Waggonways and brickworks: insights into the industrial heritage of Walker

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SUMMARY

Two programmes of archaeological investigation recorded important components of industrial era infrastructure in the Walker suburb of Newcastle upon Tyne. Until industrialisation, Walker remained an essentially agricultural area to the east of the city but, like much of Tyneside, its landscape was swiftly and dramatically altered in the nineteenth century through development of the ironmaking, engineering, and shipbuilding sectors. Both of the sites investigated — the Lightfoot Centre on Wharrier Street, and Sir Charles Parsons School on Westbourne Avenue — yielded evidence of relatively early colliery waggonways, the fundamental mode of transportation prior to iron railways. The remains of a relatively little documented nineteenth-century brickworks, St Anthony's Brickworks, the first to be excavated on Tyneside, were also recorded at the Lightfoot Centre. Such manufactories provided the materials necessary for industrial buildings and the associated infrastructure, as well as for the huge increase in housing stock required to accommodate the much-enlarged population.

INTRODUCTION

Walker is an eastern suburb of Newcastle, located *c.* 3 km from the city centre, occupying an elevated plateau overlooking a sharp bend in the Tyne (fig. 1). With the exception of early coal mining, the area was largely agricultural until the mid-nineteenth century when the riverside area developed rapidly at the heart of the Tyneside shipbuilding industry. Two archaeological investigations undertaken by Pre-Construct Archaeology Limited (PCA) revealed remains of the industrial heritage of Walker. Work in 2011 in the grounds of the Lightfoot Centre leisure complex (LWS) was undertaken as part of a redevelopment scheme (the 'Heart of Walker' project) delivered by Aura, Newcastle City Council's private sector partner, with the aim of merging two existing primary schools into a single new school and refurbishing the Lightfoot Centre. The investigations took place on the outdoor athletics track and field along with adjacent sports pitches in the southern part of the complex (NZ 2860 6366: fig. 2). The second investigation took place between 2009 and 2011 at Sir Charles Parsons School (SCP), where the original school site was centred at NZ 2900 6510 (fig. 2). This work was undertaken during redevelopment of the school as part of the Newcastle Building Schools for the Future project. Both projects were commissioned by the principal contractor, Sir Robert McAlpine Limited.

From the mid-eighteenth century onwards, Walker Colliery, the core elements of which lay *c.* 1 km north-east of the Lightfoot Centre and 0.5 km south of the SCP site, was very much the focus of the industrial township. Since the 1930s, Walker has become subsumed into the urban sprawl of Newcastle, and now forms a core element of the east end of the city. The Heart of Walker redevelopment area lies within St Anthony's, the southernmost part of Walker, which was originally part of Byker.

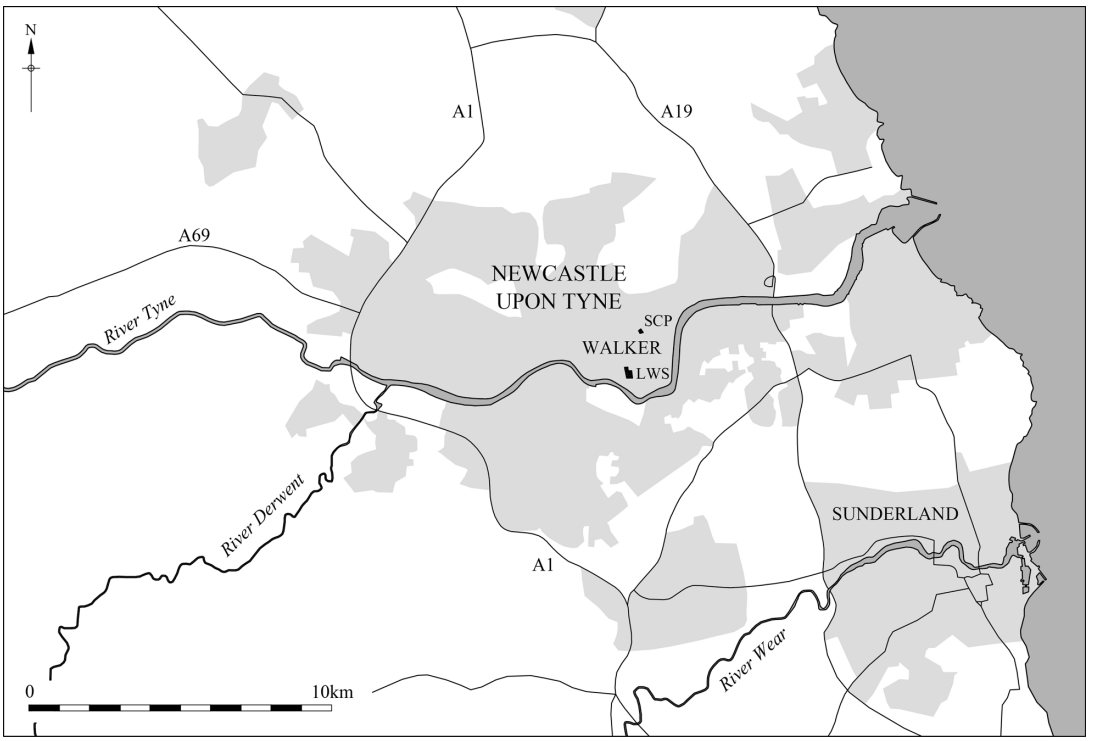

Fig. 1 Location of Walker.

Historic mapping (fig. 3) indicated that the sports pitches at the Lightfoot Centre were occupied from the late nineteenth century by St Anthony's Brickworks. Five trial trenches, investigated in 2011, revealed significant archaeological remains in two areas: structural remains of part of the brickworks complex in the central eastern part of the site and the track-side ditches of a hitherto unknown colliery waggonway in the south-western part. Two 'open areas' (Areas A and B) were investigated in March–May 2011 (fig. 2). Area A, which measured 54 m by 24 m, was positioned to record the remains of the brickworks to the maximum depth of the ground disturbance required for the redevelopment, *c.* 0.8 m below existing ground level. All exposed structural remains were hand-cleaned, photographed, and recorded in plan and section. Limited excavation took place only where necessary to understand the sequence of construction; the structural remains lay at the base of the formation level and, following the archaeological recording, they were covered in a protective membrane to be preserved *in situ*. Area B, which was positioned across the waggonway, measured 11 m by 6 m (fig. 2).

At the SCP site, historic mapping showed that a waggonway, thought to be of eighteenth-century origin, crossed the area, running from Gosforth Pit southwards towards the River Tyne. Trial trenching, undertaken in 2009, investigated its route in the south-eastern portion of the site. A substantial clay trackbed embankment was found in one trench, although no track timbers survived. Further archaeological excavation was undertaken following demolition of the school buildings, with three areas investigated along the route of the waggonway in November–December 2011; Area 1 measured 18.30 m NW–SE by 8.50 m NE–SW, Area 2

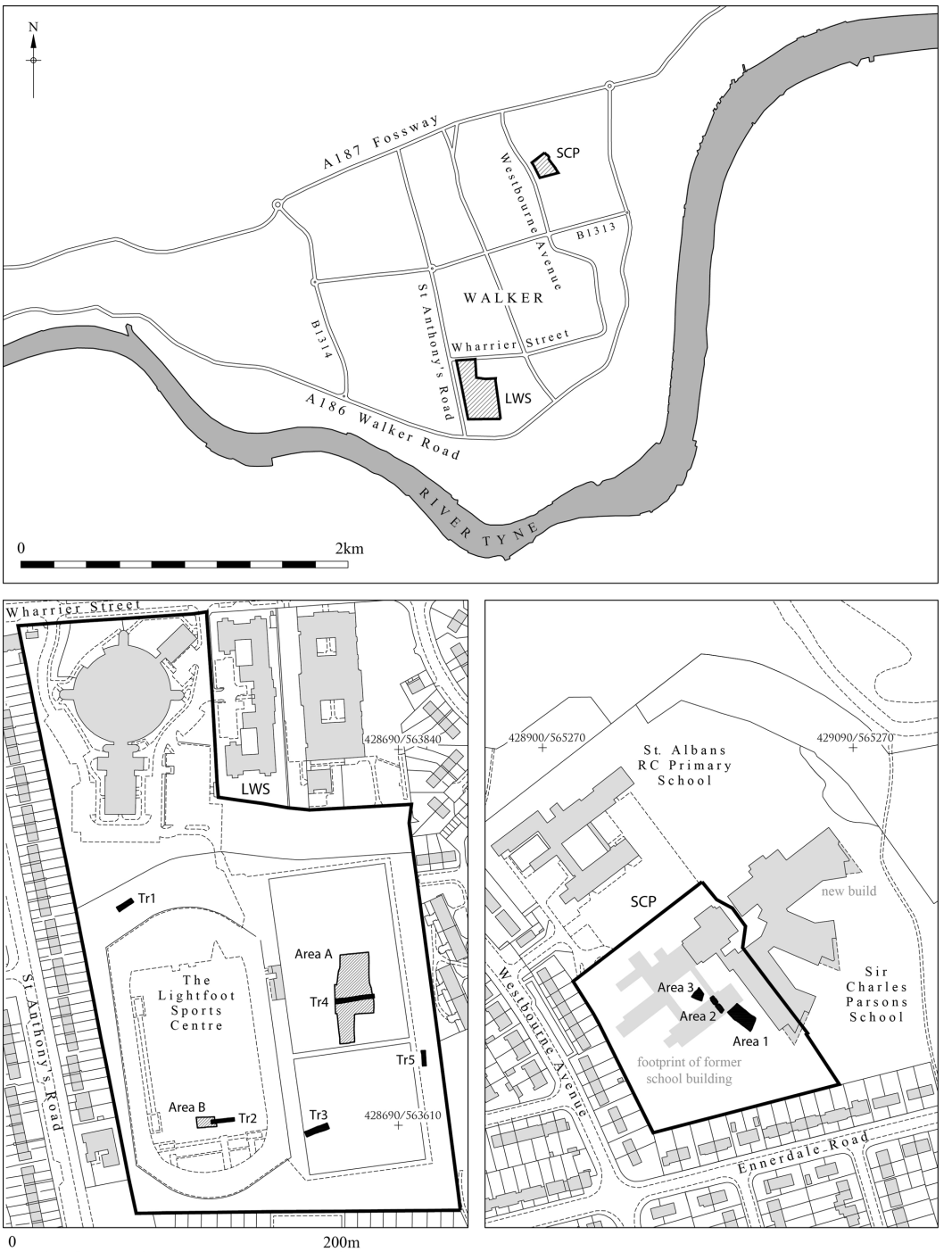

Fig. 2 Detailed site and trench locations.

