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The Wheels of Industry in a Rural English Village. The evolution of Royal Quay, Coppermill Lock, Harefield

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Figures:

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Abstract

During 2013 and 2014 Archaeology South-East undertook a series of archaeological excavations at Royal Quay, Coppermill Lock, Harefield, in the London Borough of Hillingdon. The excavations uncovered the remains of buildings associated with the various industries which used the site during the last two centuries. From corn and paper milling to copper and asbestos manufacture, the site offers a glimpse of the evolution of industry and its impact upon the local community.

INTRODUCTION

Between 2013 and 2014 Archaeology South-East (ASE; UCL Institute of Archaeology) was commissioned by PJH Development Consultancy Services on behalf of their client Oakford Homes, to conduct a series of archaeological investigations at Royal Quay, Coppermill Lock, Harefield, London Borough of Hillingdon.

Figure 1: Site location and plan of archaeological works

BACKGROUND

Coppermill Lock (Figure 1) lies to the west of Harefield, a village which historically lay within Middlesex but now lies in the London Borough of Hillingdon, close to the boundary of Buckinghamshire and Hertfordshire. The site lies on the eastern side of the River Colne valley with the Grand Union Canal forming the western site boundary.

The area around Harefield is archaeologically rich with the Colne Valley a notable source of prehistoric material. A mill is thought to have occupied the site during the medieval period and perhaps as early as Domesday (Tyack 1976, 21). During the post-medieval period, the mill was repurposed

numerous times to manufacture various products, initially corn, then paper, copper then asbestos and rubber items. Considering this history, the site has been the subject of a number of archaeological investigations of the last three decades with a 1992 evaluation by MoLAS focussing on potential prehistoric remains (Hoad 1992). When the site was finally redeveloped for housing in the 2010's planning conditions were imposed for archaeological evaluation and for historic building recording of the remaining industrial buildings. This historic building recording (Harrow and Shapland 2014) focussed on buildings known as the spuriously named Manor House and the aptly titled Long Room. The archaeological evaluation (Hogg 2014) found coombe deposits and colluvium overlain by structural remains associated with the 19th and 20th century mill buildings.

A subsequent archaeological excavation between December 2014 and February 2015 revealed evidence of the various industrial uses of the site during the 18th, 19th and 20th centuries (Clemente 2015; Figure 1).

Extensive sampling had proven that only traces of asbestos remained within Royal Quay area of Coppermill Lock. This combined with the damp on site conditions reduced the risk to human health to a negligible level. Despite this, all staff conducting fieldwork wore appropriate personal protective equipment comprising a Tyvek style suit and face mask fitted with a P3 filter. All masks and suits were discarded at the end of each working session.

SITE NARRATIVE

The excavations at Coppermill Lock took place within a relatively small part of the overall site and therefore while the results are presented within a narrative encompassing the entirety of entire mill premises, it focusses on the area of the archaeological excavations.

The archaeological sequence is divided into site-specific periods and phases and is described in terms of land use, such as buildings (B), structures (S) or open areas (OA). The basic unit of cross-reference throughout the archive that supports this is the context number, always shown bracketed – [100]. Period-specific background and finds data has been integrated into the site narrative.

The site archive will be deposited with the Museum of London under site code RYQ13. This article uses standard Museum of London type codes for ceramic building material (CBM), which are

available online (MoLA 2014a; 2014b). The CBM report with a separate bibliography and tables is available as part of the site archive and from ASE upon request.

The site before the copper mills

The site is underlain by Seaford Formation Chalk; these deposits are sealed by Shepperton Gravels and alluvium to the west and by coombe deposits within the site. The alluvial deposits are associated with the River Colne which flows from north to south through a valley. The site lies on the gentle slopes of the valley's eastern side, although any hint of the natural topography has vanished beneath successive phases of industrial development. The Colne Valley is well known to be rich in Palaeolithic material and several struck flints were recovered from colluvial deposits during the 1992 evaluation of the east of the site (Hoad 1992). Later prehistoric remains are also well represented with the remains from the Neolithic through to the Iron Age recorded during the various excavations at Heathrow. An iron spearhead and bone point were identified during excavations during the site's time as part of Harefield Rubber Works, the artefacts having been found to the north-west of the current site (GLHER ref: 050232/00/00-MLO105, TQ0406 9122).

During the most recent archaeological evaluation and subsequent excavation, coombe deposits comprising degraded chalk were recorded at the base of excavations between 42.50m and 44.43m OD. They were overlain by a sequence of colluvial deposits that filled the base of the valley. These deposits were devoid of cultural material and no signs of later prehistoric activity were recorded; later activity having removed any earlier land surfaces. Romano-British and early medieval remains are less well represented in the local area although the settlement of Harefield may have developed during the later part of the 1st millennium AD (Reynolds 1962, 240).

A settlement certainly existed at Harefield by the compilation of Domesday when it was held by Richard Fitzgilbert (ibid.). Two mills are recorded as belonging to the settlement and by the 12th century these were identified as Hacketts and Ravenings (Reynolds 1962, 247). The latter lay to the north of the site in an area known as Springwell (previously Gulchwell). The location of Hacketts is more uncertain, a watermill called Hacketts was mentioned in the mid-15th century but vanished thereafter, although it has been postulated that this mill refers to the one which lay on the Coppermill

Lock site (Cuthbertson 1983, 78). Certainly, corn mills are recorded as already existing on the site by 1636, these were rebuilt in 1670 and were extended to also manufacture paper. At the time the manufacture of paper was expanding nationally, and technological developments were being imported from abroad (Page 1911, 196).

Period 1.1, AD 1781–1845: From paper mill to copper mills and the coming of the canal

Figure 2. Period 1.1 plan

Perhaps surprisingly, given the rich prehistory of the area, and the presence of mills on the site for much of last 1000 years, no *in situ* remains predating the 18th century were recorded during the archaeological work. If present, the successive redevelopment of the site for the varying industries using it, had removed any evidence of earlier land use. Despite this, many earlier building materials were reused within the later structures. Late medieval or early post-medieval brick was present in small quantities, both within made ground deposits and reused structurally in later buildings.

The late medieval and early post-medieval CBM assemblage, comprising 49 pieces, was primarily composed of brick in red 'Tudor' type fabrics (3033, 3039, 3046 and 3065), all of which have a date range of 1450 to 1700. Perhaps suggesting these derived from the earlier mill buildings. There were also bricks with frogging in the 3039 fabric, however, these are likely to be later, particularly as some of these bricks had deeper frogs and makers' marks, both suggestive of a later date. Much of the tile assemblage, mainly comprising roof tile with three floor tile fragments, was also suggestive of a pre-19th century date.

Demolition and levelling deposits in the south-east of the site (OA1; Figure 2) attested to the clearance of the earlier paper mill that had occupied the site in preparation for construction in this area. These deposits contained some of the earlier brick and tile discussed above, but the majority of the CBM assemblage was later and even included some intrusive material attesting to the continued redevelopment of the site. The pottery assemblage was of 18th to 19th century date while fragments of 17th to 18th century bottle glass were also recovered.

The clearance of the site does not appear to have coincided with the construction of the Grand Union Canal in 1797. Although the canal provided new opportunities for both the Copper Mill and for Harefield, its construction was not wholeheartedly welcomed. The manager of the mill at the time, Mr Bowser complained in 1800 that the canal's construction had damaged the mill's pipework, while in 1802 there was a dispute over the canal taking too much water from the river. Both complaints were rejected by the General Committee of the Grand Junction Canal Company (Piercy 2024).

The earliest building recorded on the site, B1, comprised a square room in the east of the site, part of a long north-south building either converted from part of the existing paper mill or constructed as part of its change to a copper works by Mines Royal Company in 1802 (although they were marked as Copper Works on the 1800 Harefield Enclosure Map). It was built from yellow stock brick in English bond and showed evidence of many alterations and additions, testament to it remaining a working building well into the 20th century. The yellow (MOLA 3035 fabric) bricks are generally considered to have gained popularity later than the red (MOLA 3032 fabric) bricks also common on the site (Cox 1997, 58); however, given the frequency of repair rebuilding of structures and the reuse of materials, this cannot be considered a reliable indicator of date. Some of the bricks from this building were refractory or fire bricks, it is unclear whether this building was initially associated with the generation of heat, but certainly during later periods it was integral to the furnaces as steam power used within the mills.

Two further buildings B3 and B11 appear to have originated during this period and are present on the 1800 Harefield Enclosure Map (Figure 3). Building B3 (depicted and described in Period 1.2) lay to the south-east of the excavation area but was gradually extended north and eastwards during later periods. Building B11 lay just to the west of building B1 and had a similarly long lifespan, little remained of the building apart from a brick-built chamber 2.80m x 2.50m in plan and 1.60m deep. Much of the brickwork dated to the 18th to 19th centuries and it seems likely that it was constructed during this period.

Figure 3. Period 1.1 remains and the 1800 Harefield Enclosure Map

The copper mills were supposedly rebuilt in 1826 (Grand Junction Canal Company 1826), although no evidence of this was found on the site or within cartographic sources, the 1800 Enclosure Map and the 1845 Harefield Tithe Map showing the same layout of buildings.

Period 1.2, AD 1846–1881: Faltering fortunes and the return of an industry

Figure 4: Period 1.2 plan

Initially the Copper Works produced domestic items such as kettles and pans but branched out into the production of copper bolts and sheathing for cladding the hulls of wooden ships (Piercy 2024). The production of copper sheeting and bolts appears not to have required any further substantial construction judging by the similarity in the layout of the site between 1800 and 1845. This could also be, in part due to a lack investment, the result of a reduction in demand for copper with increasingly being built from iron rather than wood and copper. As a result, the workforce at the mill reduced by nearly a third between 1803 and 1851 from 121 to 86 (ibid.).

