set edge to edge on a base plate, formed the side, which stood to a height of 0.85m.

Inside the tank, two lines of horizontal planks on edge ran to the corner posts, apparently from a point just beyond the limit of excavation, where they had been cut by the modern foundations. The planks were uneven and 0.03–0.05m thick, with three planks laid edge to edge in each strut. Their maximum recorded lengths were 1.65m and 0.98m respectively, and if they were indeed originally joined together they would have been some 0.10m longer. The effect of the internal strutting would have been to divide the tank into triangular parts.

The original purpose of the tank is not immediately clear, but it is presumably connected with the paper industry. In the early 19th century the site was occupied by the Wick Lane Paper-Staining Works. Paper-staining as an industry began in Old Ford after the founders of the firm of John Allan and Son came from Scotland and set up their factory there in the early part of the 19th century. Wallpaper was the principal product and it seems likely that this feature represents evidence of the industrial processes carried out there (*VCH* 1911, 195–7).

Five assemblages of pottery were recovered from the post-medieval features within Trench 5. They all date from the second half of the 18th or early 19th centuries and contain a similar range of fabrics. The majority of the pottery is London-area, post-medieval redware, found in association with a variety of industrial finewares (Whittingham 2005, 2–3).

A post-medieval boat fragment

Damian Goodburn

The east wall of the timber-lined tank was built of a flat articulated slab from the side of a barge, timbers (5114) and (5115). It comprised two pit-sawn elm planks that were edge-fastened to each other with pegged tenons of oak. The close-butted seams were waterproofed with tarred hair ‘setwork’. This is not ‘caulking’, as it was not driven in after assembly but was put in place during the assembly of the planking. The slab of barge also included a very slightly curved oak frame timber still fastened to the planking with 30mm diameter oak treenails.

The oak frame timber (5114) was a hewn boxed heart from a relatively small log and some wane, or bark-edge, was left on. One face had iron nails driven into it, which protruded 30mm from the face of the timber, showing that the lining planking of the hold was originally *c.*30mm thick. The timber survived to 0.92m in length with the breakers’ 100mm-wide axe-marks surviving on the ends and an abandoned axe-cut recess for removing a treenail. The frame was 220mm wide (‘sided’) and 105mm thick (‘moulded’).

The lifted sawn elm plank fragment (5115) was 1.02m long by 390mm wide and 36mm thick. It was pierced by treenail holes 25–8mm in diameter. Part of one of the edge mortises survived for the 75mm(3in)-wide, 7–8mm-thick free tenons that held the planking together before the frames were inserted. The treenail holes showed that the frames were spaced around 0.50m centres. The plank also showed traces of a thin elm repair patch nailed over tarred hair inboard. It also had another empty recess for a diagonal patch or 'dutchman' inboard and traces of a seam batten outboard. The repairs suggest that the vessel had seen several years' of service, before being broken up for reuse at Crown Wharf Ironworks.

The frame and two elm planks were very similar to those found in the section of a Western barge hull-bottom of *c.*1580 found at the Millennium Bridge site. It was also similar to other later articulated hull fragments found at the Millennium Bridge and at Adlards Wharf, Bermondsey, both of which date to around, or just before, 1800 (Goodburn 2002; Divers 2002). The parent vessel from which the Crown Wharf Ironworks hull section was taken may have been of the 'punt-like' form known from the Millennium Bridge and Adlards Wharf finds and a number of Thames riverscapes from the 16th to mid-19th centuries.

Prior to 1999, this system of construction of the flat-bottomed 'West-country' (tenoned planking) style Thames barges was completely unknown. Until then the barge finds in the London area had been from round-bottomed, clinker-built vessels with overlapping planking (Goodburn 1998; Marsden 1996). These survived in the form of 'ballast' barges into the 19th century but later examples were never recorded. That tradition of construction dates back to Saxon times. Earlier barge finds from the River Lea were also of this style of construction. Now it can be seen that the tenon-joined planking system used in West-country Thames barges was also used on the Lea.

It is very unlikely that articulated hull sections would have been moved far. The parent barge was almost certainly floated to the breaking-up site, which must have been near Crown Wharf Ironworks. The Crown Wharf fragments are small but are clear evidence of an unusual vernacular boat-building style, which died out before ethnographic recording of boats got underway in the Edwardian period (Goodburn 2005, 13).