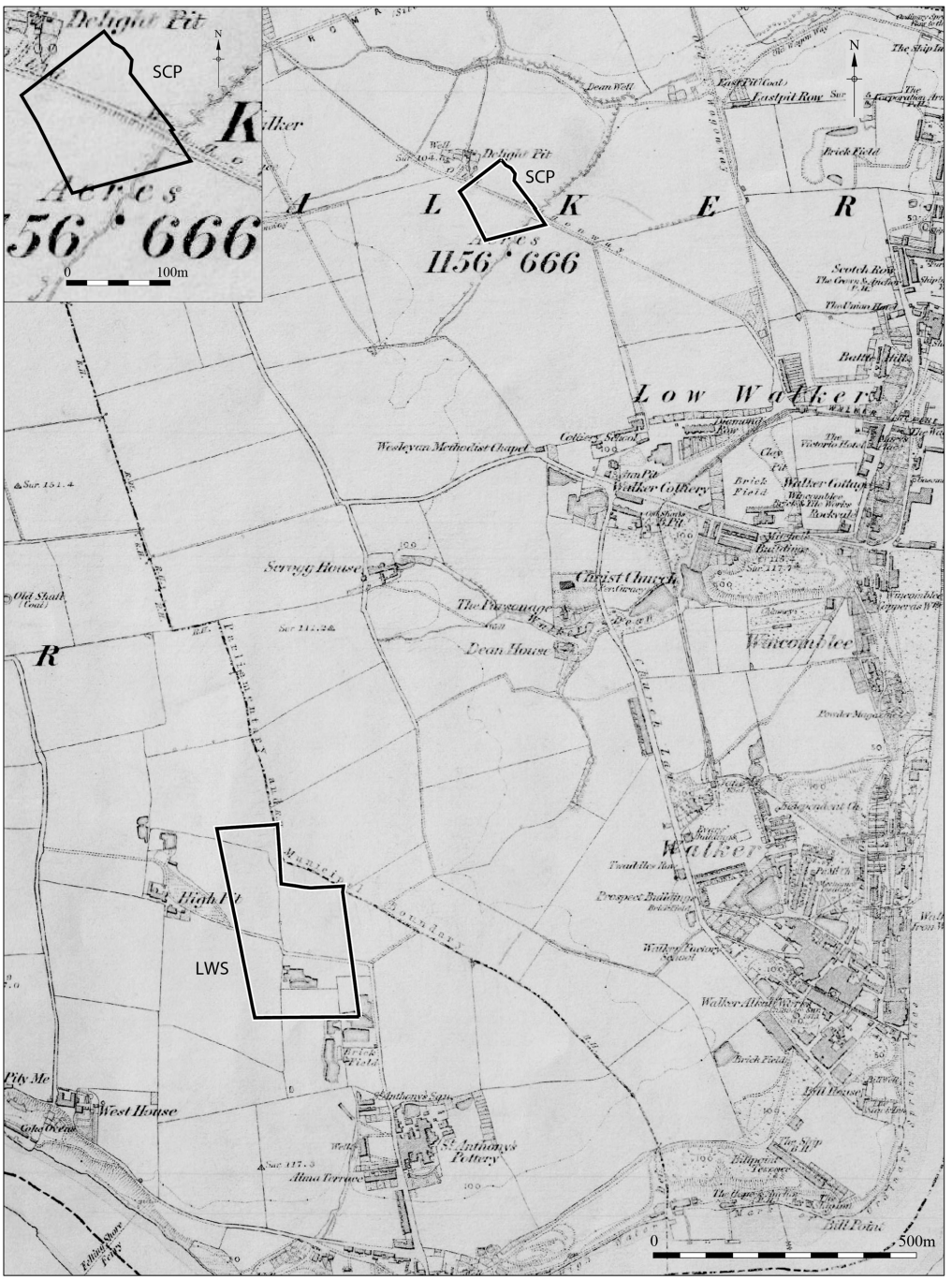

Fig. 3 Ordnance Survey first edition map of 1858, showing the sites at the Sir Charles Parsons School (SCP) and the Lightfoot Centre (LWS). The inset shows the site at the Sir Charles Parsons School, at twice the scale.

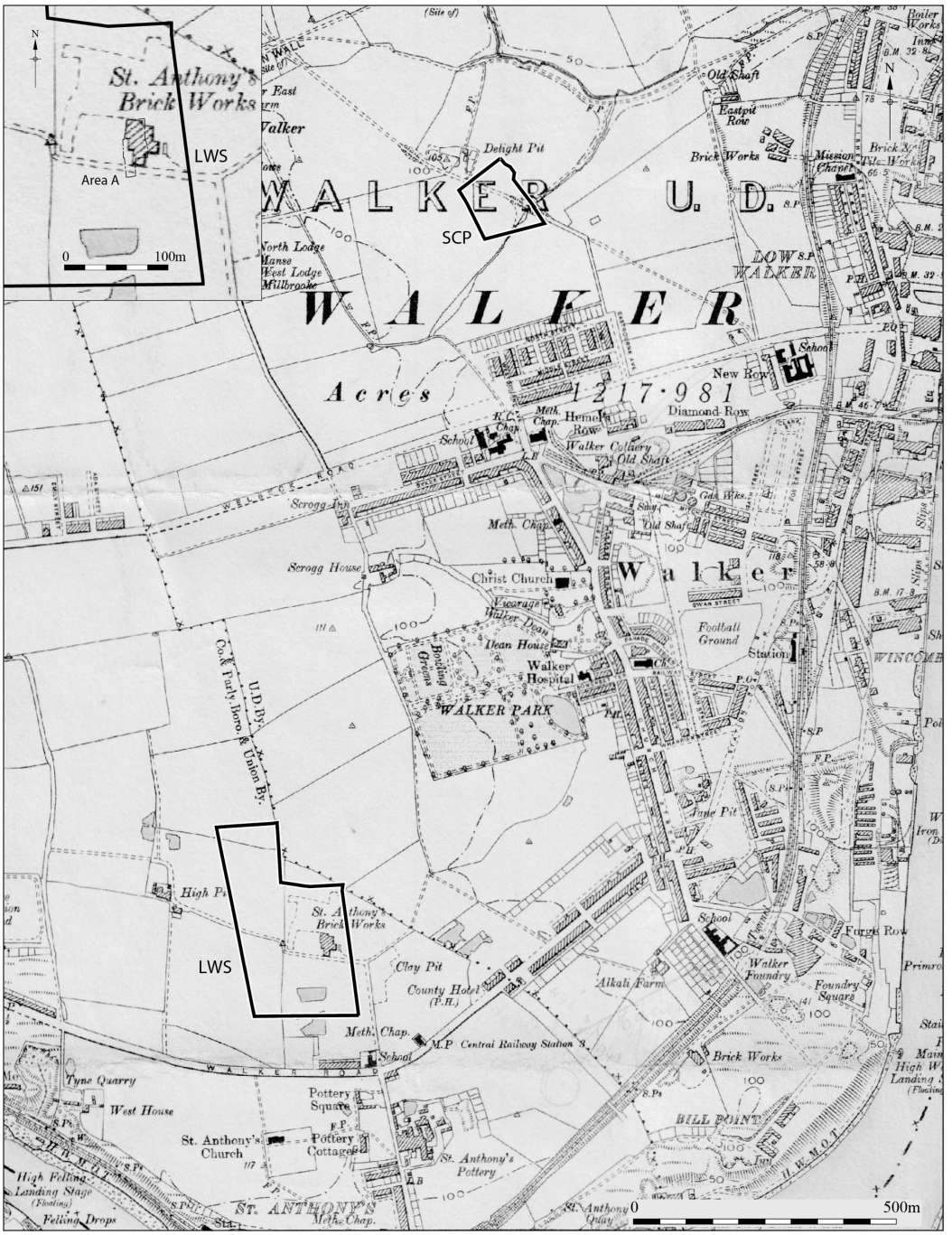

Fig. 4 Ordnance Survey second edition map of 1898, showing the sites at the Sir Charles Parsons School (SCP) and the Lightfoot Centre (LWS). The inset shows the St Anthony's Brickworks, on the site of the Lightfoot Centre, at twice the scale.

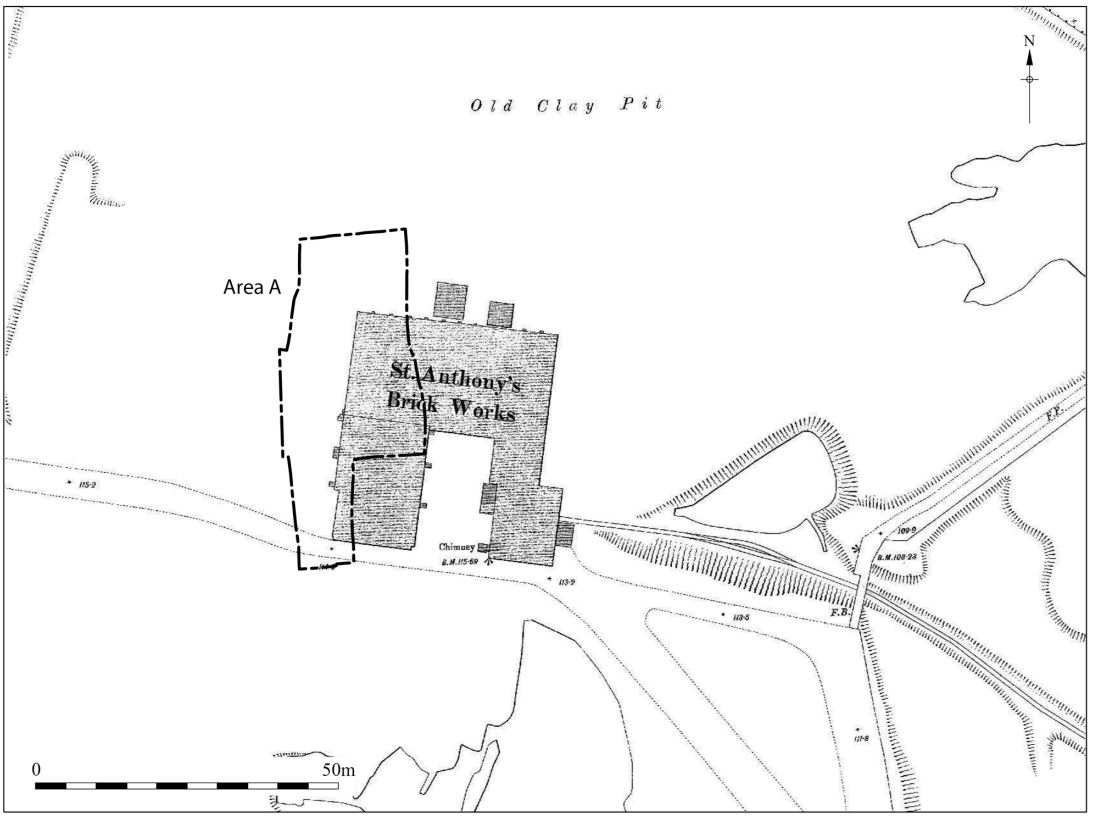

Fig. 5 Ordnance Survey map of 1907, 1:500 scale edition: detail of St Anthony's Brickworks.

measured 11 m NW–SE by 3 m NE–SW and Area 3 measured 6.65 m NW–SE by 7 m NE–SW (fig. 2). Two slots were excavated by machine within the north-western and south-eastern portions of Area 1 to establish the profile of the trackbed embankment, and slots were excavated by hand through the trackside ditches in the central part of Area 1, and through trackside ditches and other features associated with the waggonway in Areas 2 and 3.

TOPOGRAPHY

The geology of this part of Tyneside is formed by the Pennine Middle Coal Measures of the Upper Carboniferous, covered by a mantle of glacial debris which is often relatively thin. The Lightfoot Centre site lies *c.* 0.7 km north of the river (fig. 2). Across the wider area the ground level falls away to the south and east towards the Tyne. There is a slight fall across the overall complex, although the level athletics track and sports pitch is a product of modern landscaping. Sir Charles Parsons School lies *c.* 0.8 km to the west of the river as it loops northwards in this area. The new school lies on what was previously the western margin of the Waverdale Open Space, an area subject to substantial tipping of domestic and industrial waste after the Second World War and up to the 1970s. This activity infilled the denes of several converging streams, one of which is depicted on eighteenth- and nineteenth-century mapping crossing

the south-eastern portion of the original school site and continuing across the Waverdale Open Space. The streams in the vicinity of the site are generally tributaries of a watercourse known as Stott's Burn, which converged to the east before discharging into the Tyne. There is also evidence for some earlier infilling of this dene in the later post-medieval period in association with the construction of the colliery waggonway; this ran south-eastwards from Gosforth Pit, crossed the original school site on a NW–SE alignment, and headed towards the main workings of Walker Colliery and the riverside staithes. This waggonway is depicted on mid-nineteenth-century maps running along a substantial embankment as it crossed the dene in the south-eastern portion of the SCP site.

The SCP site was relatively flat, with a slight fall in ground level from north to south. Geotechnical investigations established the presence of a sinuous corridor of sub-surface 'made ground' crossing the school site and continuing onto Waverdale Open Space; this represents the infilled dene and demonstrates significant alteration to the natural topography: the main dene of Stott's Burn has been filled in to a depth of at least 9 m.

ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

The medieval village of Walker lay *c.* 0.5 km to the north of the Lightfoot Centre and *c.* 0.5 km to the north-west of the SCP site. The location of the village is known from mid-eighteenth-century mapping, which shows 'Walker' adjacent to Hadrian's Wall, with a triangular 'Town Green' to the south. By the mid-nineteenth century, maps depicted a small settlement there as 'Old Walker' (fig. 3). The settlement limits would not have extended as far south and south-east as the two sites described in this paper, but the area adjacent to the settlement nucleus would have been used for growing crops and pasturing livestock. St Anthony's is now the southernmost element of the Walker, but historically it was a parish of Byker township to the west (Dodds 1930). The Byker township was broken up into four parishes, and the modern parish of St Anthony's was formed in 1868 (Dodds 1930).