This decline led the Mines Royal Company to sell the mill in 1863, leaving it in a poor state (Vernon 1872, 3). Interestingly, however, by 1864 the buildings on the site had been substantially enlarged and supplemented, perhaps in an attempt to arrest the dwindling fortunes of the business or more likely on account of the introduction of steam power. Certainly, the most major construction during this period was a chimney, probably a flue gas stack, immediately to the east of building B1. The base of the chimney, S3 (Figures 4 and 5), was still extant and comprised red and yellow frogged bricks with an exterior skin of engineering bricks. These bricks varied in date from the 18th to 20th century probably due in some part to reuse of materials but also to repair. One of the bricks was stamped VGC, potentially deriving from the Victoria Garsfield Colliery in Tyne and Wear, attesting to the sizable transport network possible when the Grand Union Canal lay adjacent.

The chimney stack had a flue on its western side which linked with a horizontal brick-built flue, S2, which headed westwards, apparently from the chimney stack. These two elements may have formed part of the earliest steam powered mill on the site and were to remain integral to manufacture at the site

well into the 20th century. This is supported by the bricks of this structure being of 19th to 20th century date, one of these was a refractory brick.

Figure 5: Photograph of chimney stack base S3 looking west (1m scale bar)

The use of steam power in mills had originated in the late 18th century and began to be a viable alternative to water in the 1820's and 1830's. Drawings of the steam engines supplied to the Mines Royal Company by James Watt and Co. in 1857 show that initially two 25 horsepower horizontal engines with 27-inch cylinders were installed (Mines Royal Company 1857). The Grand Union Canal continued to be both a boon and a hinderance to the mills, the requirement for steam power probably being in part due to the amount of water being diverted to the canal rather than powering the mills. However, the introduction of steam power was feasible at the site solely because the canal allowed the importation of coal, from collieries such as Victoria Garsfield as well as being a necessary water source. No trace of the original turbines was noted although it was likely to be close to the chimney, perhaps within building B1.

Figure 6: Period 1.2 remains and the 1864 Ordnance Survey map

Historic mapping shows that further buildings were added in the south of the site at this time with building B3, being extended northwards twice into the excavation area. The first extension appeared on the 1864 Ordnance Survey map; it was apparently extended again by 1881 (Figures 6 and 7). Only a single portion of frogged red brick wall remained of the building as well as a brick-built drain (S1) which ran north-eastward from the building and appears to have served it. The drain was constructed from 19th to 20th century bricks indicating it remained in use for some time and was repaired during its lifespan.

Figure 7: Period 1.2 remains and the 1881 Ordnance Survey map

In the south-eastern corner of the site, a row of probable sheds or workshops B2 were built on the demolition deposits of OA1. The remains were again fragmentary, comprising an east-west aligned stepped brick foundation. This building remained in use into the 1930's and can be seen on photographs (not reproduced) as a row of single storey buildings with pitched rooves. Despite this, the majority of the brickwork comprised of reused red brick of late medieval or early post-medieval date. Such ancillary buildings are likely to have been constructed from readily available materials.

Despite the introduction of steam power and the expansion of the site the Mines Royal closed the copper mills in 1863 due to the reduced demand for products (Vernon 1872, 3). The use of wood and copper on ships had given way to iron and steel. This was a difficult time for Harefield, the mill having been a major employer in the area and having built houses for its employees in previous years.

Fortunes appeared to be improving when Thomas Newell of Paris purchased the premises and in 1870 converted it back to a paper mill producing 12 tonnes of fine quality paper each week. Newell, a Baptist, had a reputation as an enlightened employer, keen to develop a sense of community within his company. He established lecture rooms at the mill for musical evenings and talks and used the Union Chapel for a Christmas Fete in 1874 (Piercy 2024).

Despite Newell's popularity with the local community, the Harefield Paper Mill was not a commercial success. A notice for sale by auction was issued first in 1872 and then in 1875 and described the site as 'Harefield Paper Mills - valuable water power, machinery, capable of turning out 12 tons of writings per week, store, office, engine houses, etc., envelope factory, lecture room' (Tyack 1976, 22). These attempts at sale were obviously unsuccessful as the paper mills limped along for another four years until finally going bankrupt in 1879.

A speculative plan of 1881 by the Anglo-Russian Iron and Tinplate Manufacturing Co. to convert the property and create employment for 400 or 500 was met with happiness by locals (Piercy 2024) but ended up coming to nothing and it was not until the following year that a more realistic plan was put into place.

Period 1.3, AD 1882–1895: Asbestos —the Miracle Mineral.

Figure 8: Period 1.3 plan

In 1880 the United Asbestos Company was formed by the takeover of the Italo-English Pure Asbestos Co, Furse Brothers and Co of Rome, and the Patent Asbestos Manufacture Co. (Skinner 1908, 2178). The newly formed company then took over the leasehold of the Harefield Mills in 1882.

Asbestos, a naturally occurring group of six minerals, the most commonly used of which were Chrysotile (white asbestos), amosite (brown asbestos) and Crocidolite (blue asbestos). These minerals have a long history of mining and processing for use as far back as the Neolithic period (Dilek and Newcomb 2003, 449) and its fire resistance was certainly known within the ancient world with Herodotus describing its use as a funeral shroud to separate the ashes during cremation. Marco Polo describes its mining and use in textiles in c. AD 1250 (Polo, 1920, 216) and links the mineral with fire-proof salamanders. This link endured, with asbestos described as 'fire-wool' in the 17th century (Browne 1646, 139) and within the site with the Salamander Works decoration factory, situated within the United Asbestos Company's Works, making asbestos infused wallpaper and other paper products. The paper mill was one of three individual works within the site with a textile factory producing asbestos infused cotton and woollen goods and an Indian Rubber works. Although these three avenues may seem somewhat disparate, asbestos was frequently combined with textile and rubber products to produce waterproof, fire resistant materials. The growing dominance of steam power was again important, with insulation key for effective power generation. Asbestos woven mattresses and linings were used as insulation around ships' boilers. In 1884 the United Asbestos Company received its first government contract supplying the Royal Navy.

Despite the nation's increasing reliance upon steam power, much of the machinery at the mills continued to be driven by water. Watermills probably serving each of the three individual components of the business. The division of the site between these businesses is rather uncertain, although it is likely the Salamander Works lay at what is now known as Salamander Quay to the south of Park Lane.

Additional buildings were added during the 1880's and 1890's, the largest of which was the Long Room, (B9) an apt name for a building more than 140m in length. This building, originally single storeyed, remains visible on the site. Sadly, later alterations have robbed the building of any internal machinery or fitting from which its function can be gleaned. However, it is likely to have been used in the manufacture of paper products or perhaps textiles. Late 19th century paper making machines could be over 100m in length (Cossons 1975, 286). The new Long Room building B9 initially extended to the northern edge of the excavation area, only being expanded to encroach onto site during the 20th century.

Figure 9: Period 1.3 remains and the 1895 Ordnance Survey map

Cartographic sources suggest that at least part of building B3 was rebuilt during this period, although only a single wall foundation remained from this alteration. Similarly, few changes were noted to the B2 sheds in the south-east with a gully dug and backfilled within the building. The open space between the two buildings, OA2 (Figure 8), was maintained and contained a well that was built at this time. The advertisement for United Asbestos published in 'Engineering' Magazine in 1889 (Figure 10) includes an illustration of the mills viewed from the west. The chimney relating to B3 is shown on the left of the image, surrounded by buildings B1, B4, B8 and B11 with B3 to the south. The Grand Union Canal along with other mill buildings can be seen in the foreground.

Figure 10: United Asbestos Company advertisement (Engineering; 13th December 1889; with permission of Graces Guide https://www.gracesguide.co.uk/File:Im18891213Eng-United2.jpg)

The most notable addition to the site observed within the excavation area belonging to this phase of activity was the construction of two new buildings B4 and B8, abutting the existing building B11. The brick-built chamber of B11 was still in use in this period as evidenced by asbestos fibres as well as later 19th century pottery within the chamber backfill. It appears that it was repurposed for use within asbestos manufacture.

To the south of B11, new building B4 was a substantial, rectangular structure with cellars throughout, measuring c.9m x 6m and up to 1.5m in depth. Its external walls were built atop a stepped foundation with regular buttresses on its external sides. Internally the building was divided by an east-west partition wall into two rooms. The northern room (Figure 11) contained a red brick floor with a series of low walls forming three plinths upon which boilers for a regenerative furnace would have been housed. Finds from the backfill of these boiler housings included fragments of coal, fuel ash slag and hammerscale perhaps suggesting some smithing activity in the immediate area. The presence of refractory bricks again attested to the function of the building. To the south of the partition wall lay a single room, the full width of the building, the backfill of which contained abundant charcoal suggesting it functioned as a coal bunker. A brick flue ran along the eastern side of the cellar and fed into the existing flue, S2. The flue showed signs of vitrification confirming the building's role in heat generation.

Figure 11: The northern room in building B4 looking west (2m scale bar)

Building B8 was constructed to the north of existing building B11. It was less we preserved than building B4, mainly because it did not possess a basement. Only the external walls of the building survived. They were constructed from a mix of mainly reused brick in no particular bond suggesting this was a less substantial building than B4, perhaps some form of warehouse or shed. The reuse of a mix of brick including earlier 'Tudor' brick, may, like building B2, indicate that ancillary buildings were constructed from cheaper, reused materials. There was an absence of the 'Tudor' bricks from any other buildings constructed in this period, perhaps suggestive of more uniformity in building techniques or merely older materials were no longer readily available.