Of similar date but stratigraphically later, was a group of plank-built elm conduits. Three of these were recorded in the west-facing section, (5103), (5104) and (5106), with (5106) being recorded as (5189) 6.00m away in the east-facing section.

Modern layers were recorded above these pipes, comprising dumped deposits for ground-levelling of a thickness varying between 1.50 and 2.00m, occasionally cut by modern building foundations and service trenches up to a ground level of 4.40m OD.

DISCUSSION

Although there have been a few artefacts of prehistoric date found in the general vicinity of the site (Burton *et al* 2004), none were found during these excavations. The peat layers dated to the Mesolithic period are at a typical level for that date as seen elsewhere in the Lea Valley (Sidell *et al* 2000, 21–101). The covering of the peat by fluvial deposits may have begun during the Mesolithic and, had there ever been any evidence of later prehistoric activity on the site, it could have been removed as a result of processes truncating the upper part of the peat layers.

The Roman period is the first for which evidence of occupation was found on site. The site is very close to the projected line of the main Roman road from London to Colchester (Fig 7). The approximate route of this Roman road has been known for a long time, although there has been a little uncertainty about its precise alignment in some localities. Margary (1973, 246–7) suggested that the main Roman road in the area, Road 3A, 'The Great Road. London to Colchester', ran between Silchester and Colchester on the western side of the Lea, through Bethnal Green via Oxford Street and Old Street, and that another road from Aldgate to Old Ford joined it nearby (Fig 7). At the time, he accepted that Iceland Wharf was the crossing-point of the Lea, but this seems less likely in the light of the more recent evidence, as discussed above. This road was recorded in detail for its full width at Lefevre Walk (Brown *et al* forthcoming).

Another road in the vicinity was Route 30, 'London (Clapton)–Great Dunmow'. Margary (1973, 250–1) refers to: 'a well-made gravel road [which] was found on the

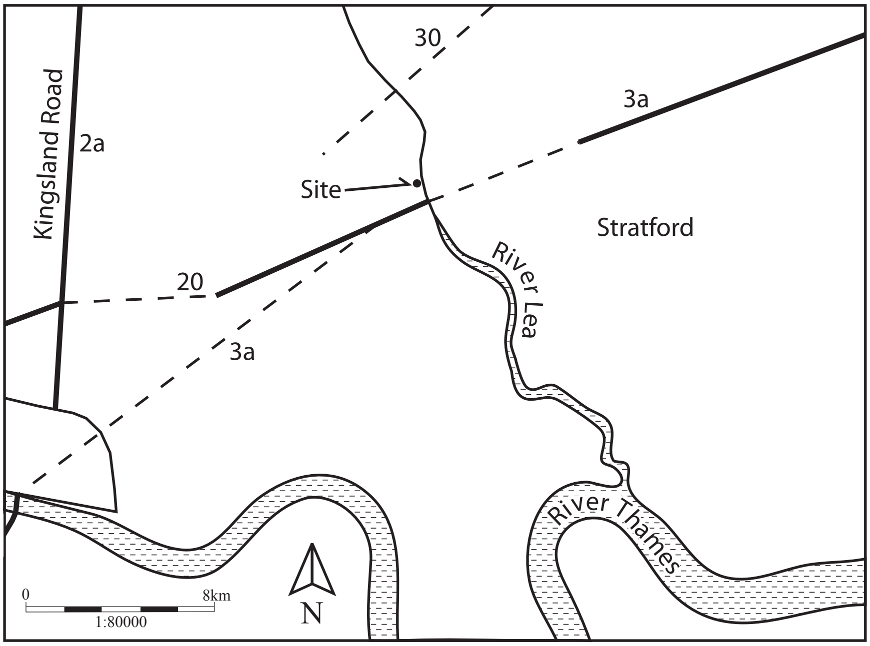

Fig 7. The Roman road network in the vicinity of the site (after Margary 1973, fig 2: The London Area)