St Anthony's Colliery, founded in 1769, comprised three pits: Farewell, Nightingale and Restoration (Turnbull 2009, 108). The closest to the Lightfoot Centre was Restoration Pit, which lay immediately to the west of the northern part of the site. This is thought to be the same working named on the 1st edition Ordnance Survey map of 1858 as the 'High Pit' of Byker Colliery (fig. 3). Walker Colliery was also established in the second half of the eighteenth century; by the late eighteenth century it had become one of the most important collieries in the coalfield with several important developments in mining technology taking place here (Turnbull 2009, 105). Accounts held by the Durham Mining Museum show that West Engine Pit was sunk in 1766, Ann Pit shortly afterwards, East Engine Pit in 1770, and Gosforth Pit in 1782 (www.dmm.org.uk accessed 29 May 2013). An early nineteenth-century waggonway which crossed the SCP site on a NW–SE alignment ran south-eastwards from Delight Pit which was located a short distance north of the site, to riverside staithes at Wincomblee; this waggonway was later extended north-westwards to Gosforth Pit.

Little documentary evidence survives charting the history of the St Anthony's Brickworks; what is known comes mainly from Ordnance Survey maps. Brick manufacture was certainly being undertaken in the immediate vicinity of the Lightfoot Centre by the mid-nineteenth century; the 1st edition Ordnance Survey map of 1858 depicts a 'Brick Field' immediately adjacent to the south-eastern corner of the site (fig. 3). An architect's drawing submitted as a planning application to the Town Improvement Committee in 1886, and now held in the Tyne

and Wear Museums and Archives (T186/11858A), shows plans and elevations of two buildings to be constructed at 'Grant and Watsons Brick Works Saint Anthony's' (see fig. 20). The 2nd edition Ordnance Survey map of 1898 shows a building annotated as 'St. Anthony's Brick Works' (fig. 4). The brickworks had been completely rebuilt by 1907 (fig. 5) and were demolished sometime between the 1940 and 1951 editions of the map.

THE ARCHAEOLOGICAL REMAINS AT SIR CHARLES PARSONS SCHOOL

Phase 1: Natural deposits

The natural boulder clay within the excavation areas dropped from a level of 26.30 m OD in Area 3 to 24.20 m OD in the south-east of Area 1, a total of 2.10 m over 40 m, reflecting the original topography as ground level fell towards the dene of the Stott's Burn tributary.

Phase 2: Late eighteenth-century waggonway

WAGGONWAY EMBANKMENT

Phase 2 represents features and deposits associated with the eighteenth-century colliery waggonway that ran south-eastwards from Gosforth Pit of Walker Colliery through the site, crossing the dene of the Stott's Burn tributary, and continuing towards 'Low Walker' and riverside staithes. A substantial NW–SE aligned clay embankment was recorded in Areas 1 and 2 over a maximum distance of 27.6 m (figs. 6, 7 and 8). No embankment was identified within Area 3; this part of the site had been subject to horizontal truncation, and only natural boulder clay was present between the waggonway trackside ditches. However, as the purpose of an embankment was to create the necessary gradient for the efficient operation of the waggonway it is likely that no embankment was required in this area due to the height of the ground. In Area 2 the embankment survived to a maximum thickness of 0.17 m thick but was most substantial at the south-eastern end of Area 1 where the ground dropped towards the dene; here it was at least *c.* 3 m wide across the top, with a maximum recorded thickness of 1.35 m (Sections 1 and 2: fig. 9). The maximum recorded basal width of the embankment was 6.50 m, but the full width was not exposed at any point (Sections 1, 2 and 3, fig. 9). The top of the embankment was recorded at a height of 26.26 m OD in Area 2 and 26.16 m OD in Area 1, a drop of just 0.10 m over 14 m, and although the top of the embankment had been subject to some horizontal truncation, these heights do reflect the gentle gradient that was constructed to ensure the efficient operation of the waggonway.

A small assemblage of pottery, ceramic building material, and glass, recovered from the embankment deposits, was broadly datable to the eighteenth to nineteenth century (see Vaughan, below). Clay tobacco-pipe fragments of seventeenth- to eighteenth-century date included a stem with a stamp identified as Thomas Parke, a late seventeenth-century Gateshead maker (*c.* 1667–87).

WAGGONWAY TRACK

No waggonway track timbers survived *in situ*, but linear impressions infilled with coal and ash within the upper part of the clay embankment in Area 1 indicate the positions of timbers

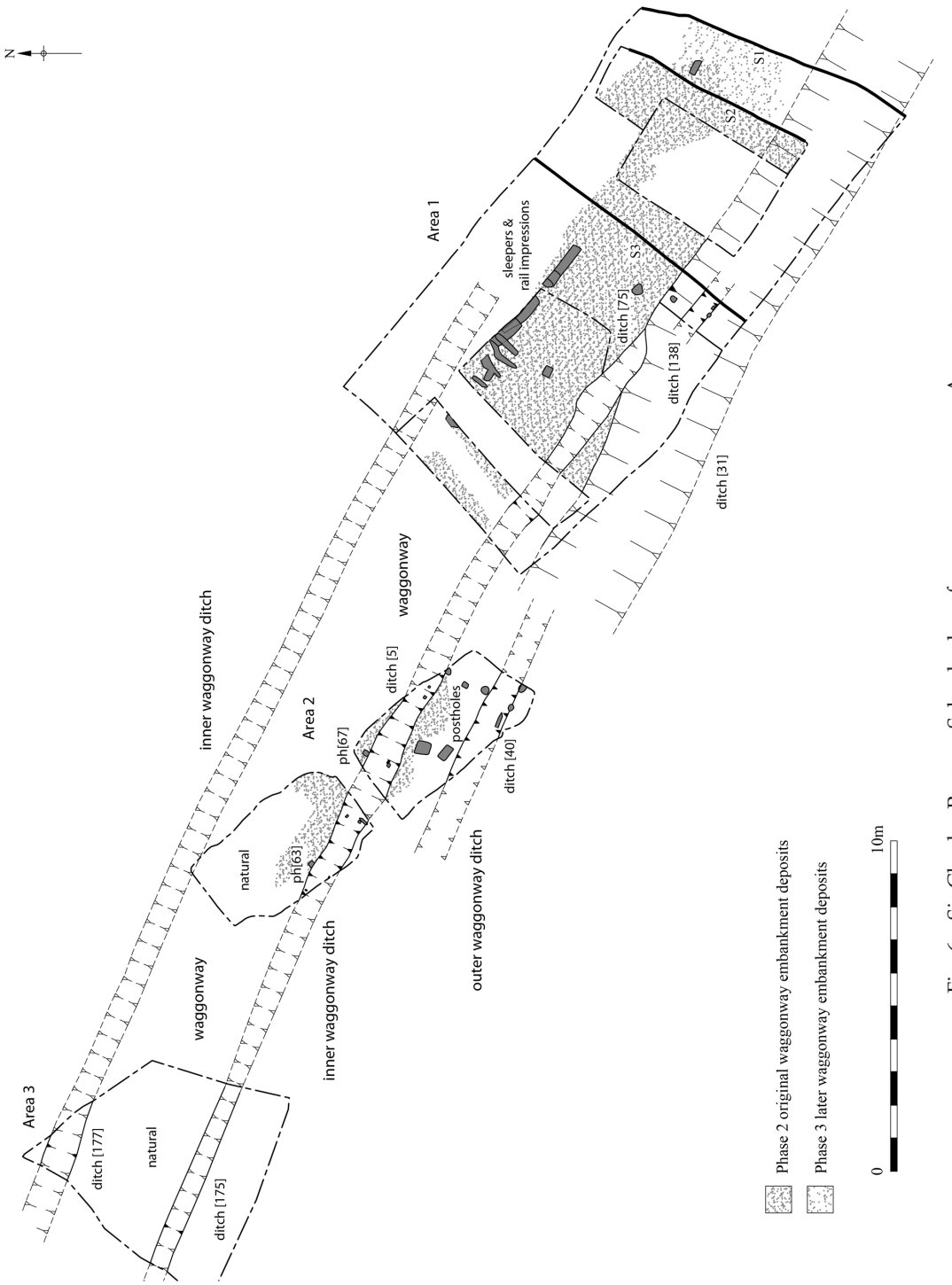

Fig. 6 Sir Charles Parsons School: plan of waggonway across Areas 1–3.

Fig. 7 Sir Charles Parsons School: waggonway embankment in Area 1, looking south-east, with trackside ditches to right of picture.

Fig. 8 Sir Charles Parsons School: waggonway embankment in Area 1, looking north-east, with trackside ditches to left of picture, ditch [75] visible in section in background.

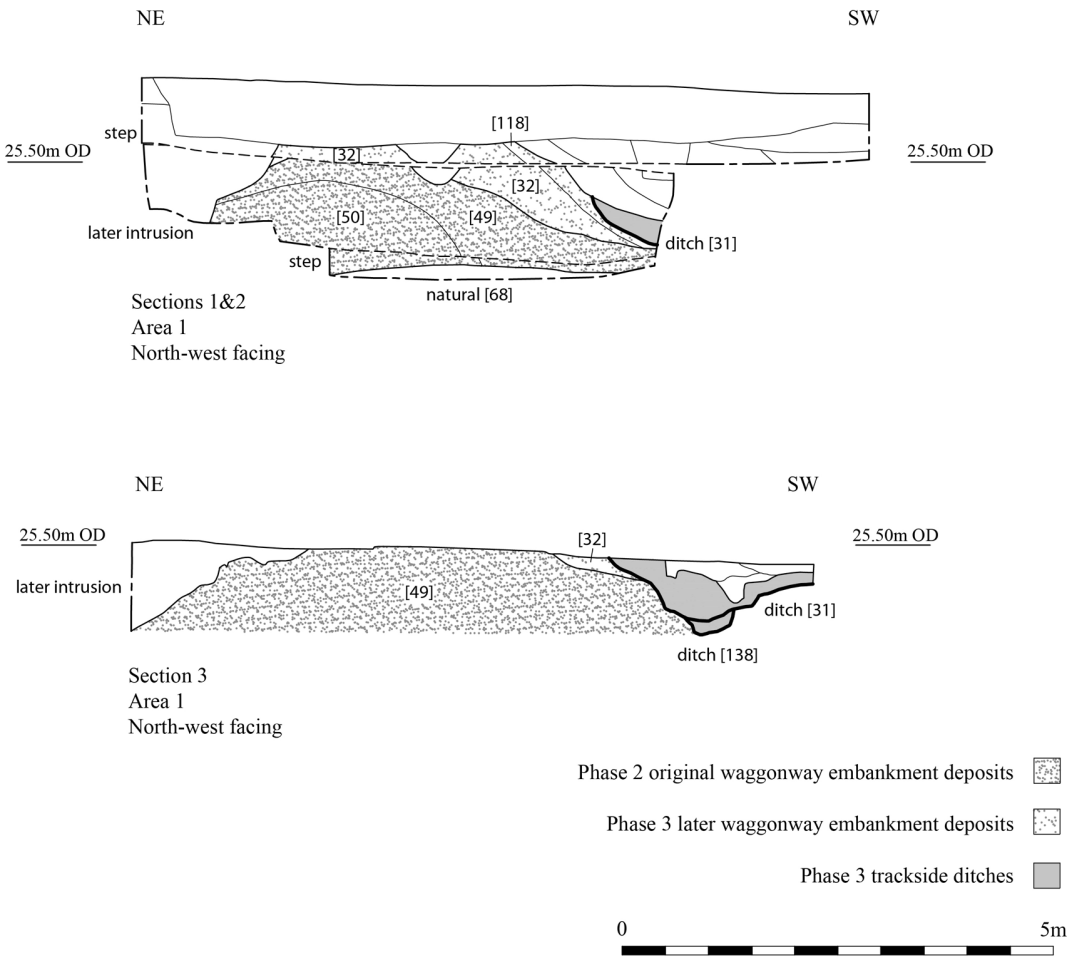

Fig. 9 Sir Charles Parsons School: sections across the waggonway embankment and trackside ditches in Area 1.

that had been removed. Four irregular sleeper impressions, up to 0.28 m wide, survived for a maximum length of 1.17 m; four rail impressions running along the north-eastern side of the embankment varied in width from 0.20 m to 0.35 m and were up to 1.70 m long (fig. 6).