To the east of B11, B1 appears to have been extended northward during this period. The floor was of concrete while the eastern and southern walls were extant and were constructed from a variety of reused bricks bonded with lime mortar, perhaps surprising when cement mortar was prevalent. Interestingly one of the best-preserved stamped bricks derived from this structure but is likely to date to the early 20th century suggesting some swift repairs to the building. The brick bore the wording

„ADAMANTINE; TRADE MARK; H.B.H; CHAS DAVISON C?LD". Adamantine was one of the trade names used by Charles Davison & Co Ltd, who operated from Ewloe Barn Brickworks in Buckley, Chester, c.1900 (Welsh Govt. 2015). Makers' marks or stamps were found on 27 bricks from Periods 1.2 to 2.2, although the majority derived from Period 1.3 structures including the probable Victoria Garsfield Colliery bricks. The majority of the makers' marks simply comprised round indentations and aren't easily identified.

A new drainage system, S4, was constructed in the open space between buildings B1 and the range of buildings to the west at this time. It comprised three manholes connected by a north-south aligned ceramic pipe. Additional drainage suggests there was perhaps a concern with the damp conditions that tend to pervade riverside locations. This appears to have been a concern not just within the workplace but also for the accommodation of the mill workers; in 1886 Mr J Boyd, the manager of United Asbestos at Harefield requested additional drainage for housing leased by the company for its workers (Piercy 2024).

The provision of accommodation was something that proved necessary. The mills were becoming the largest and most important employer in the area, while Harefield and nearby West Hyde remained rural villages with limited transport links making commuting to work from further afield an unappetising prospect. Most workers appear to have been locals (K. Piercy pers. comm.) although some accommodation had been built, initially during the early part of the 19th century, a terrace known as 'Workhouse Row' constructed to the west of the mill; its name indicating the poor quality of the accommodation. Further housing was constructed including along Summerhouse Lane immediately to the east of the site (Tyack 1976, 38), this can be seen in the background of Figure 10 Despite this recruitment remained an issue as attested by continued advertising in local paper such as the Middlesex Gazette. These new workers became boarders in the houses of local residents many of whom worked for United Asbestos themselves. The success of this strategy was limited with over 90% of employees living in Harefield according to the 1911 census (K. Piercy pers. comm.).

The conditions for workers at the mills were often bad. The Watford Medical Officer complained in 1890 about the, often delayed, threat of dust (Tyack 1976, 50), an early hint of the massive health problems found to be associated with asbestos. The death rates in both Harefield and

West Hyde were consequently higher than elsewhere in the area (ibid.). The poor working conditions extended beyond the now obvious hazard of asbestos manufacture. United Asbestos were prosecuted by the Uxbridge Petty Sessions Court in November 1890 for 35 cases of infringing the Factory Acts (The Provinces 1890, 3). These infringements included employing women and children during prohibited hours and the extensive use of overtime with some cases of working over 30 hour shifts with little rest. The company admitted culpability in all cases, arguing allowances be made for the unpredictability of the water flow to the mills. It is notable that in each case, when asked, the workers said that they volunteered to work overtime and would rather have the extra money than the rest, perhaps saying more about the wages at the mills rather than the enthusiasm of the staff. Nevertheless, the wages were better than those for most alternative employment in the area (Tyack 1976, 21).

Figure 12: The spinning department in 1891 (permission granted by the Harefield Historical Society. Donated to them by Reg Neil)

One of the company's representatives during the case was the Works Manager Mr John McCallum, perhaps the man with the closest and longest association with the asbestos mills. McCallum had joined the works in 1884 (Tyack 1976, 22), he remained Works Manager for three decades. His influence on the mills and on the Harefield community was immense, extending into politics as a local councillor, sport and leisure as part of the factory cricket and football clubs and within the Methodist community. It is unclear to what extent he bears blame for the poor conditions at the works in 1890; certainly, there was an improvement over his tenure and he actually became a Guardian of the Poor in 1897 (Tyack 1976, 23).

Period 2.1, AD 1896–1914: The heyday of asbestos

Figure 13: Period 2.1 plan

The United Asbestos Company continued to profit greatly from its contracts with the Royal Navy, receiving the contract for 17 years in succession (K. Piercy pers. comm.). This commercial success led to the expansion of production and consequently of employment. United Asbestos, already one of the largest employers in the area, had between 180 employees in 1890, but by 1901 over 400 people worked there (Piercy pers. comm.).

The demographics of the workforce was reasonably broad, the 1911 census showing that 85 of the 214 employees were female (Piercy pers. comm.). The vast majority of women were young with nearly half being aged between 14 and 19, this is a much higher proportion than in males where it was 22.5%. The number of women and girls employed was partly down to the nature of the industry where weaving and textile manufacture were integral. Photographs of spinning department in 1891 and of mattress production in the 1910's show primarily women (Figures 12 and 14).

Figure 14: Mattress production during the 1910's (Imperial War Museum, The employment of women in Britain; IWM Q28244; Q28250)

In 1910 United Asbestos merged with Bell's Asbestos Company of Southwark who produced asbestos packing, importing raw material from Quebec, Canada. United Asbestos appears to have been the minor partner within the merger, with few of the management of United Asbestos, still listed as such in 1914 (Skinner 1908, 2178; 1912, 1589). Despite this, Mr McCallum remained ever present at the works, as well as continuing to acquire honours and positions in the local community. During the 1910's he became Council Schools Manager and then a Justice of the Peace.

Figure 15: Period 2.1 remains and the 1914 Ordnance Survey map

The 1914 Ordnance Survey map (Figure 15) shows some significant alterations from the 1895 map. It is unclear precisely when these occurred, although the Harefield Land Valuation begun in 1909 used the 1896 map so it would be fair to surmise that many of the structural changes occurred around

the time of the merger with Bell's rather than before. The most major change within the excavation area was the demolition of building B4 and its replacement by a larger, building B7 (Figure 13), which was single storeyed with a double pitched roof. The previous building was demolished with its cellar partially backfilled. The new rectangular building was constructed from red and yellow brick; the new footprint extended eastwards to abut building B1. A new cellar in the north-west of the building reused portions of the previous cellar with the addition of a new red brick floor surface. Two chambers lay to the north of the floor, one appearing to be a combustion chamber that showed signs of burning. The second chamber had an iron pipe extending from it and may have functioned to regulate the temperature of the gases produced, another refractory brick was recovered from this chamber. A brick base for a now lost piece of machinery was also recorded within the cellar. A second cellar was recorded in the south-east of building B7 comprising red and yellow brick walls and a concrete floor with no indication of the room's function.

While only minor changes were made to buildings B8 and B11 with the infilling and disuse of the chamber in B11 and the addition of a single wall in B8, a large new building B6 was constructed immediately to the north of building B1. This may not have functioned as a single coherent structure above ground level and does not appear as such on the 1912 Ordnance Survey map. It may rather have comprised some covered rooms and some left open, perhaps for ventilation. The remains consisted of a north-south wall with two perpendicular walls running eastwards; all were constructed from red and yellow brick, again much of which was reused. Between the east-west walls, was a large circular tank sealed by a reinforced concrete cap. This structure contained waste and oil but does not seem likely to have been fuel tank as it was connected to a new drainage system, S5, which ran north-westwards from the tank out towards the canal.

The Long Room was extended southwards in this period with the remains of this new extension recorded within the excavation area B9. The new building comprised two external brick walls as well as a cellar with yellow brick walls and a concrete floor which had drainage channels in. The room was accessed via steps abutting the north wall.

A new long, irregularly shaped building B5 was added in the south-east, abutting the B2 sheds and connecting it to B1. The building comprised two north-south ranges connected by a series of east-

west aligned rooms. The shape of the building suggests it may not have been constructed as a single building, although it is depicted as such on maps. Although much of the building had been removed by modern services, the northern part of the building connecting to B1 was recorded within the excavation as a stepped foundation of red and yellow brick, surrounding a rectangular chamber constructed from the same materials. The function of the chamber and of the building is uncertain, although the fill of the chamber contained frequent asbestos fibres. The redevelopment of the B2 sheds included a westward extension of the sheds. The only sign of this seen in the excavation was the installation of a new drainage systems S6 and S7 in the open area between building B2, B5 and B3. S6 was L-shaped and consisted of ceramic pipes connecting two manholes. Drain S7 ran north-westwards from building B5 and comprised a ceramic drain and little else. New internal walls within the existing B2 sheds were also recorded.

The largest assemblage of finds derived from this period, perhaps because of the increase in construction or more likely the better preservation from more recent periods. The finds were generally a mixture of residual material as well as later artefacts attesting to the continued use of building well into the 20th century. The CBM was almost exclusively dated to the 19th and 20th centuries suggesting some reuse of materials from earlier structures alongside new, modern brick.

Period 2.2, 1915–1934: The rise and fall of Bell's United Asbestos Company

Figure 16: Period 2.2 plan

The years following the merger with Bell's were a time of great change for the business and for Harefield. Perhaps the most significant change was the development of Poilite, a product that combined asbestos with cement to produce tiles and board still seen in many places. The product began large scale production in 1913 in a new purpose-built factory to the south of the site (K. Piercy, pers. comm.). It required large amounts of cement imported by barge from the Harefield Cement Works further downstream. Poilite was a major success for Bell's United and heralded a profitable period, rising dividends being paid to the shareholders each year from 1910 to 1914 (K. Piercy, pers. comm.). The

First World War was also a time of considerable profit, the British Navy contracts, established in the 1880's, continuing to bear fruit. This was in spite of a near doubling of the wage bill between 1914 and 1918, probably a result of a decline in the labour pool with most young men taking part in the war (K. Piercy, pers. comm.).