E side of the River Lea opposite Clapton at a depth of 6 feet below the modern surface (fig 7). Its course appears to have crossed the Lea Canal 184 yards SE of Pond Lane Bridge, E of the electricity works, and then the River Lea just to the E of a sharp S-bend where there is a hard bottom once used as a ford. A Roman sarcophagus was found beside this route where it reaches the streets of Clapton, and it probably joined the eastern route (20) somewhere near Shoreditch. These finds give certainty to the earlier portion of this road, for there is little enough of it now to be seen for a long distance. Probably Leabridge Road represents it from Leyton Green to Whipps Cross, and on to Snaresbrook…'

Another observation deserves quotation at length before inferences are drawn about what the remains at Crown Wharf Ironworks may represent. In 1722 Daniel Defoe wrote in his *A Tour through the Eastern Counties of England* (ch 1):

> [He is not intending to repeat what is in Camden's Tour of 1607] except it be to add what may have since been discovered, which as to these parts is only this: that there seems to be lately found out in the bottom of the marshes, generally called Hackney Marsh, and beginning near about the place now called the Wick, between Old Ford and the said Wick, the remains of a great stone causeway, which as it is supposed, was the highway, or great road from London into Essex, and the same which goes over the bridge between Bow and Stratford.
>
> That the great road lay this way, and that the great causeway landed again just over the river, where now the Temple Mills stand, and passed by Sir Thomas Hickes' house at Ruckolls; all this is not doubted, and that it was one of those famous highways made by the Romans there is undoubted proof, by the several marks of Roman work and by Roman coins and other antiquities found there, some of which are said to be deposited in the hands of the Reverend Mr. Strype, vicar of the parish of Low Leyton.

The evidence for Roman timber bridges is not extensive in Britain or in continental

Europe, whilst the remains of stone bridges tend to be more common and substantial. Possibly the most famous classical sources for timber bridge-building are Julius Caesar's description of his bridge across the River Rhine to invade Germany and the illustrations on the 2nd-century triumphal columns of the emperors Trajan and Marcus Aurelius. Essentially these involved constructing a preliminary timber-piled framework with horizontal beams forming the superstructure and decking. Caesar's description of bridge-building involved driving piles into the deep river-bed, joining them with transverse beams, laying horizontal plank decking at right angles to the transverse beams across the river, and putting poles and brushwood over the decking as the running track (Sandford 1982, Book IV, 16–19). The bridges on Trajan's Column included various examples of both large and small bridges with handrails, timber decking, braced and unbraced piles (Lepper & Frere 1988).

In Britain, the best-known example of an excavated timber-framed bridge was found at Aldwincle in Northamptonshire in the 1960s (Jackson & Ambrose 1976). The remains there comprised a bridge abutment on the edge of the former channel of the River Nene, a large number of driven timber piles, both vertical and obliquely-angled, a substantial part of the collapsed jointed timber superstructure, and substantial layers of road gravels. The bridge at Aldwincle was deemed to have been built and rebuilt after several collapses over a period stretching from the late 1st century to at least the 3rd century, during which it was rebuilt after a final collapse.

The remains at Aldwincle show many close parallels with those at Crown Wharf Ironworks. The vertically-driven piles in the river bed run across the channel in groups in roughly parallel lines at right angles to the stream on both sites. At Aldwincle, although there was a line of obliquely-angled piles on the downstream, north, side of the main vertical piles, probably bracing them, the alignments of the somewhat irregularly-spaced vertical piles were roughly 7.00m long, with the road approaching them from the bank being 6.40m wide, so that the bridge would have been very much the same width as the road. The abutment was 5.49m wide; the variation in the width of the elements may have been due to repair work.

The extent of the original spread of timbers at Crown Wharf Ironworks was uncertain. Any further timbers beyond the edge of the excavation to the east were inaccessible and are likely to have been truncated a short distance beyond the edge of the trench section by modern river-wall foundations. The survival of context (5185) suggests that this may not have been the case on the west side and that timber (5157) was the westernmost of the posts. The exact nature of (5185) was uncertain; the excavator suggested that it may have been part of the superstructure of the bridge, possibly brushwood matting of the type Caesar describes as being laid on the decking of bridges, but it has been interpreted here as driftwood,

If we are to conclude that the westernmost timbers at Crown Wharf Ironworks were found and that the easternmost timbers were not far to the east of (5158), the full width of the road (*agger*) and bridge represented by them would be *c.*7.0m, which is approximately the same width as the road and bridge at Aldwincle. Margary (1967, 21) comments that 'The widths of the roads varied considerably and the underlying agger was often much wider than the effective road width. On important roads 30 feet seems to have been about the maximum, 24 feet or so being very often found, and on lesser roads a width of 15–18 feet is very common indeed'. The distance between the centres of the two later posts is 5.60m or *c.*18 feet.