WAGGONWAY DITCHES

Traces of parallel trackside ditches, aligned NW–SE, that may have been associated with the earliest phase of the waggonway were visible in section below later recuts of these features in Areas 2 and 3. Such ditches would have served the dual purpose of draining the trackway and delineating the wayleave corridor. The north-eastern side of the waggonway was originally bounded by a U-shaped ditch, which had become infilled with crushed coal and ash; this was recut, along the same line, by ditch [177] which is assigned to Phase 3. Projection of

the alignment of this ditch shows that its course lay beyond the limits of investigation in Area 2, and within Area 3 it had been truncated by later activity (fig. 6). Traces of the original ditch along the south-western side of the waggonway were recorded in Area 2; the base, which was steep-sided and flat, was recorded in section due to a later recut. In Area 3, all traces of this original ditch were truncated by a later reinstatement [175].

Phase 3: Late eighteenth- to early nineteenth-century waggonway development

EMBANKMENT DEPOSITS

Within the south-eastern half of Area 1, the Phase 2 embankment was overlain by crushed coal and ash deposits [32] and [118] which raised the height and increased the overall width of the embankment; the top of the new embankment was at least 3.7 m wide (fig. 6 and Sections 1–3, fig. 9). It survived to a maximum height of 25.72 m OD, although the top had been horizontally truncated. The full extent of the later embankment could not be established due to substantial modern truncation to the north-east.

WAGGONWAY DITCHES

In Area 3, the Phase 2 north-eastern trackside ditch had been largely recut [177]: it was now 0.92 m wide with almost vertical sides and a flat base, all infilled with crushed coal (fig. 6). The south-western trackside ditch [175], which was 3.30 m to the south-west of ditch [177], was of similar profile and was up to 0.55 m wide. This ditch was recorded in Area 2 as ditch [5], where it was up to 1.60 m wide and 0.37 m deep with steeply sloping sides and a flat base (fig. 10). Two sub-rectangular postholes, [63] and [67], on the north-eastern edge of ditch [5] possibly formed part of a fenceline. Seven upright timber stakes and a stakehole in two rows on either side of the base of the ditch may represent the surviving elements of a timber revetment (fig. 10). Eighteenth- to nineteenth-century pottery was recovered from the primary crushed coal fill of ditch [5] and its upper clay and silt fills produced a small assemblage of finds dating broadly to the eighteenth to nineteenth century.

A parallel ditch [40] located *c.* 1.5 m to the south-west of ditch [5] was 0.8 m wide and 0.5 m deep with vertical sides and flat base. A group of postholes spanned the area between the two ditches, including a row in a NNE–SSW alignment; these may have formed part of a bridge structure across the trackside ditches. It was not possible to determine if this double ditch system was more extensive; projection of the outer ditch shows that it was situated beyond the limit of excavation in Area 3 and was truncated in Area 1.

Further stretches of the inner south-western ditch were recorded intermittently in plan and section in Area 1; the sequence of activity was more complex here, with several intercutting ditches present. The inner ditch was traced in Area 1 as ditch [75] for a distance of 8.1 m (fig. 6). It had steeply sloping sides and a narrow flat base and measured up to 1.55 m wide by 0.70 m deep (fig. 8).

To the south-east, a sequence of intercutting linear features was recorded in plan and section. The earliest comprised the lower part of ditch [138], traced within the central part of Area 1, which produced a small assemblage of finds including eighteenth- to nineteenth-century pottery (fig. 6; section 3, fig. 9). Two small postholes along the edge of the ditch, one of which still contained the base of an upright timber, may represent part of a retaining structure for the ditch. It is possible that this represents a continuation of the revetted outer ditch [40].

Fig. 10 Sir Charles Parsons School: trackside ditch [8] and recut [5] with timber revetment stakes, in Area 2, looking north-west; scale 1 m.

The latest ditch in this area was ditch [31], which had an irregular broadly U-shaped profile, and was up to 2.5 m wide and 0.7 m deep (fig. 6; sections 1, 2 and 3, fig. 9). This produced a small assemblage of finds dating from the eighteenth to nineteenth century.

Phase 4: Post-Waggonway activity (later nineteenth to early twentieth century)

The waggonway embankment deposits and associated trackside features in Area 1 were overlain by successive colliery waste deposits, up to 1.2 m thick, representing nineteenth- to early twentieth-century levelling. The 1908 1:500 scale Ordnance Survey plan shows a road running through the site of the later school, along the line of the former waggonway embankment and skirting the 'Walker Refuse Destructor' building. This road was evidently created by dumping colliery waste over the disused embankment. The 'Walker Refuse Destructor' is shown as a substantial rectangular structure on the 1908 and 1912 Ordnance Survey maps. The north-eastern edge of the waggonway embankment was truncated along the length of Area 1 by a substantial, deep feature which is assumed to be associated with this building.

THE ARCHAEOLOGICAL REMAINS AT THE LIGHTFOOT CENTRE

Phases 1 and 2: Natural sub-stratum and agricultural features

Natural boulder clay was exposed across Area B and in the southern part of Area A, and in some areas this was overlain by an agricultural soil horizon. Two phases of ditch, aligned north to south, were recorded in Trench 2, to the east of Area B. One of these produced pottery of sixteenth- or seventeenth-century date along with part of a clay tobacco-pipe bowl of later seventeenth-century date. These ditches represent a long-lived field boundary; the earliest Ordnance Survey mapping of the area (fig. 3) demonstrates that this field boundary survived into the nineteenth century.

Phase 3: Late eighteenth-century colliery waggonway

The truncated remnants of a colliery waggonway were recorded in the south-western part of the development site at the Lightfoot Centre, within the western end of evaluation Trench 2 (fig. 2), where the ditch flanking the eastern side of the track was visible. The trench was subsequently extended to the west (Area B) and both trackside ditches were recorded in plan (fig. 11) with sections excavated across both.

A deposit of silty clay [2029], up to 0.35 m thick, had been dumped over a developed agricultural soil to create a level platform and low embankment on which to construct the trackbed of the waggonway, and also presumably to create the necessary gradient. Two trackside ditches, aligned NW–SE, delimited the wayleave. The eastern ditch [2013] was up to 2 m wide and 0.50 m deep and had silted up with coal fines and silty clay. A relatively large ceramic assemblage was recovered from the ditch, comprising 35 red earthenware pottery sherds broadly datable to the eighteenth to nineteenth century. The central part of the ditch had been

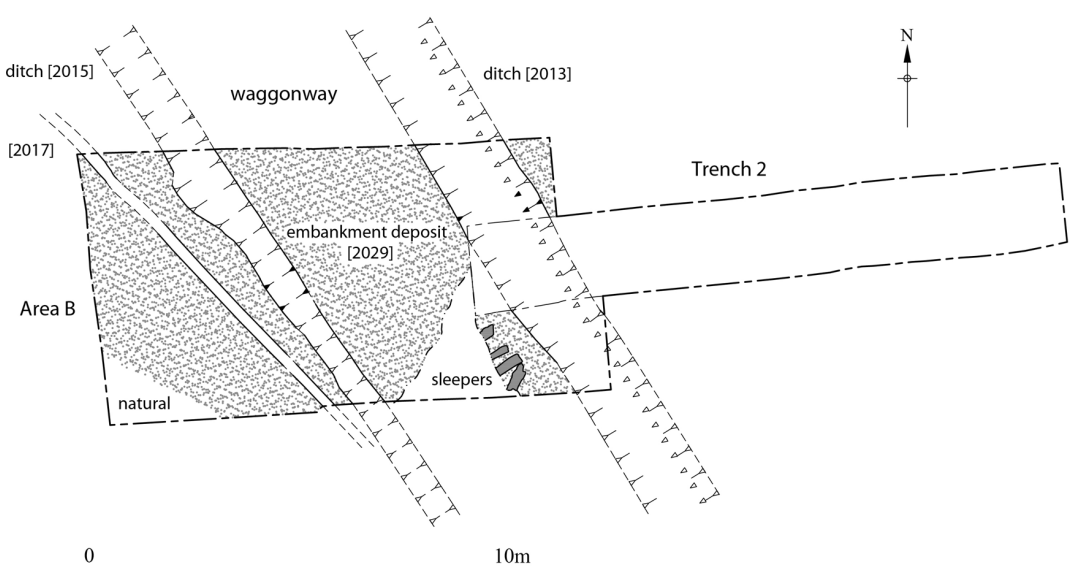

Fig. 11 The Lightfoot Centre: plan of waggonway in Area B.

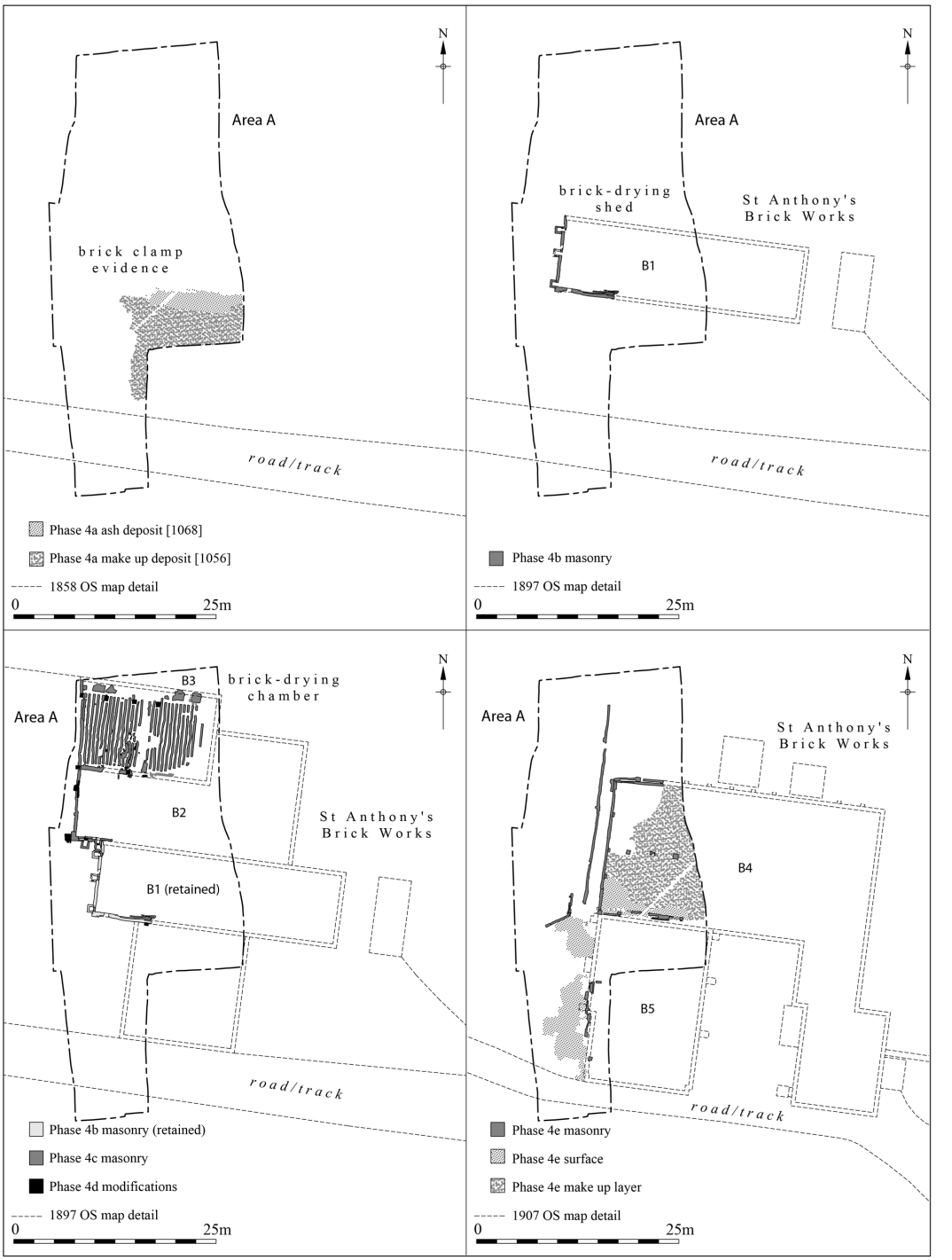

Fig. 12 The Lightfoot Centre: the main phases of activity at St Anthony's Brickworks.

recut by a much narrower ditch with almost vertical sides and this had been infilled with clinker. The western trackside ditch [2015] had suffered horizontal truncation during recent landscaping; its maximum surviving width and depth were 1.30 m and 0.20 m, respectively.