The focus of development during the period was unsurprisingly on the Poilite works to the south rather than the older part of the site. The only new building within the excavation area was building B10 which replaced the previous building B8, this work also saw the demolition of buildings B6 and B11. Two lengths of east-west aligned wall, both of which abutted a north-south wall all had stepped foundations with regular counterforts. A brick pier was located in the west of the building. Despite its relatively substantial construction, little else of the building survived, primarily as it did not possess a cellar and had been demolished below floor level.

Figure 17: Photograph of the Bell's United Asbestos Works in 1921 viewed from the west (Historic Environment Scotland. [EPW006657] Bells United Asbestos Works, Harefield, 1921. Historic England)

The remaining building work dating to this period comprised alterations and repairs to existing buildings, particularly to the older structures on the site. Buildings B1 and B2 were repaired and a portion of new floor added in B1. The flue system, S2, was also repaired with an inspection pit dug and a drain added; one of the bricks from this was stamped with the name 'FOSTER' which can be traced to H. Foster and Company, which made bricks at Backworth, North Tyneside, from 1877 to 1967 (Newcastle City Council 2024). Building B3 in the south-west was extended eastwards although this appears to have been a lightly built structure.

Figure 18: Period 2.2 remains and the 1934 Ordnance Survey map

Bell's Asbestos Company were acquired by Turner and Newall, an asbestos manufacturer from Manchester in 1928. The new owner clearly did not see the site as viable and production ceased in 1929.

Period 2.3, AD 1935–1980: The last years of industry; mid-20th century rubber production

Figure 19: Period 2.3 plan

Following the closure of the asbestos works in 1929, the site was left derelict until in 1935, Turner and Newell having asset stripped the site, removing much of the removable machinery to their site in Manchester, the lease was then taken up by Rubberware Ltd (Tyack 1976, 24). Though most of the existing buildings were maintained, the post-wars years saw a degree of fragmentation in the industry at the mills with various small companies taking up residence to manufacture products, many of which would have been familiar to previous generations of workers such as rubber valves and some asbestos products (ibid.). The layout of the site would have also been familiar, with very few structures added after 1935 although a new furnace was constructed within building B7 (Figure 19). The large chimney, S3, appears to have finally been disused and demolished in the post-war period. The associated flue system (S2) appears to have undergone some alteration, potentially indicating it was still in use in some capacity, perhaps as a drain. Many of the previous spaces between buildings were occupied by new sheds or extensions amalgamating many of the buildings into one continuous structure, these cannot have been substantial additions though as no evidence of them survived.

By 1962, Rubberware traded under the name Harefield Rubber Company which occupied the site until the late 1980's. Many of the buildings were demolished in the early 1990's and those that remained were let as commercial and office space. Evidence of this clearance was seen in the form of demolition deposits rich in brick and tile, and made ground for the subsequent concrete surfaces, laid for car parking.

DISCUSSION AND CONCLUSIONS

Coppermill Lock provides a fascinating glimpse into the process of industrialisation that occurred within rural communities in many parts of Britain during the 18th and 19th centuries. The impact of this process was profound, reshaping the landscape, the economy and in many ways society as well. The development of the Coppermill Lock site and of the Grand Union Canal are still perhaps the dominant

features of the west of Harefield, with roads, houses and topography all being influenced by their construction. The archaeological excavations have shone a light on the rapid and in some ways chaotic path that led to the site becoming the largest business in the area. Despite the succession of alterations and rebuilds, it was notable that many elements of the mills, particularly the chimney and central building, remained in use for perhaps as much as 150 years. The technological progress that led to the frequent rebuilds, also indirectly caused the changes to the materials being produced, paper, copper and asbestos. Despite these changes, the mills continued to rely on the natural resource which had originally dictated their location, water, whether providing directed power, or for steam and transport.

Within Harefield, the mills and neighbouring canal brought new wealth to some, particularly business owners, but also to a lesser extent those who had laboured on farms in previous generations. Increased wages did not necessarily lead to better living conditions, however, and certainly not to better health. It is difficult when examining the asbestos industry, not to view it through a prism of tragedy and shame which has enveloped the asbestos industry. Concerns about the effect of asbestos dust were being voiced even in the 19th century. These concerns were seen as secondary to the importance placed upon a product that fast became almost ubiquitous in Britain. It is then perhaps surprising that, despite the safety difficulties, asbestos manufacture has not been paid more attention within industrial archaeology. The works at Royal Quay, Coppermill Lock go some small way to addressing this.

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Fig.1

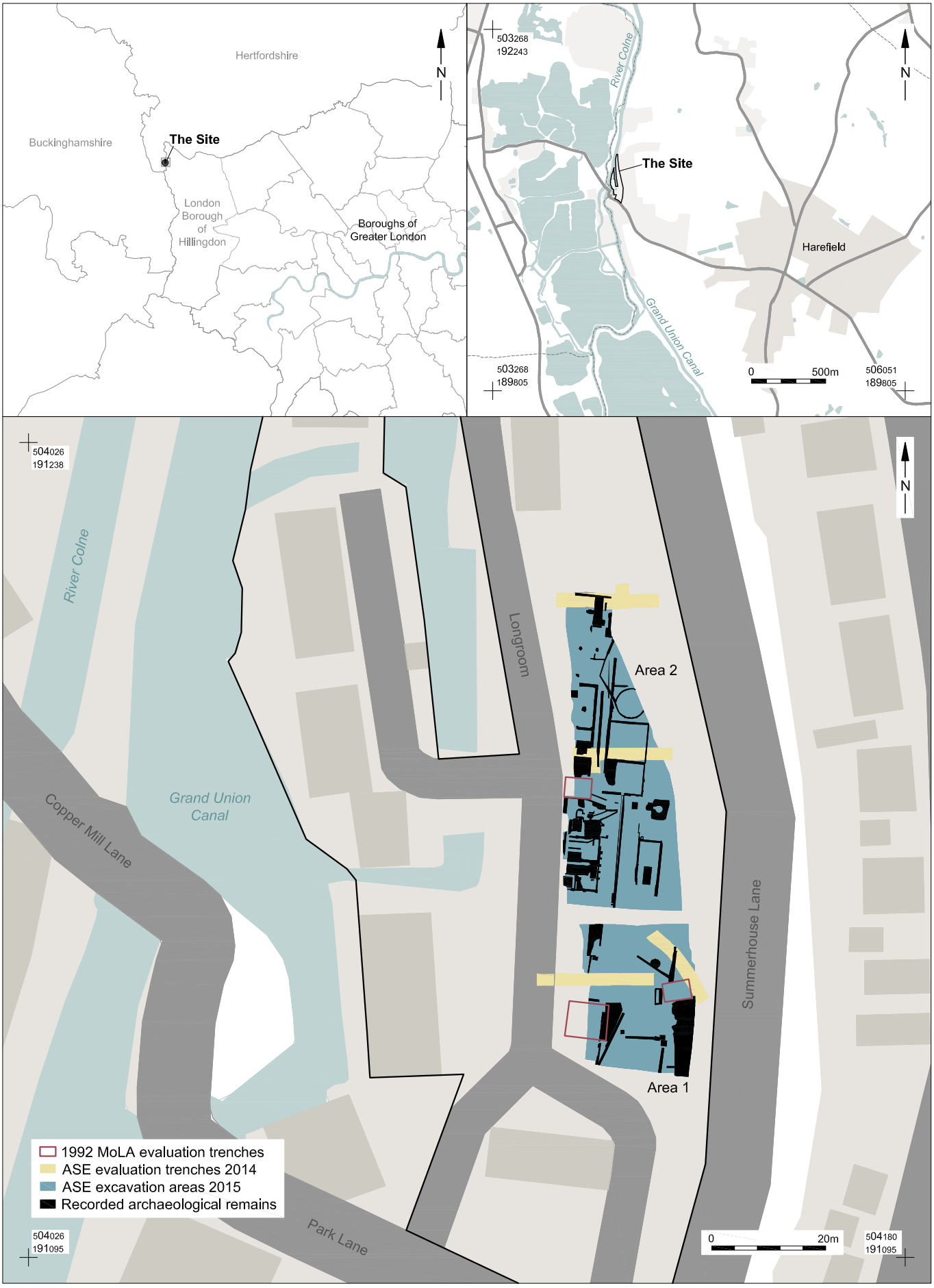

Hertfordshire
Buckinghamshire
The Site
London Borough of Hillingdon
Boroughs of Greater London
N
503268
192243
River Colne
The Site
Harefield
Grand Union Canal
503268
189805
0
500m
506051
189805
504026
191238
River Colne
Grand Union Canal
Copper Mill Lane
Longroom
Area 2
Area 1
Summerhouse Lane
Park Lane
1992 MoLA evaluation trenches
ASE evaluation trenches 2014
ASE excavation areas 2015
Recorded archaeological remains
504026
191095
0
20m
504180
191095