If the lower timbers represent the footprint of a bridge, it is perhaps surprising that there was no evidence of an abutment visible where the bridge reached the bank, but the ground-surface was certainly eroded at a later date by river water action, as evidenced by the fluvial deposit (5159). This may have been a contributory factor to the absence of an abutment, but a more likely explanation could be that the bridge was substantially dismantled when it went out of use.

At Aldwincle, the bridge was deemed to have collapsed and been rebuilt on several occasions. The evidence for this was that the lower timber framework of the abutment survived and several of the subsequently driven piles had been rammed through it. Jointed timbers had fallen from the superstructure and were buried within the gravel layers deposited when they also fell from the trackway. Larger Roman bridges carried roads built in the same way as they would have been on land, with a mounded *agger* or bank topped with gravel metalling. The excavators at Aldwincle thought that the road across the bridge must have been metalled with stones and gravel, which fell onto the collapsed timbers resulting in the deposits of gravel lying between and separating fallen timbers.

The gravel dumps excavated at Crown Wharf Ironworks are not believed to have fallen into position from a roadway above for several reasons. Firstly, the spreads were seen in the other trenches to the north and upstream of the bridge timbers. It appears from this that they were part of a generalised spread over a larger area than just that of the bridge, although this is where the gravels were at their thickest. In the other trenches the gravels were also clearly redeposited, although more uneven.

Secondly, there were no obviously structural timbers found out of place below the gravels. Although the piles were of similar size to those at Aldwincle, implying a similar sized superstructural load, there was nothing at Crown Wharf Ironworks comparable to the 5 and 6m-long structural beams found there. The gravel dumps formed two reasonably distinct layers, rather than the mixed jumble one might expect if they had fallen into position. Finally, the date range of the carbon-dated timber samples and the pottery found in the overlying gravels suggests a considerable gap between the construction of the bridge and the dumping of the gravels.

The implication of this is that the bridge was either systematically dismantled, when it went out of use, or that the timbers were washed away. The first explanation is probably to be preferred, as they could easily be reused if they were of the size seen at Aldwincle and may even have been too large to be easily washed away. After the bridge had gone out of use the line of it was deliberately covered with gravel, apparently to a level where all of the existing timbers were completely covered, although the decay at the tops of some of the piles makes this slightly uncertain. The size of the later posts also implies that they were founded in ground which saw considerable later truncation.

A possible explanation of why and when this was done may relate to variations in river levels throughout the Roman period (Milne 1985; Brigham 1990; Watson *et al* 2001, 25–7). The level of the River Thames has been subject to many changes during the whole Holocene period. These have been the result of eustatic changes, changes to sea level, and isostatic changes, changes in land uplift and subsidence, and the causes and effects of these have been the subject of much multi-disciplinary discussion. Environmental observations have been analysed for many sites on both banks of the Thames and the conclusion has been reached that mean sea level dropped by up to 2.00m between the mid-1st century AD and the mid-3rd century AD (Watson *et al* 2001, 26). One effect of this was that the tidal head of the river shifted significantly downstream during the Roman period; this may have been reversed near the end of the Roman period or early post-Roman period, so that both the Roman city of London and Saxon *Lundenwic* around The Strand may have both been near the tidal heads of the river at the time they flourished. There is also evidence that the tidal head continued to migrate downstream again after this until the 12th century, after which the process was reversed with the tidal head and river levels continuing to rise until the present day (Sidell *et al* 2000, 110). One method of gathering data for this purpose is the assessment and analysis of diatoms, as evidence of the relative salinity of riverine deposits. Diatom valves were found to be absent from all samples from this site (Branch *et al* 2004, 8).