The distance between the inner edges of the trackside ditches, i.e. the corridor occupied by the track, was *c.* 4 m. Very little evidence of the waggonway track itself survived due to horizontal truncation. In the south-eastern corner of Area B were the north-easternmost ends of four sleeper-impressions, filled with compact coal fines. The average distance between the centres of the sleeper impressions was *c.* 0.40 m and the two central impressions contained the fragmentary remains of wooden dowels, *c.* 30 mm in diameter, presumably for attaching the rail to the sleepers. Running approximately parallel to the west of the western trackside ditch was a shallow linear feature [2017] which may be the remnants of a fenceline associated with the waggonway.

Phase 4: Brickmaking activity

The evidence for brickmaking activity within Area A at the Lightfoot Centre, dating from the mid-nineteenth through to the mid-twentieth century, has been divided into five sub-phases, 4a–4e (fig. 12).

PHASE 4A: EARLY TO MID NINETEENTH-CENTURY BRICK CLAMP

A group of deposits recorded within the south-eastern portion of Area A are interpreted as the remnants of at least one brick clamp associated with early brick production at the site prior to the establishment of the permanent manufactory building. The 1st edition Ordnance Survey map of 1858 depicts a 'Brick Field' and a series of large open clay pits some distance to the south of Area A (fig. 3). No structures are shown within the excavated area, but brickmaking at this date is likely to have utilised relatively simple technology, the bricks being fired in clamps.

The earliest deposit associated with brick manufacture at the site comprised a compact brownish red ash deposit with fragmented burnt sandstone throughout; this was the basal deposit in the section at the southern limit of excavation. It was overlain by a layer [1056], 0.10 m thick, of brownish red clayey ash with frequent pebbles which was exposed across an area measuring 12 m from north to south by 15 m from east to west (fig. 12). These deposits had evidently been subject to intense heat and are interpreted as levelling and make-up deposits for the floor of a brick clamp. Along much of its northern extent, deposit [1056] was overlain by a layer of black ash [1068], probably the remnants of the clamp flue; this black ash was exposed for a distance of 12 m by 2.10 m (fig. 12; fig. 13).

A sequential group of deposits, comprising ash, ashy sand and clay, with a combined maximum thickness of *c.* 0.35 m, was recorded in section at the southern limit of excavation; these are interpreted as the waste material associated with early brick manufacture, possibly derived from either the dismantling or the post-firing process of a brick clamp.

PHASE 4B: ST ANTHONY'S BRICKWORKS; LATE NINETEENTH-CENTURY BRICK-DRYING SHED

A group of dump deposits, recorded across a large extent of Area A (47 m north–south by up to 16 m east–west), represent material laid down for levelling and consolidation ahead of

Fig. 13 The Lightfoot Centre: phase 4a brick clamp deposits to centre and left of picture and Phase 4e brickworks structure to right, looking west; scales 1 m and 2 m.

construction of a brickworks building. These deposits were generally composed of silty clay, although silt, ash, and sand deposits were also recorded. At the southern end of Area A, and external to the building, ash and coal fines had also been used as levelling material; this was presumably waste from earlier brick-making. Inside the building, the levelling material had been affected by heat, presumably from the manufacturing activities undertaken.

Building 1, brick-drying shed

Building 1 (B1), situated in the central part of Area A (fig. 12), was a brick-drying shed which is depicted on an architect's plan of 1886 (see fig. 20). Much of the structure had been truncated by the early twentieth-century rebuilding of the complex, but the foundations of the west wall and a short length of the south wall survived (fig. 14). It had an external and internal width of 9.5 m and 8.8 m, respectively, and was recorded for a length of 7.45 m. The external elements of the drying shed were all built using pressed wire-cut common brick (average size 220 mm × 110 mm × 70–75 mm) bonded with brittle sandy mortar. The western wall [1102] was up to 0.35 m wide and survived to a maximum height of 0.35 m in four courses at its southern end; elsewhere just one or two courses survived. Three small, square

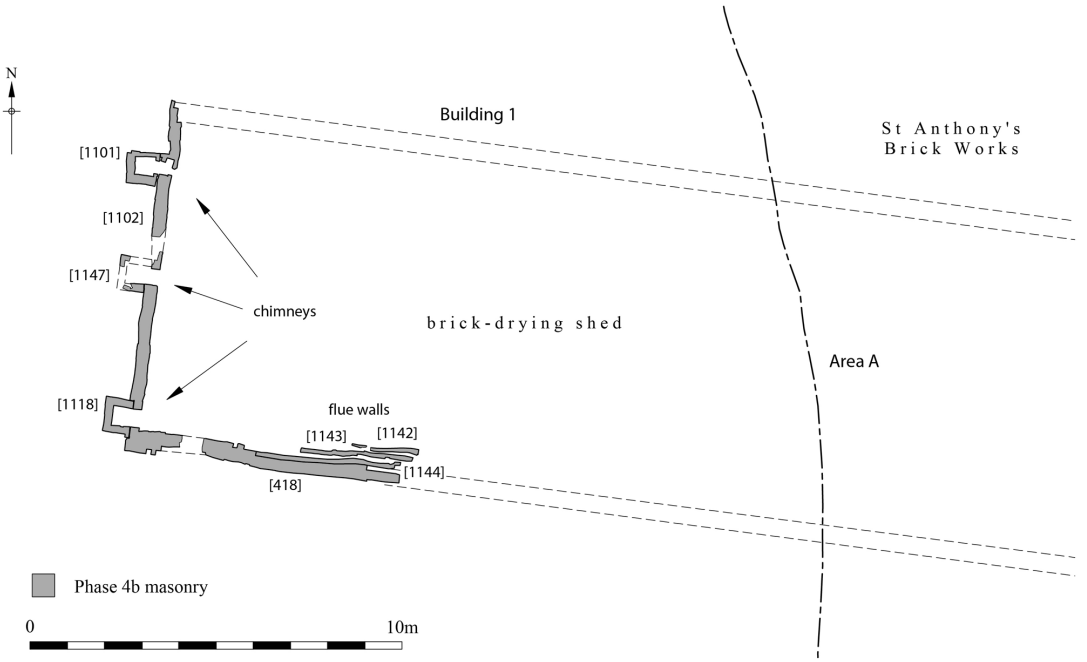

Fig. 14 The Lightfoot Centre: plan of Phase 4b brick-drying shed (Building 1).

external brick structures [1101], [1118] and [1147], with internal dimensions of 0.5 m, were located along this west wall. These originally opened into the structure, though they had subsequently been blocked (Phase 4c), and are interpreted as the bases of chimneys that drew air through underground flues in the drying shed. The southern wall [418] was of more substantial construction, up to 0.5 m wide. Just a single course survived for much of its length, although there were up to three courses in the east. Three parallel, narrow, walls [1142], [1143] and [1144] were found inside the building, immediately to the north of wall [418]. All were of similar rudimentary construction, comprising a single skin of brickwork constructed with dry bonded bricks of the same type and size used in the external walls; up to three courses survived. These are interpreted as the remnants of sub-floor flue channels; air would have been drawn along these flues under the drying shed floor and out through the chimneys at the west end of the building.

PHASE 4C: LATE NINETEENTH-CENTURY ADDITIONS TO BRICKWORKS

The drying shed was constructed sometime between the submission of the plans in 1886 and the compilation of the 1898 Ordnance Survey map; the building can be seen on the map as a long narrow range in the central part of the brickworks, but additional structures had been constructed to the north and south by this date. Elements of the northern range of the building as shown on the 1898 map were recorded within Area A, but no traces of the element constructed to the south of the drying shed survived (fig. 12).

Building 2 and Building 3, brick-drying chamber

The original drying shed was incorporated into a larger building, and the maximum surviving dimensions of this Phase 4c structure were 29 m north–south by 15 m east–west. The new building was divided internally into two areas, Buildings 2 and 3 (B2 and B3: fig. 12). B2 measured 8 m internally from north to south and survived for a distance of 9 m east–west; the surviving internal dimensions of B3 were 15 m east–west by 10 m north–south (fig. 15). B3 contained a brick-drying chamber and the fact that the chimneys along the western wall of the original drying shed were blocked suggests that B3 replaced the original drying shed, which was presumably modified for some other use within the manufactory.

The external elements of the Phase 4c structure were built with bricks of the same type as used in B1. Wall [1001], which formed the western external wall of B2 and B3, was 16 m long and 0.4 m wide (fig. 15). It was built within a broad construction cut and survived to a maximum height of 0.37 m as three courses of brick, including a lower header course and two stretcher courses. The intermittent remains of a wall [1003], 0.5 m wide and aligned east–west, divided B2 and B3; the gaps indicated that there was access between the two areas. At the southern end of wall [1001] was an external L-shaped corner buttress [1103]. A double-skinned wall [1099], with a combined width of 0.54 m, formed the southern wall of B2. Two small brick structures on the external side of this wall were of similar dimensions to the chimneys along the west wall of B1; they had also originally opened into the building but had later been blocked (Phase 4d). This suggests that whatever purpose B2 was originally built for, it was subsequently modified.

A stretch of wall [1162] situated north of wall [1001] continued beyond the northern limit of excavation, but cartographic evidence demonstrates that the northern wall of the building would have been just beyond the limits of Area A. Abutting it was a square brick structure [1000], and to the east were five further areas of brickwork; [1159], [1160], [1161], [1163] and [1165]. These were poorly preserved, but seem to have been constructed as discrete features; they may possibly represent air vents on the external northern wall of the building.

B3 contained the remains of a heated brick-drying chamber which survived across a rectangular area measuring 15 m from east to west by 10.5 m from north to south. Twenty-nine parallel brick walls formed flue channels which would have drawn warm air under the floor of the drying-chamber, discharging it through vents or chimneys along the northern side of the building (figs. 16 and 17). The flue walls were roughly equally spaced, *c.* 0.2 m–0.3 m apart, and were generally *c.* 0.24 m wide. The maximum surviving length and height were 8.95 m and 0.40 m, respectively, and the best preserved comprised five dry bonded courses, laid in irregular header and stretcher bonds. They were mostly built from pressed wire-cut common brick (average size 230 mm × 110 mm × 75 mm) with occasional firebricks. The stamps of four different makers were recorded — Coxlodge, Hannington, Lister and TSB — which are all broadly datable to the second half of the nineteenth century. Many of the bricks in the flue walls were in poor condition and some were highly fragmented due to exposure to high temperatures. Whilst this may in part have occurred *in situ*, it is also likely that over-fired waste bricks were used to build the flue walls. These walls were poorly constructed, with no bonding material, so that some parts had a slightly sinuous form, and there were also several collapsed or missing sections, particularly in the central part of the chamber. The northernmost portions of fifteen of the flue walls were notable for their more robust construction, in each case this being a rectangular structural element, *c.* 0.48 m in length, constructed using firebricks laid in stretcher bond, bonded with sandy mortar.