Fig.2

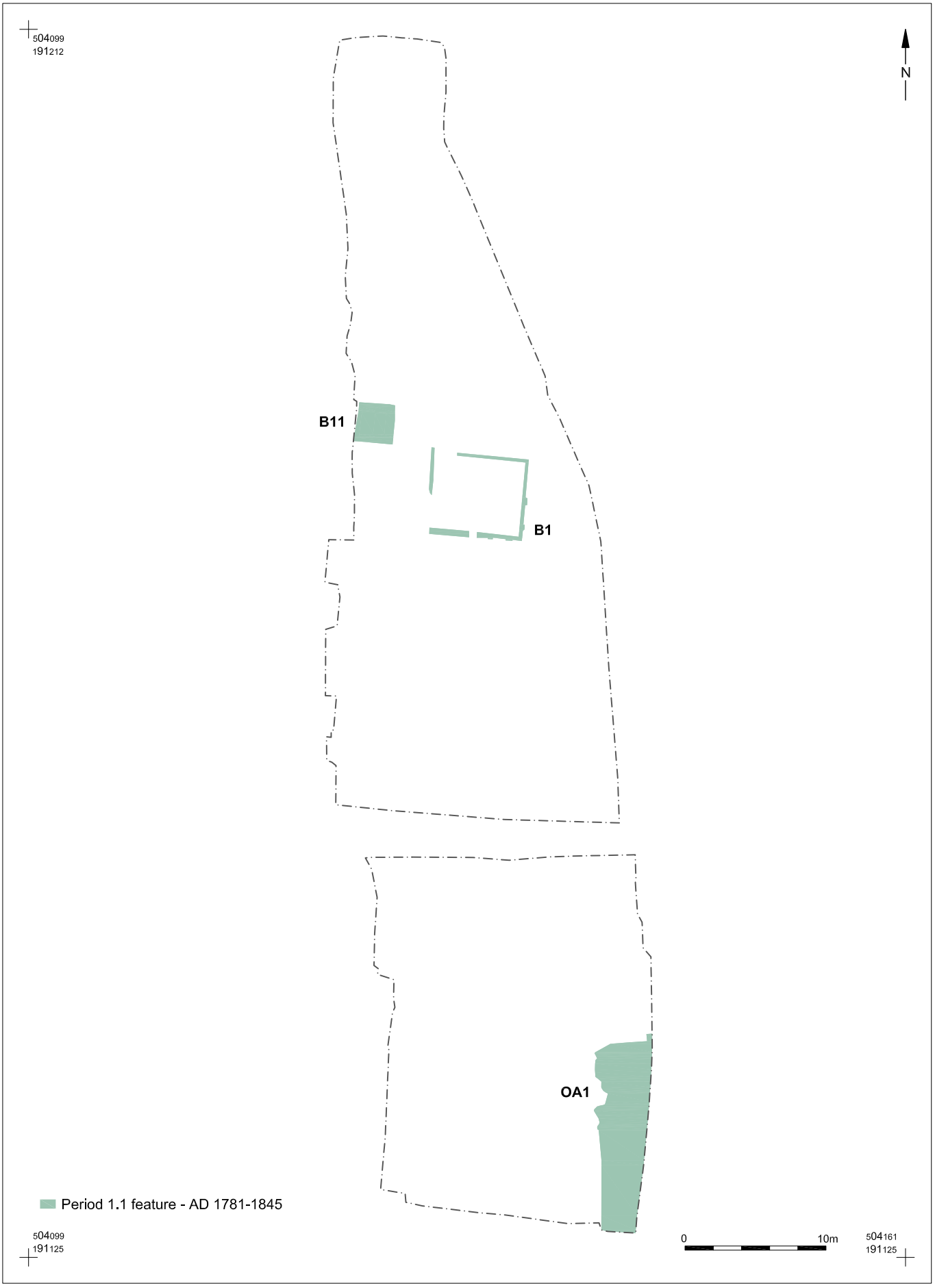

504099
191212
N
B11
B1
OA1
Period 1.1 feature - AD 1781-1845
504099
191125
0
10m
504161
191125

Fig.3

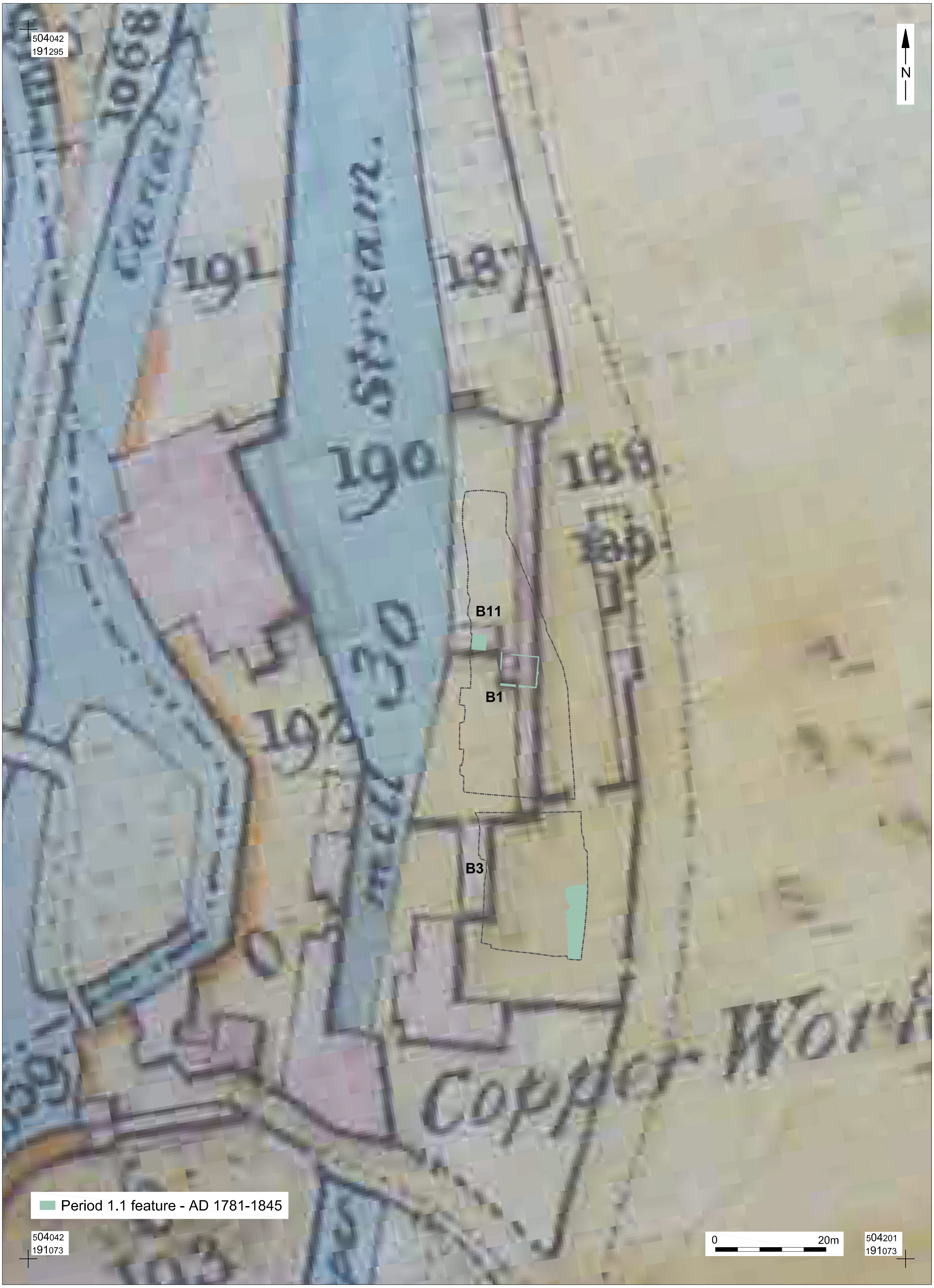
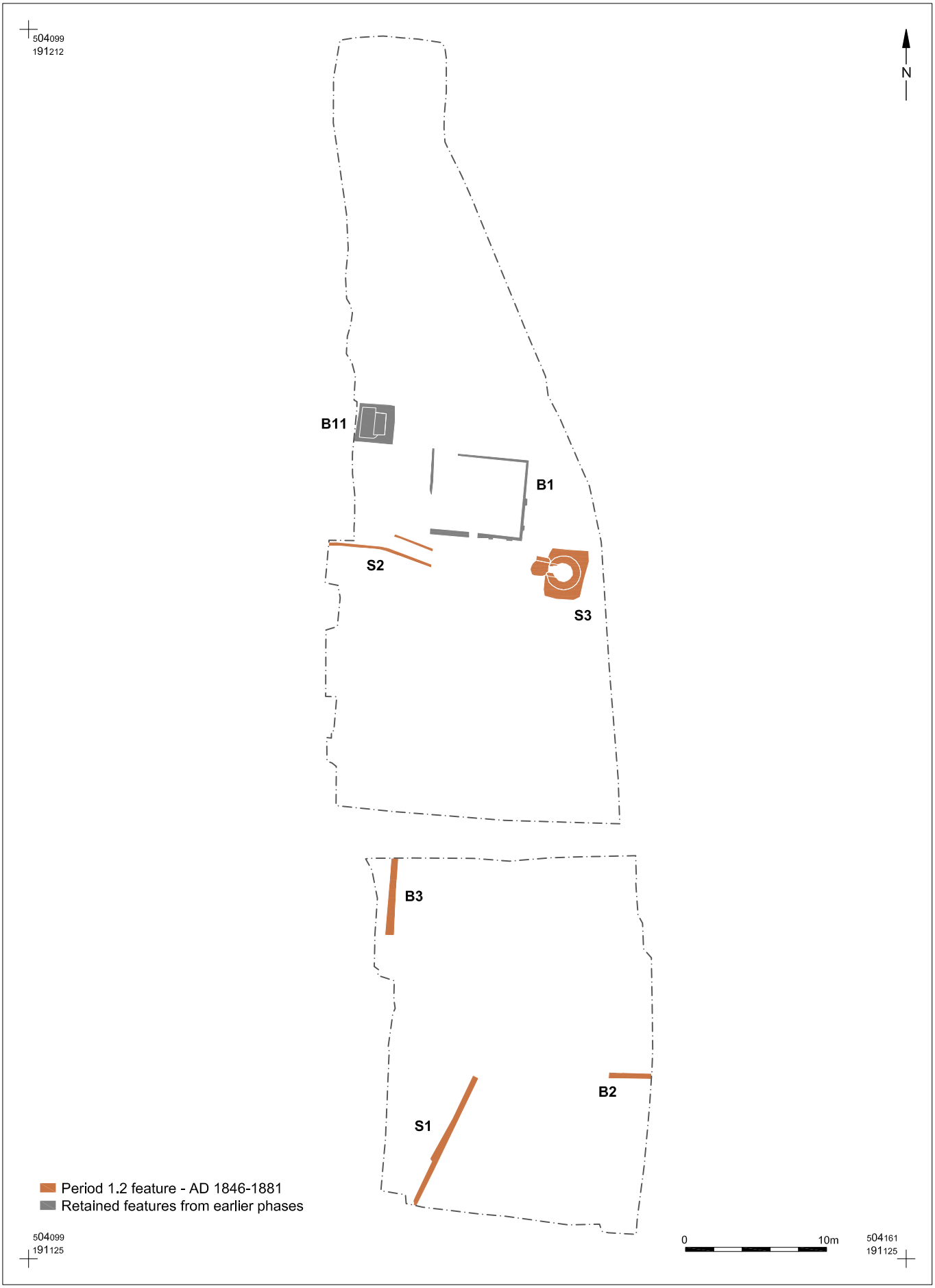