Falling sea levels during the Late Roman period would have affected both the main channel and the tributaries of the Thames and it may be that the timber bridge was dismantled at a time when the water level of the River Lea had fallen, possibly with associated migrations of the channels such as those which predated the bridge. The Old Ford area may have been towards the upper limit of navigability on the Lea during the later Roman period. With the water-table dropping, it might then have been possible to do away with the bridge through the marshes in this area, perhaps leaving a gravel road or causeway. The pottery recovered from the causeway dumps suggests that it would have been in use at least until the 4th century.

The two large posts cut into the gravels are interesting for a number of reasons. They appear to stand alone, associated only with the road gravels. They are both very large timbers cut to *c.*0.45m square dimensions, the standard Roman 1 *cubitum* measurement. The depths to which they were seen to be founded would have left them liable to topple over, but in both cases there was evidence of truncation at the tops of the features. It seems likely then that they would have been founded in a gravel bank which might have continued for some way to the north and south of the main causeway route. Such a bank might account for the redeposited gravels found in the trenches to the north.

These timbers were set in pits 4.5m (or three Roman *passus*) apart with centres 5.60m apart and may have formed two substantial gateposts. The hypothesized bank, possibly with a fence on top, could have formed a boundary on the edge of the causeway road just as it emerged from the marsh to the east. Although there is no way of proving it one way or the other, this may have been one of a pair of adjacent gates, with the eastern half beyond the edge of the trench.

In the later Roman period there is abundant evidence of primary butchery waste, with large cattle and horse components, in the Old Ford area around the London–Colchester road and it is possible that this was the location of the equivalent of a cattle market just beyond London (Brown *et al* forthcoming). A substantial gate or pair of gates across one of the main roads leading into it might have made an effective control point for the market traffic, with the gate or gates controlled and opened from the west.

How long this arrangement might have been in place is uncertain. The final phase of occupation seems to be represented by a line of smaller stakes between and above the larger posts. These would appear to have cut off access along the route at some date presumably much later than the foundation of the large posts, allowing them time to go out of use and decay, possibly towards the end of the period of Roman occupation.

The final point to be considered in relation to the Roman remains is, if the timbers represent a bridge carrying a road at right-angles to their alignments and the gravels a causeway through the marshes, where they were going.

It is a commonplace observation that Roman roads are usually fairly straight, although this is not always the case. Margary (1967, 18) notes that 'rigid straightness is not an invariable characteristic and if the road had to follow a ridge or river valley it takes the most convenient and winding course, although it will then often be laid out in a series of short straight lines rather than on true curves'. With this caveat in mind, as well as the short distance observed on this site, if one projects the line implied by the angle of the timbers and the gravels seen at Crown Wharf Ironworks, it does not require much adjustment to see that the general angle of this road would be very much the same as that of the London to Great Dunmow road, Margary's Route 30 (Fig 7). Specious precision would be out of place, as Margary notes several minor changes of angle even along the generally straight part of that route beyond modern London, but, allowing for the common sense of the surveyors, the alignments are very similar.

The route would appear to skirt the west bank of the main channel of the Lea (bearing in mind that the nearby channel of the Hackney Cut is modern), avoiding the hill on the east bank of the river at Marshgate Lane, then across the lower, Hackney Wick, end of Hackney Marsh, perhaps to cross the Lea near Temple Mills.

Projecting lines beyond this would be pushing the evidence too far on the basis of what was found on the Crown Wharf Ironworks site but it can be noted that the line through Hackney Marshes corresponds well with Defoe's (slightly confusing) description of the causeway through the marshes towards the modern Ruckholt Road. This would also be a fairly short and direct method of connecting the lines of the London–Colchester and the London–Great Dunmow roads, as projected on the basis of previous observations (Fig 7). Although the terrain to be crossed would have been marshy during the early Roman period, the shortness of the connection might have justified the labour involved in building it.

Similarly, as the water-table fell during the later Roman period, dumping the gravel needed to form a causeway might have been a justifiable expenditure of resources.

Following the departure of the Romans, the water-table rose again as described above, resulting in the site being flooded, with no evidence of occupation being seen between the 4th and 18th centuries, after which the site was developed with industrial buildings.

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