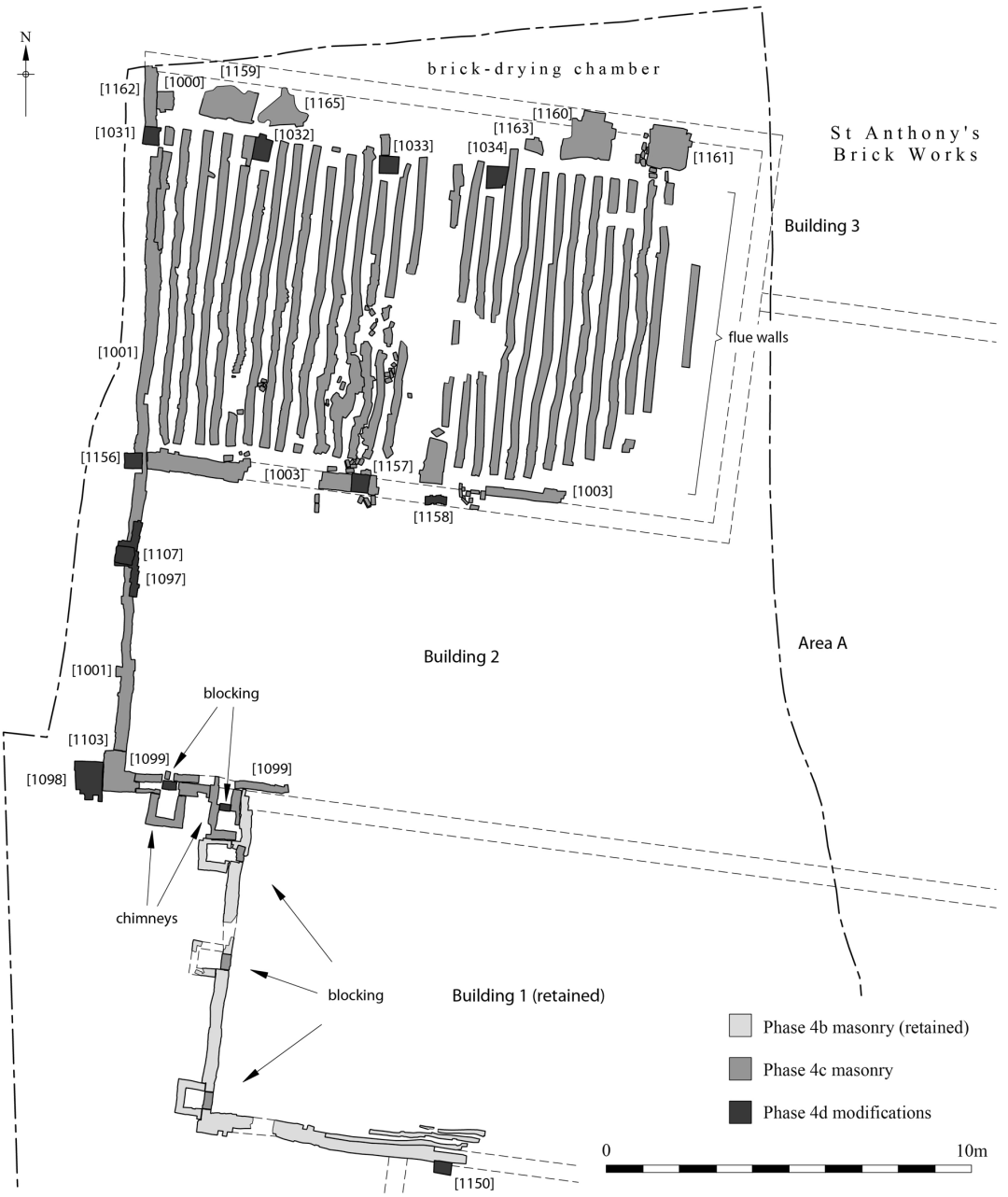

Fig. 15 The Lightfoot Centre: plan of Phases 4c and 4d brickworks (Buildings 1–3).

Fig. 16 The Lightfoot Centre: brick-drying chamber in Building 3, looking west; scale 2 m.

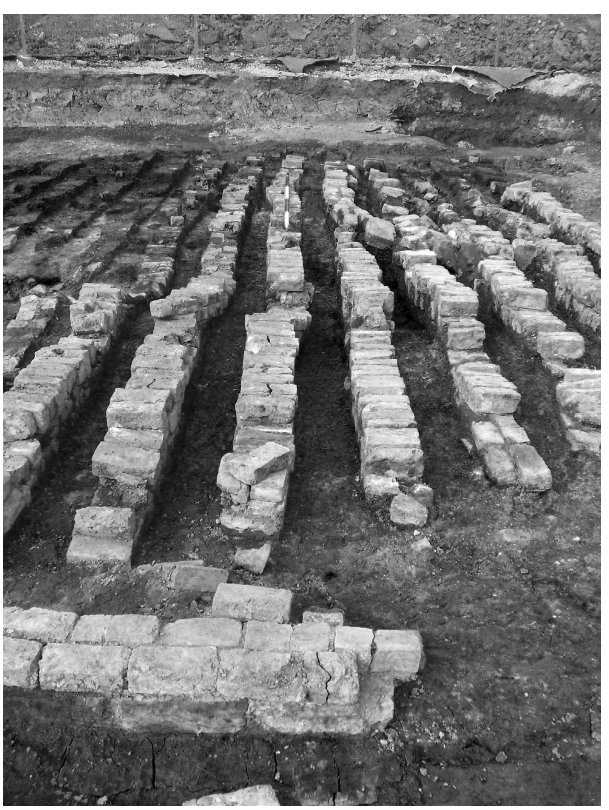

Fig. 17 The Lightfoot Centre: detail of flues in brick-drying chamber in Building 1, looking north; scale 2 m.

PHASE 4D: ALTERATIONS TO LATE NINETEENTH-CENTURY BRICKWORKS

The two chimneys on the southern wall of B2 were blocked at some stage internally with brickwork, indicating a change in function for this part of the brickworks (fig. 15). Four square brick piers [1031], [1032], [1033] and [1034] at the northern end of B3 evidently post-dated the construction of the flue walls and were presumably added to provide additional structural strength. Three other piers [1156], [1157] and [1158], at the southern end of the drying chamber, were similarly constructed, using pressed wire-cut common brick (average size 240 mm × 120 mm × 70 mm) with a sandy mortar bonding.

A short stretch of wall [1097], representing a partial rebuild of the western external wall of B2, had been constructed mainly with pressed wire-cut common brick, but included a late nineteenth-century firebrick made at the Lintz Colliery brickworks. A brick and concrete pier [1107] may have been added to the exterior of the wall in this area at the same time. To the south, at the corner of this building, a substantial brick buttress [1098] supported the Phase 4b buttress, and another buttress [1150] was added to the southern wall of B1.

PHASE 4E: EARLY TWENTIETH-CENTURY REBUILD OF THE BRICKWORKS

Phase 4e relates to the rebuilding of the brickworks which occurred between the 1898 and 1907 Ordnance Survey maps. The footprint of the new building overlay the south-eastern portion of the previous one and extended farther to the east and south (see fig. 12). The 1907 map shows a building, aligned east to west, in the northern part of the new complex; it extended southwards at its eastern end and a square structure stood at the south-eastern corner. All of these elements were part of one large building (see fig. 5). A separate rectangular structure was attached to the south of the western end of the building. With survival of structural remains decreasing to the east across Area A, it appeared that very little of the rebuilt brickworks complex survived; in fact the surviving remains comprised just the north-western corner of the complex and fragmentary sections of the western external wall, exposed in the southernmost part of Area A.

An extensive deposit of silty clay, up to 0.35 m thick, had been dumped over the structural remains of the Phase 4c drying chamber, representing infilling and levelling ahead of the construction of the new brickworks. Broken pantile in this material presumably derived from the demolition of the earlier buildings.

Buildings 4 and 5

The surviving structural elements within Area A are interpreted as representing the entire western wall and parts of the southern and northern walls of the northern range of the brickworks: Building 4 (B4: figs. 12 and 18). The western external wall of B4 [1145] measured 16.80 m from north to south and was up to 0.34 m wide; it survived to a maximum height of 0.23 m. It was built with pressed wire-cut common brick (average size 240 mm × 110 mm × 75 mm) bonded with soft sandy mortar. Two rectangular brick buttresses [1146] and [1149] were provided on its inner face. At the southern end was a wall [1141], aligned east to west, which survived intermittently for a total of 8.10 m. This was just a single-brick skin and thus certainly an internal sub-division. The 1907 map indicates that the structure that stood to the south of B4 was a separate building, but this evidence for an internal partition indicates that by at least the final stage of use, the buildings were connected internally.

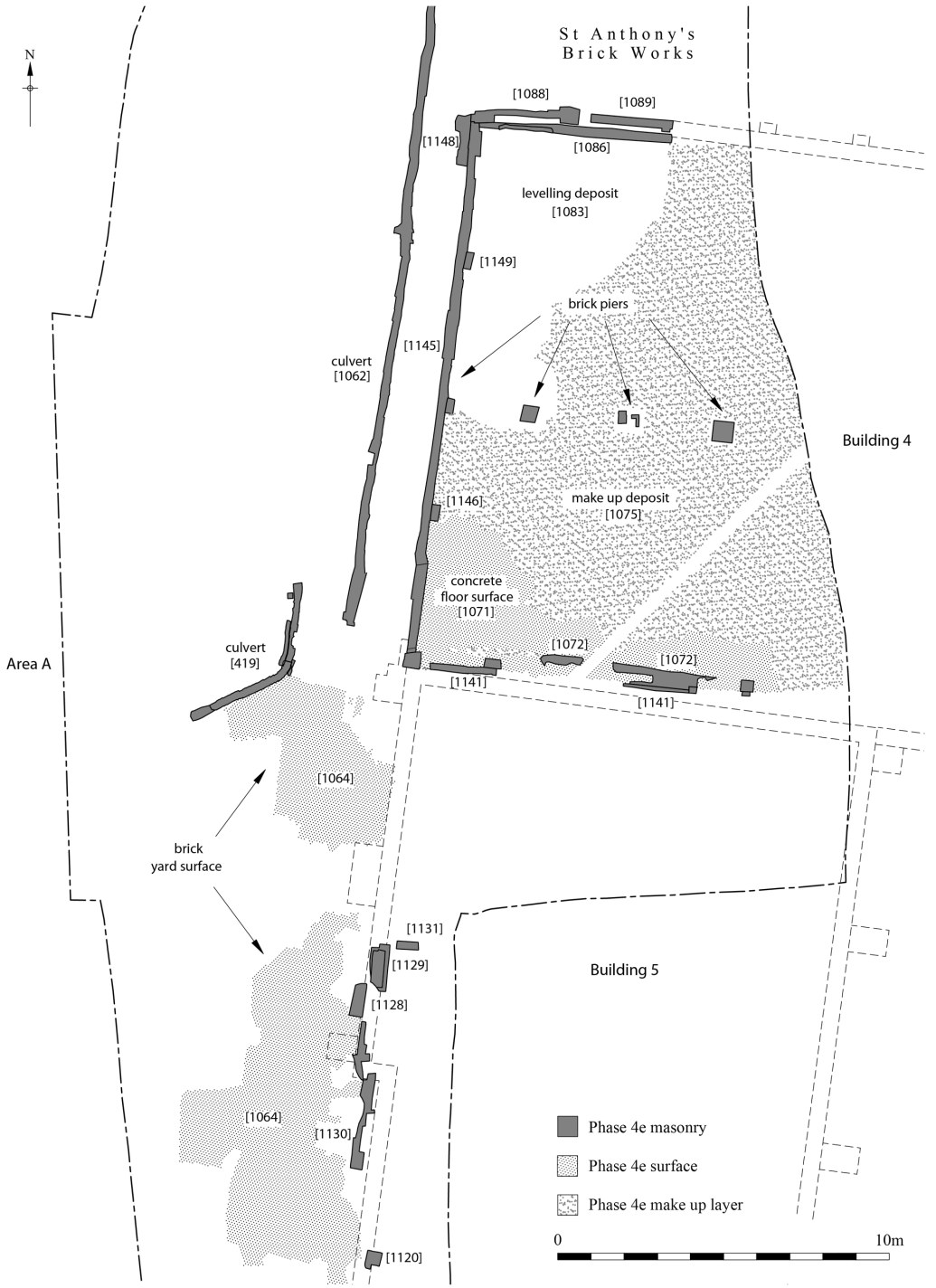

Fig. 18 The Lightfoot Centre: plan of Phase 4e brickworks (Buildings 4 and 5).