504042
191295
N
Canal
1068
191
Stream
187
190
188
189
30
B11
B1
B3
192
Copper Work
Period 1.1 feature - AD 1781-1845
504042
191073
0
20m
504201
191073

Fig.4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191212
N
B11
B1
S2
S3
B3
B2
S1
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Retained features from earlier phases
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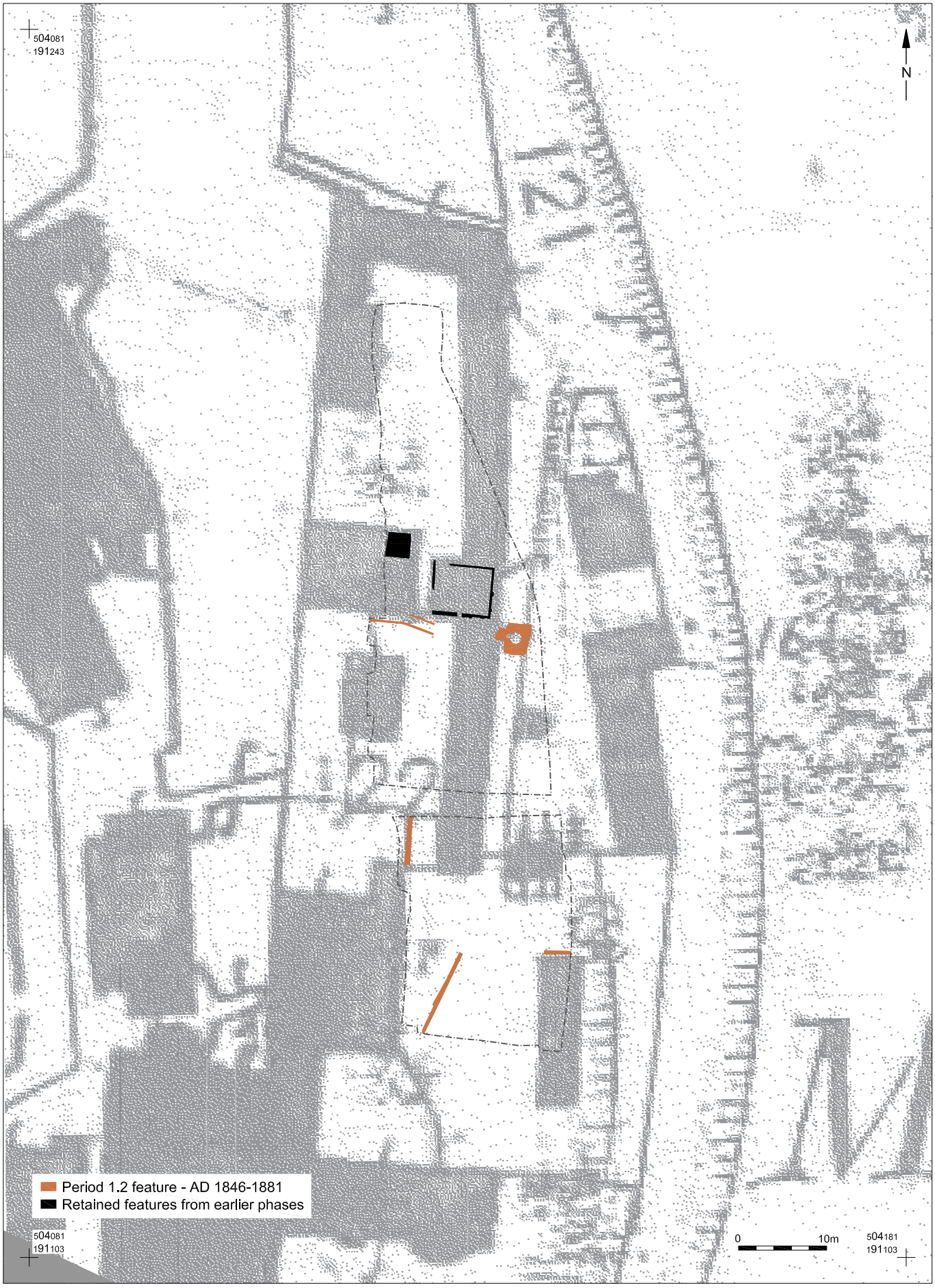
191125
0
10m
504161
191125

Fig.5

Fig. 6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191243
N
Period 1.2 feature - AD 1846-1881
Retained features from earlier phases
504081
191103
0
10m
504181
191103

Fig. 7


504081
191243
N
121
67
22
Period 1.2 feature - AD 1846-1881
Retained features from earlier phases
504081
191103
0
10m
504181
191103

Fig. 8


504099
191212
N
B8
S4
B11
B1 extension
B1
S2
S3
B4
B3
OA2
Well
B2
S1
Period 1.3 feature - AD 1882-1895
Retained features from earlier phases
504099
191125
0
10m
504161
191125

Fig. 9


504078
191241
N
181
F.B.
57A
315
Period 1.3 feature - AD 1882-1895
Retained features from earlier phases
504078
191100
0
10m
504178
191100

Fig. 10

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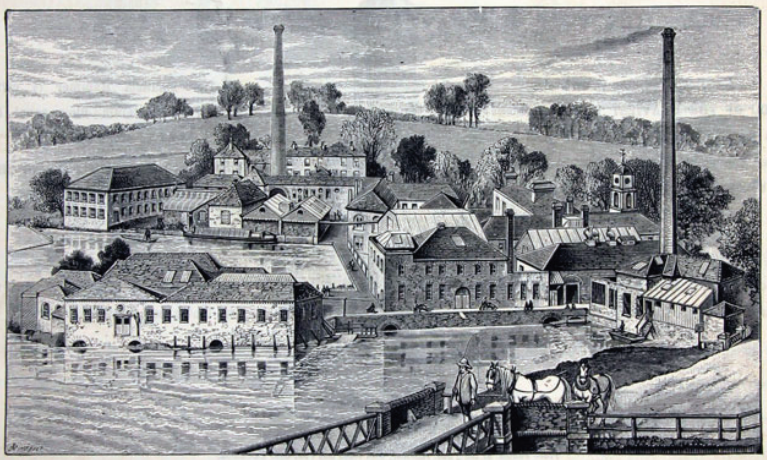

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United Asbestos Rubber Expansion Tape.
United Asbestos Rubber Composition Sheeting.

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United Asbestos Soapstone Packing.
United Asbestos Lubricated Packing.
United Asbestos Yarn.