The north wall of B4 comprised two sections of walling [1088] and [1089] with a combined length of 6 m (fig. 18). For the most part, wall [1088] was up to 0.50 m wide and survived to a height of 0.18 m, in two courses, the upper course in stretcher bond. At the eastern end of wall [1088] was a rectangular pier, fully integrated into the wall rather than a separate element, which projected a short distance to the north of the wall-line. This was *c.* 2.5 m from the corner of the building and corresponds to the location of a small rectangular projection shown on the north wall of the building on the 1907 map; several similar projections were depicted along the length of the north wall. A break in the line of the wall, about 0.3 m wide, to the east of the projection, indicates that this was probably the location of an air vent thought the external wall. A concrete foundation and a brick wall [1086] ran parallel to the northern wall, presumably representing part of an internal feature.

Survival of structural remains within the building was variable; in the north-western corner only levelling deposits [1083] survived. A compact sandy clay deposit [1075] containing frequent fragments of brick and tile was exposed across a large part of the building's interior; this was a make-up deposit for a concrete floor surface [1071], which only survived in the south-western corner. Overlying the floor was the poorly defined remains of a structure comprising bricks and brick fragments set within concrete [1072], possibly part of an internal wall that replaced the southern dividing wall [1141]. Four square brick piers, for roof supports (including one on the inner face of the external western wall), were set at intervals of 2 to 2.5 m along the central axis of B4.

To the south of B4 were the fragmentary remains of Building 5 (B5), although little survived due to extensive disturbance in this part of the site. A few segments of wall [1128], [1129] and [1130], recorded for a combined length of *c.* 6.8 m, represent parts of the west end; another fragment [1131] may have been part of an internal east–west wall (fig. 18). To the south was an isolated brick pier [1120].

External structural elements

A brick-lined culvert [1062] ran parallel 1.50 m to the west of Building 4 and was traced for a total length of 24.70 m (fig. 18). It was built within a narrow construction cut, with the walls set just 0.10 m apart, and was capped with distinctive large pressed bricks (e.g. 400 mm × 240 mm × 120 mm, although with considerable variation). Brick culvert [419] lay to the west; this was aligned SW–NE for a distance of 3 m then ran northwards for 3 m, cutting through B1, beyond which point it was not exposed. It was built with a variety of brick types: wire-cut common bricks and firebricks, including a damaged voussoir brick, probably made *c.* 1870 at Lister's Yard, Scotswood.

The remains of an extensive brick surface [1064], representing an external yard, were recorded in the southernmost portion of Area A across an area that measured up to 20.2 m by 4.8 m (fig. 18). It had been constructed with bed-laid bricks (average size 230 mm × 115 mm × 75 mm) of late nineteenth- to early twentieth-century date and occasional firebricks. The date of its construction was not certain; it abutted the southern wall of the Phase 4b drying shed, but this may be because traces of this wall survived after the building had been demolished as the surface also appeared to have been constructed to abut the west wall of Building 5. The surface has therefore been assigned to Phase 4e, although it is acknowledged that it could originate from an earlier phase of the brickworks; it may have remained in use throughout the lifetime of the brickworks with repairs taking place as required. Considerable wear was observed on the bricks across the southern part of the surface.

SPECIALIST REPORTS

Bricks

John Nolan

Six firebricks and five common or house bricks samples were examined from the Lightfoot Centre investigations along with a fragment of kiln stilt. All of the firebricks carried maker's stamps; identifications are based on Davison (1986).

Two bricks from Phase 4c Building 3 flue walls were marked 'HANNINGTON', including a side-wedge from an arch. These might have been made by Hannington and Company of Swalwell who operated from 1850–1906. A J. Hannington is also recorded working at Byker in 1869, but not as a firebrick maker. Another firebrick taken from the Building 3 flue wall was stamped 'COXLODGE' and was made at Coxlodge Colliery's Jubilee Mine firebrick works, working between 1873 and 1929. The stamp 'TSB' on another flue wall firebrick may be a product of T. Smith's Clarence Brickworks, at Billingham, working 1855–1906. Neither Coxlodge or TSB is recorded in Davison (1986). A firebrick taken from a Phase 4d alteration to the west wall of Building 2 was marked 'LINTZ', a product of Lintz Colliery Brickworks, Burnopfield, which are recorded as working between 1868 and 1924. One firebrick from the Phase 4e culvert had a partly defaced stamp '...BSON'], probably made by W. C. Robson at Lister's Yard, Scotswood, working 1869–72. The known dates of working for the firebrick makers whose stamps were found at the site — such a wide variety is usual — span the mid-1850s to the late 1920s.

The five house or common brick samples were all of similar form, pressed and wire-cut, and none had frogs. They are all of a form which is broadly datable to *c.* 1860 onwards. In addition to the bricks, a small piece of a white earthenware kiln stilt was recovered from the Phase 4b ground levelling deposit.

Pottery, and clay tobacco-pipes

Jenny Vaughan

A small assemblage of 106 sherds of pottery, weighing 1.84 kg, was recovered from the investigations at the Lightfoot Centre. The Phase 3 waggonway ditches produced an assemblage which probably dates from the eighteenth or very early nineteenth century. The eastern ditch produced 35 sherds exclusively from red earthenwares, including at least three bowls with flanged rims and brown (iron/manganese) mottling, along with a ring base and a bowl with simple rim and brown mottling. The western ditch produced fragments from the same red earthenware fabric along with two small fragments of glazed white earthenware.

The assemblage recovered from the brickworks came from the Phase 4b levelling deposits, and from the infilling of the flues in Building 3, which took place prior to the construction of the Phase 4e building. The two main pottery types present are glazed red earthenware and white glazed whitewares, as is usually the case on nineteenth-century sites. Red earthenwares (the contemporary name was 'brownwares') were manufactured locally from the early part of the eighteenth century through to the twentieth century. The assemblage included a complete white earthenware vessel of jam-jar type and a complete, though very chipped, small shallow jar probably for paste of some kind. The rest of this group were probably table wares. Six of the fragments were biscuit-fired, including a small ring base with transfer printed decoration

depicting three figures in a boat. One other fragment had a partial maker's mark '...WOOD STEPNEY PO...' identified as J. Wood Stepney Pottery. This dates the piece to after 1872 when John Wood took over this manufactory (Bell and Gill 1973, 14).

Just forty sherds of pottery were recovered from the embankment deposits and trackside ditches at the SCP site. One of the red earthenware sherds was perhaps of seventeenth- or early eighteenth-century date, but this was recovered from a ditch associated with the later development of the waggonway and was presumably residual in context. The majority of the assemblage recovered from the Phase 2 embankment deposits were later redwares dating from the eighteenth to nineteenth century. Only two fragments were of the slip-coated kitchenwares typical of later redware assemblages. The few refined whiteware fragments were undecorated, apart from one with a gold band. One of the china vessels present also had gold bands. There were seven sherds of some type of closed china vessel, but the top was missing so it could not be identified. The interior was unglazed, suggesting that it might have been an ornament.

A few clay tobacco-pipe fragments were also recovered from the investigations at the SCP site. Those from the waggonway embankment deposits included a clay stem of 6/64-inch bore with a stamp readable as Thomas Parke, a late seventeenth-century Gateshead maker (*c.* 1667–87). The other stems from this deposit also had bores of the same size and could be of this date or early eighteenth century. The rest of the group, recovered from Phase 3 features associated with the later use of the waggonway, are of 5/64-inch bore and are probably later in date.

DISCUSSION

Walker Colliery and St Anthony's Colliery waggonways

Demand for coal greatly increased following the rebuilding of London after the Great Fire; Tyneside coal was particularly suitable for the hearths of the new housing (Atkinson 1966, 46) and the growth of local industries such as glass-making, brewing, and smithing also increased demand. Initially, horse-drawn four-wheel wain carts used coal roads, or 'wainways', which were purpose-built, extending from the pits to the staithes (Guy and Atkinson 2008, 162). However, these roads were largely unusable in winter, the carts only had a limited capacity, and this transport system was expensive to run. As the seams along the Tyne banks became exhausted, sources began to be worked farther away; with the expansion of the Northern coalfield from the latter part of the seventeenth century came the construction of a network of simple wooden waggonways across south Northumberland, Tyneside and Wearside. Their widespread use throughout the coalfields of the North-East was linked directly to the need to move coal quickly and efficiently for export (Lewis 1970). In terms of technology, colliery waggonways had their origin in the simple horse and cart, with wooden rails initially being laid down to facilitate the movement of horse-drawn wheeled vehicles. Early rails were typically of oak, ash, or birch, resting on sleepers that were usually made from untrimmed oak branches (Lewis 1970). The upgrading to iron rails began on some lines in the region in the late eighteenth century, although wooden waggonways were still used extensively on Tyneside in the early nineteenth century (Atkinson 1966, 49). The early nineteenth century also saw the beginning of the use of engines to haul trucks up the lines (Atkinson 1974, 41); most of these were eventually replaced by locomotive-powered railways, heralding the end of the waggonways. Many waggonways went into disuse following the construction of the

public steam railways, or they were realigned to connect with the railways at the nearest point. By 1850 all wooden rails had disappeared (Warn 1976, 20).

The precise date at which St Anthony's Colliery was established is not known; the online catalogue of the Papers of the North of England Institute of Mining and Mechanical Engineers lists an 'Estimate of the cost of working St Anthony's, Byker and part of Heaton Colliery, 2 Oct 1746' (www.mininginstitute.org.uk; Northumberland Archives, Woodhorn 3410/For/1/4/115, accessed 29 May 2013). John Gibson's plan of 1788 depicts a waggonway running south-eastwards from 'Byker St Anthony's', joining a route that ran from 'Endeavour Pit' of Walker Hill Colliery (known to be operating by 1784) to the north. The waggonway then ran southwards to staithes on the Tyne at St Anthony's. The remains identified at the Lightfoot Centre are assumed to form part this waggonway which was built in the second half of the eighteenth century. The pottery assemblage from the trackside ditches indicates that the waggonway was certainly in use during the late eighteenth century. William Casson's 1801 plan (and amended editions up to 1805) depicts a waggonway originating farther north at 'Heaton Main' and bypassing 'St. Anthony's' to the east, indicating that, by this date, St Anthony's waggonway had gone out of use. No disused waggonway on this line is shown on the Ordnance Survey map of 1858, suggesting that it had been out of use for some time by this date. However, a linear feature on this map runs north-westwards from St Anthony's Pottery for a short distance towards High Pit in the north-west, and in the south-east joins a track running south to St Anthony's staithes. These features are probably relics of the two sections of waggonway shown on Gibson's plan.

The date at which Delight Pit — part of Walker Colliery, located a short distance north of the SCP site — was first worked is uncertain, but documents from 1824 refer to this pit (Northumberland Archives, Woodhorn 3410/For/1/19. Colliery Report and Account Book 1766–1835). Walker Colliery was served by a complicated series of small waggonways, including a line built from Delight Pit to staithes at Wincomblee, later extended to the north to Gosforth Pit and Henry Pit (Turnbull 2012, 150). This waggonway appears on Greenwood's (1828) map and an early nineteenth-century date is therefore proposed for the waggonway recorded at the SCP site. The waggonway is depicted in detail on Oliver's (1840) plan running south-eastwards from Gosforth Pit, passing Delight Pit and crossing the SCP site, where it is shown running along a substantial embankment as it crosses the dene of the Stott's Burn tributary. Most of the route can be traced on the Ordnance Survey first edition map of 1858, though by this date the waggonway was disused. The 1897 edition shows that one section of the former waggonway route, beyond the SCP site to the south of the burn, was subsequently upgraded into a road.

There have been relatively few detailed archaeological investigations of former colliery waggonways in the region, and only two have resulted in published papers. The substantial and well-preserved remains of a timber waggonway dating from *c.* 1780–90 were uncovered at Lambton D Pit, Fencehouses near Sunderland in 1995 (Ayris *et al*. 1998). A waggonway that was possibly earlier in date was excavated in 2002 at Rainton Bridge, near Houghton-le-Spring (Glover 2005). These, and other excavated, but unpublished, examples, along with the many contemporary accounts of waggonway construction, use and maintenance detailed by Michael Lewis in 1970, have facilitated the interpretation of the remains of the Walker and St Anthony's Colliery waggonways.