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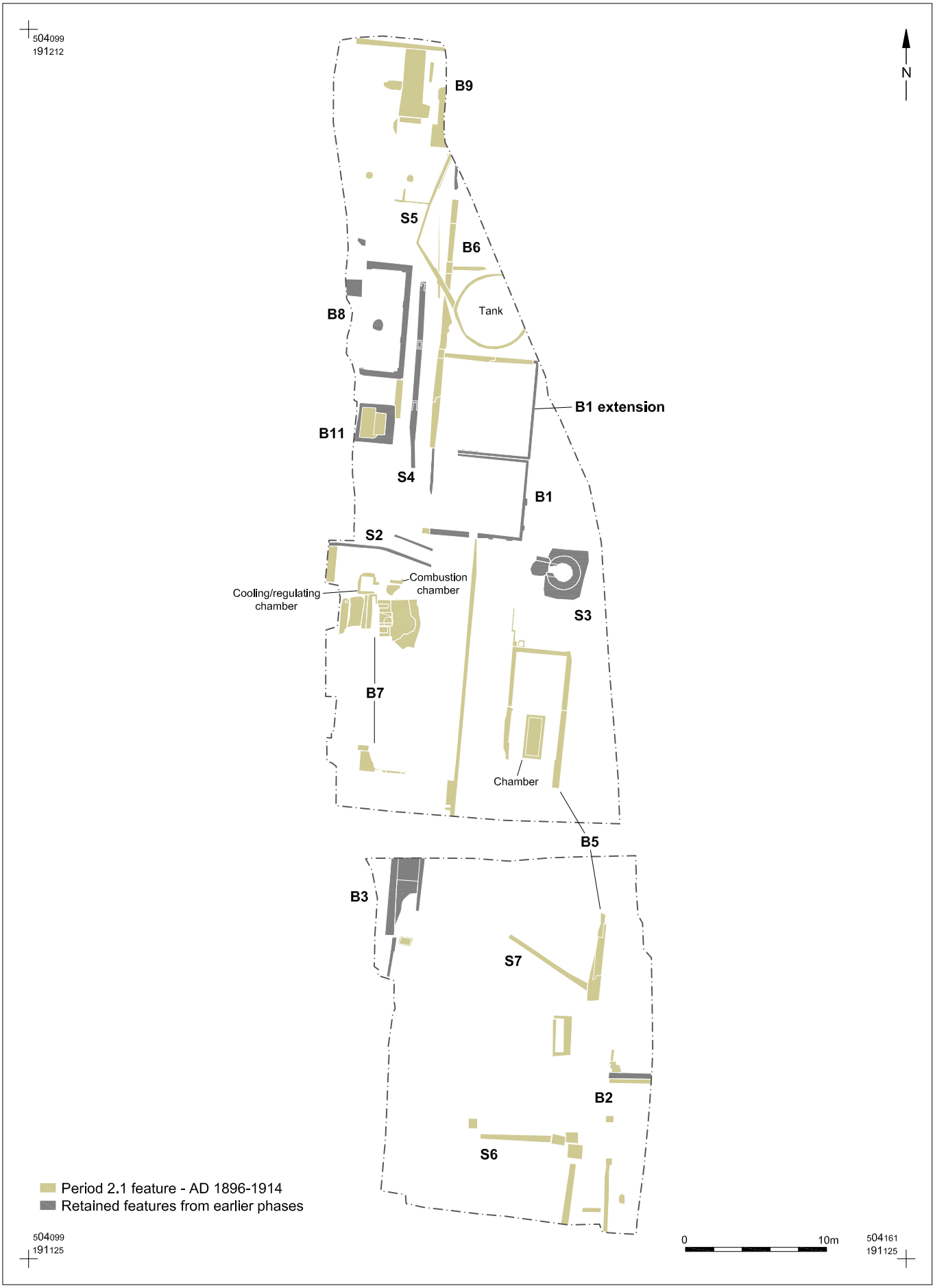
Special Trade Mark.

1967

Fig. 11

Fig.12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191212
N
B9
S5
B6
Tank
B8
B1 extension
B11
S4
B1
S2
Combustion chamber
Cooling/regulating chamber
S3
B7
Chamber
B5
B3
S7
B2
S6
Period 2.1 feature - AD 1896-1914
Retained features from earlier phases
504099
191125
0
10m
504161
191125

Image: IWM (Q 28244)

Image: IWM (Q 28250)

Fig.14

Fig.15


504089
191223
N
F.B.
Period 2.1 feature - AD 1896-1914
Retained features from earlier phases
504089
191112
0
10m
504169
191112

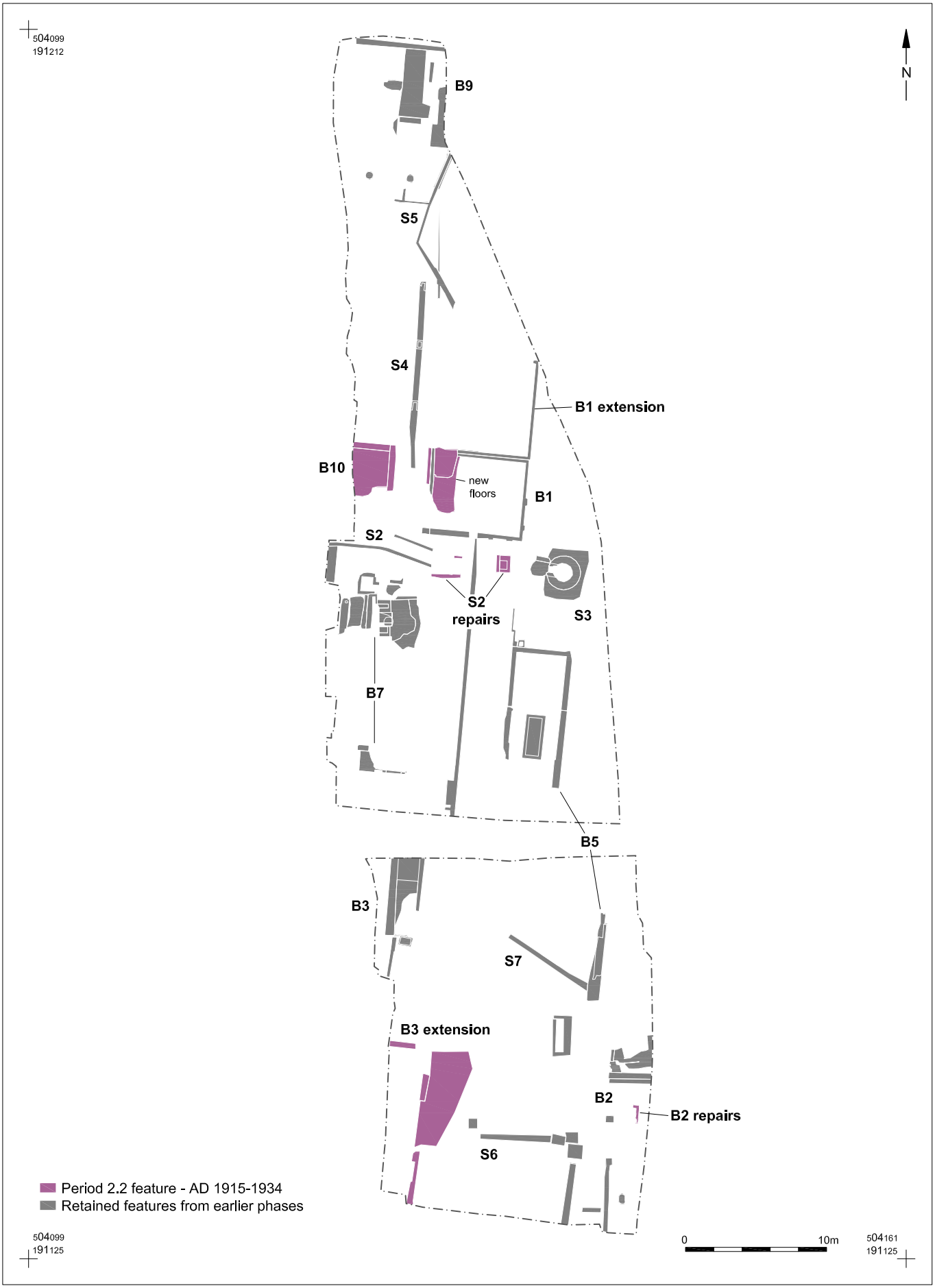

504099
191212
N
B9
S5
S4
B1 extension
B10
new
floors
B1
S2
S2
repairs
S3
B7
B5
B3
S7
B3 extension
B2
B2 repairs
S6
Period 2.2 feature - AD 1915-1934
Retained features from earlier phases
504099
191125
0
10m
504161
191125

Fig.17

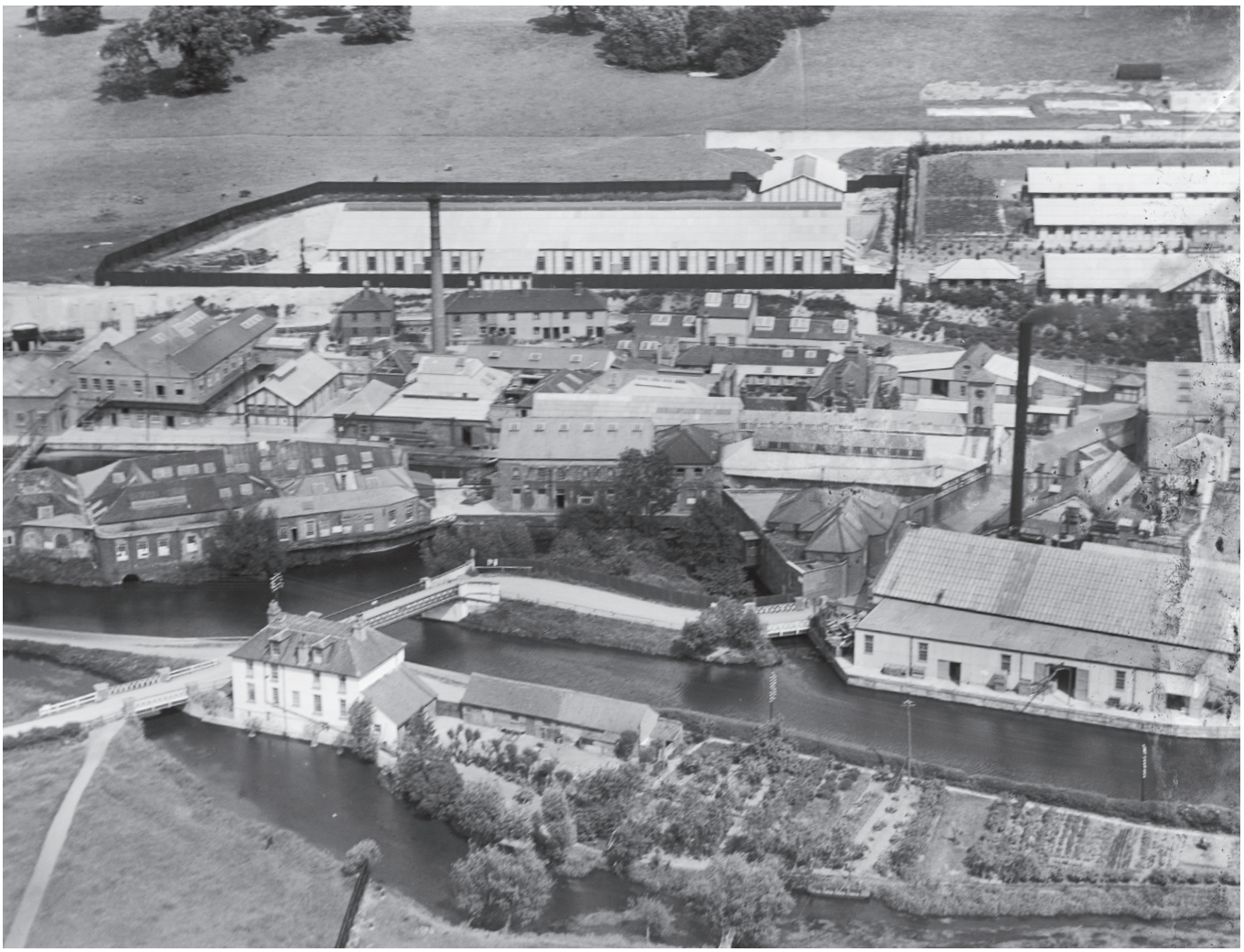


Fig. 18

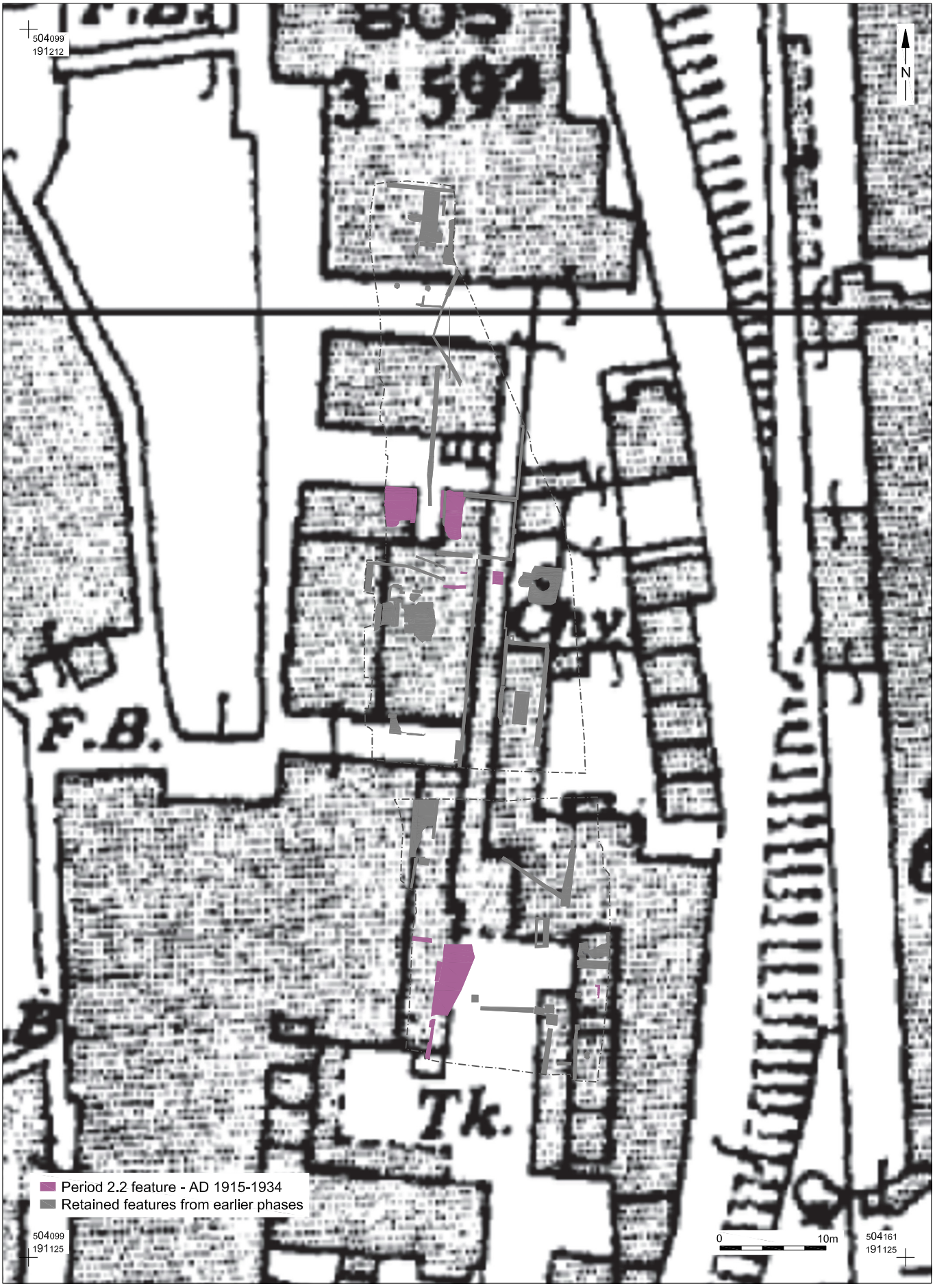
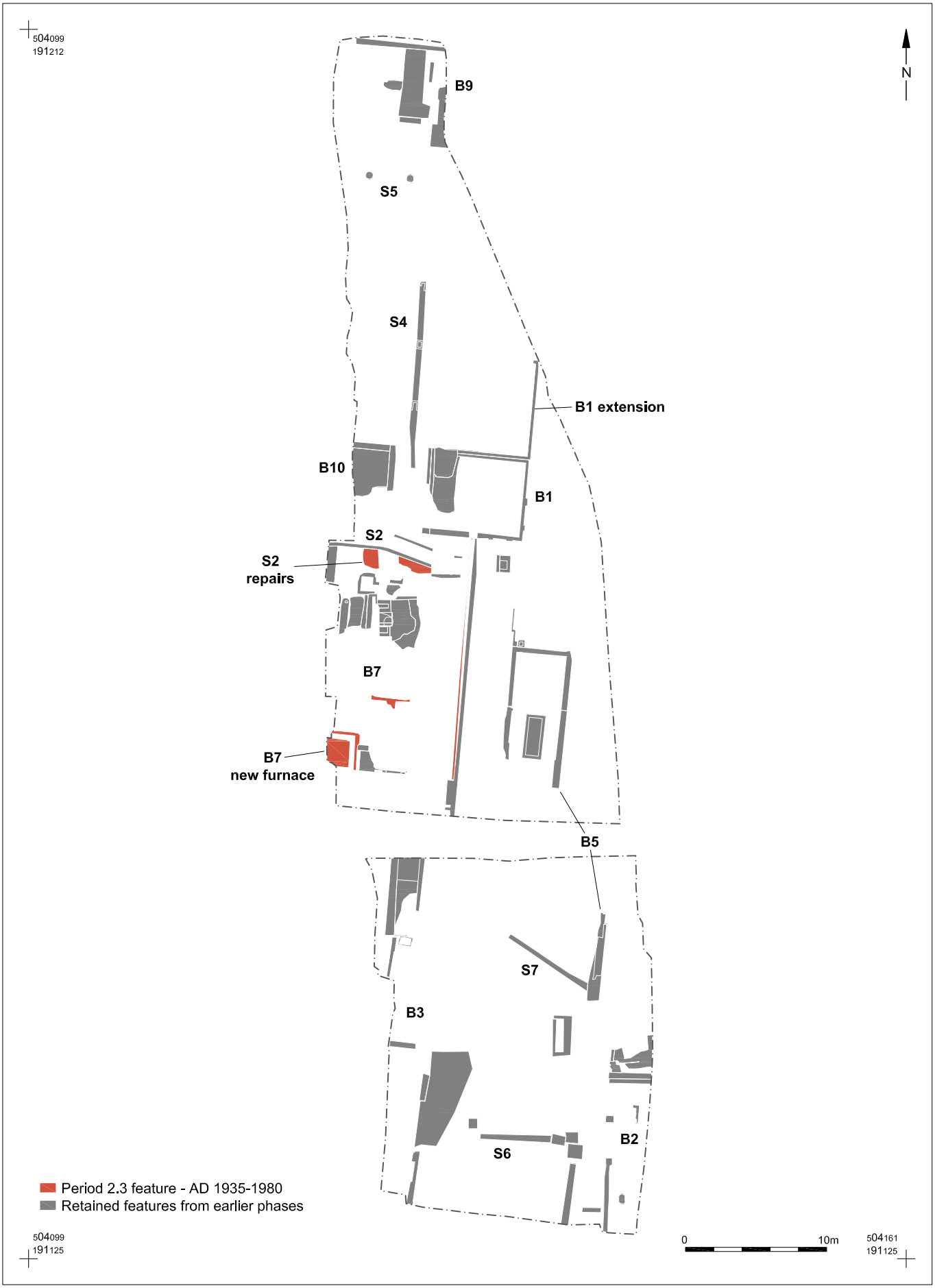

504099
191212
N
F.B.
Tk.
Period 2.2 feature - AD 1915-1934
Retained features from earlier phases
504099
191125
0
10m
504161
191125

Fig. 19


504099
191212
N
B9
S5
S4
B1 extension
B10
B1
S2
S2
repairs
B7
B7
new furnace
B5
S7
B3
B2
S6
Period 2.3 feature - AD 1935-1980
Retained features from earlier phases
504099
191125
0
10m
504161
191125