The earliest surviving evidence for the Walker Colliery waggonway recorded at the SCP site was the clay embankment. This had been constructed using natural boulder clay and

would have provided a solid foundation, as well as the required track gradient. Wherever possible, waggonways routes were constructed with a regular falling gradient from colliery to staith so that waggons could run on gravity, but it was crucial that the gradient was not so steep as to make transport of full waggons dangerous and pulling empty ones back uphill difficult (Lewis 1970, 144). To achieve such a route, it was necessary to make cuttings and raise embankments, or batteries as they were known. Often the embankments were no more than *c.* 1 m high, but where lines crossed valleys, substantial and costly earthworks had to be constructed; a late eighteenth-century account of the Bowes line reports 'Immense works are frequently made of masonry or soil across valleys and rivulets' (Hutchinson 1794, *in* Lewis 1970, 148). The Walker embankment increased substantially in size in the south-east where the waggonway approached the dene and it would have been a massive earthwork where it crossed the dene itself.

The full width of the waggonway only survived in the north-western part of the site (elsewhere its north-eastern side had been truncated by later activity.) In this area the distance between the two trackside ditches was *c.* 3.2 m and this shows that it would have been a single track route, which were on average around 14 ft (4.25 m) wide (Lewis 1970, 164). Many waggonways remained as single track, especially if they did not carry heavy traffic. It may be that the topography of the area was a factor in the decision to construct this particular waggonway as a single track due to the additional cost of building an embankment wide enough for a double way, which would have required a total width of 22 ft (6.7 m) (Lewis 1970, 164), to carry the waggonway over the dene.

The earliest waggonway tracks in the region were constructed using regularly spaced sleepers of untrimmed oak branches, onto which flat wooden rails would have been fixed (Lewis 1970, 164; Ayris *et al*. 1998; Glover 2005). Little remained of the waggonway track at the SCP site; the timbers themselves did not survive and track components were only identified as impressions of sleepers and rails in the clay embankment of Area 1, these forming part of the north-eastern side of the earliest waggonway track. The timbers were presumably removed during the later redevelopment of the waggonway; removal of timber elements from disused waggonway tracks is typical for the region, and was noted, for example, at both Lambton D Pit (Ayris *et al*. 1998, 10) and Rainton Bridge South (Glover 2005). The sleeper impressions survived, being up to 1.17 m (3 ft 10 in) long and up to 0.28 m (11 in) wide; their irregular shape indicates that they were made from roughly-trimmed branches. Rail impressions were only recorded on the north-east side of the track, therefore the precise gauge of the Walker Colliery waggonway is unknown, but the known range of gauges used on waggonways within the North-East coalfields is 4 ft–5 ft (1.22 m–1.52 m) (Lewis 1970, 165; Guy and Atkinson 2008, 177). The distance between the central points of the sleeper impressions at the site varied between 0.45 m and 0.50 m (1 ft 5 in and 1 ft 7 in). Sleepers on main ways and single lines were generally spaced between 1 ft (0.30 m) and 1 ft 6 in (0.45 m) apart (Lewis 1970, 165).

At some stage the embankment was widened and heightened; the earliest waggonway track would have been dismantled at this time. No remains survived of the track that would have been built on top of this new embankment, horizontal truncation having removed the upper levels. It may be that this development of the waggonway was associated with the upgrading of the tracks to iron rails, but in the absence of any surviving evidence this must remain speculative.

The track would have been bounded on either side by drainage ditches ('gutters') from its earliest construction. Such trackside ditches served to delineate the wayleave corridor of the

waggonway and provided drainage for the track; adequate drainage was essential to stop the timbers rotting. The ditches in the north-western part of the SCP site were not large, but were well constructed. The timber stakes lining the base of one ditch are likely to represent the remains of a revetment and presumably held timber planks, subsequently removed, that prevented the sides of the ditch collapsing. In Area 2 the south-western side of the waggonway was bounded by two ditches, and this double-ditch system may have been more extensive. A similar system of trackside drainage ditches was recorded at Rainton Bridge South, and these too had been subject to recutting and maintenance (Glover 2005, 238–9). At that site, a ditch and an outer drainage gully ran along one side of the waggonway, providing a close parallel. In Area 1 the waggonway was bounded in its latest phase by a ditch of much greater proportions, presumably required due to the height of the embankment.

All the trackside ditches had silted up; they contained large quantities of ash and crushed coal which represents ballast from the tracks. Ballast was crucial to the efficient operation of a waggonway and would have been packed under the rails and around the sleepers so that the weight of the vehicles was transmitted through the rails and taken up by the ballast rather than by the sleepers (Lewis 1970, 164). Ballast also protected the timbers from the horses' hooves, it facilitated drainage, and was laid down beyond the rails to create paths for waggon men to walk on. Coke, cinders from the pumping engines, gravel and small coal were typically used for ballast (Lewis 1970, 164).

As with the Walker Colliery waggonway, the St Anthony's waggonway wayleave was defined by ditches. These had been truncated, but their maximum surviving depth of *c.* 1.15 m indicated that they were originally substantial features. The fenceline external to the south-western ditch would have restricted access to the track by both people and animals where the waggonway ran through pastureland. Similar evidence was recorded at Rainton Bridge, where a line of stakeholes on the outer edge of a trackside ditch marked the position of a fenceline (Glover 2005). Little of the waggonway track survived within the area investigated. Parts of the eastern side of the trackway were identified and the corridor defined by the trackside ditches was 4 m wide, demonstrating that, like the Walker Colliery example, this was a single track route.

St Anthony's Brickworks

Several factors contributed to the success of brick production in Walker and surrounding areas. The raw materials necessary for production could all be obtained locally: thick deposits of glacial till offered a readily accessible source of clay suitable for brick manufacturing; it was obtained by digging extraction pits and also as a by-product of the coal-mining industry. A nineteenth-century treatise on brick manufacture describes how boulder clays, if prepared properly, 'make satisfactory common bricks with a considerable proportion of bricks suitable for facing purposes' (Dobson 1886, 24). Local availability of raw materials was crucial as the cost of transporting clay meant that the brickyard had to be situated at the source of the clay itself (Brunskill 1990, 20). Numerous streams in the area provided water and the local coal mines could supply fuel with minimal transport costs. Bricks were transported to the building site by pack horse or by horse and cart, if adequate roads existed. The proximity of consumers was an important factor in the establishment and development of brickworks. The mechanisation of brickmaking in the mid-nineteenth century coincided with the abolition in 1850 of the tax on bricks that had been in place since 1784 (Brunskill 1990, 193). There was a

vast increase in brick production in rapidly industrialising areas like Tyneside; there was a building boom in Walker in the latter part of the nineteenth century, creating a huge local demand for bricks. Bricks were needed not just for housing, but were also required in vast quantities by industries and associated infrastructure; for example, for tunnels, mine shafts, factories, warehouses, railway bridges and viaducts (Brunskill 1990, 171).

The 1858 Ordnance Survey map shows a brick field with several clay-extraction pits to the north of St Anthony's Pottery, and a brick field was also located farther to the east at Bill Point, on the edge of the extensive industrial complex along the western bank of the Tyne (fig. 3). By the time of the 1898 edition, both of these sites had developed into brickworks with permanent structures, another was located to the north in Low Walker (fig. 4). Construction of extensive areas of housing had also begun by this date. Plans for another proposed drying shed — to be built to the west of St Anthony's at the junction of Raby Street and Walker New Road — were submitted as a planning application in 1876 by the South Byker Estate Company (TWAM: T186/7238). This presumably represents the site of a short-lived manufactory to supply bricks during the construction of that housing estate.

The earliest evidence for brick manufacture at St Anthony's is provided by the 1858 Ordnance Survey map and the traces of the brick clamp recorded in the south-eastern part of Area A. The manufacture of hand-moulded bricks, and clamp-firing, did not require a permanent kiln or ancillary structures, and was common until the mid-nineteenth century (Palmer and Neaverson 1994). Dobson's treatise on brick manufacture (first published in 1850 and revised in 1886), describes the general methods used to construct a brick clamp; a diagram from this book showing a cross-section of a clamp is reproduced as fig. 19. Preparation of the area on which the clamp was to be constructed involved levelling, draining, and compacting the ground; adequate drainage was necessary to prevent the unfired bricks from becoming wet while the clamp was being constructed, and discarded bricks from previous firings were often used for this if they were available. Channels in the prepared floor formed flues which extended through the entire thickness of the clamp, and bricks were placed on the floor between the flues to form platforms onto which the unfired bricks were stacked (fig. 19). Various types of fuel could be used in a clamp: wood, charcoal, turf, coal, domestic rubbish, or breeze (coal dust or cinders), depending on local availability and ease of transport (Cox 1979, 27). The clamp would burn for two to three weeks, although larger examples could burn for up to twelve weeks. After it had cooled the clamp would be dismantled. The average number of bricks in a clamp was 30,000–45,000 but the number of bricks suitable for construction would be less due to the proportion of misfired bricks that were produced by this method (Brunskill 1990, 27–8). The quality of the bricks produced varied according to their position within the clamp. Despite the variation in quality and in the number of misfired bricks, clamps still offered a number of advantages over kilns; they could be built relatively quickly and easily, and therefore much less capital was required to start up a business.

Relatively few brick clamps have been excavated; they were temporary structures, few of which have survived, but a few published examples provide useful parallels for the remains exposed at the Lightfoot Centre. An eighteenth- to nineteenth-century clamp at Shotesham St Mary, in Norfolk, survived as an area of charcoal with a series of shallow parallel channels, interpreted as flue bases, surrounded by burnt natural clay; the sides of the clamp were defined by lines of crushed brick (Wade 1980). Traces of several brick clamps, dating from the late seventeenth to the early eighteenth century, were excavated at New Cross in south-east London (Proctor *et al*. 2000). At that site, sandy silt deposits containing brick fragments,

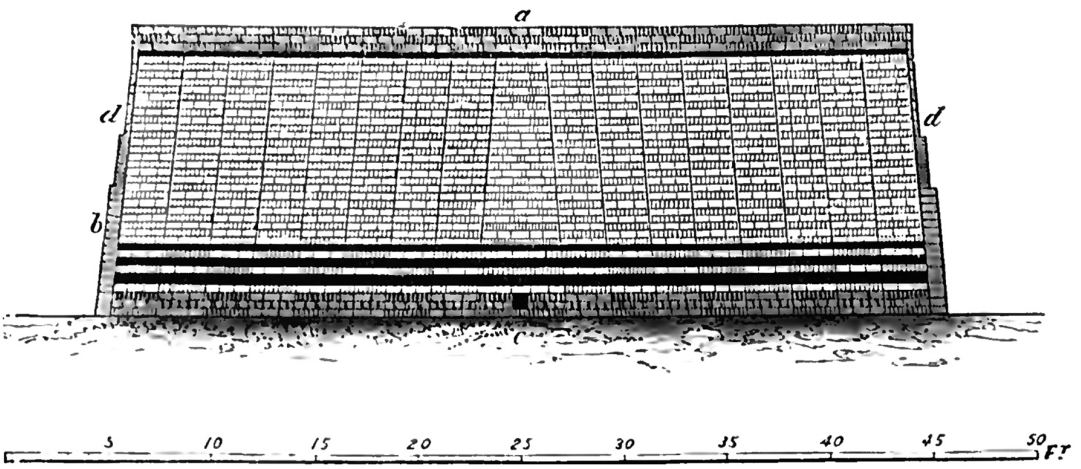

Fig. 19 Cross-section of a brick clamp showing flue channels filled with fuel (Dobson 1886, 146).

overlain by straw, had been dumped to level the ground and improve drainage. The floor of the brick clamp was made with another sandy silt deposit, which had become fired hard red due to the subsequent heat. There were also the remains of brick platforms onto which the unfired bricks would have been stacked, along with ash-filled shallow linear flues.

As well as the clay pits and clamps, several other elements would have been associated with this early brick production at St Anthony's. Brick manufacturing required a large area for the various stages of production and it was operated seasonally; the clay was dug in autumn and left to weather over the winter; the clay was prepared, and the bricks were moulded and fired during spring and summer (Dobson 1886). After the clay had weathered, all stones were removed and the clay was tempered with a spade or by machine (either ground by rollers or in a pug-mill). The bricks were moulded in boxes by hand or by machine and these 'green' bricks were left to dry, either on a hack ground, which was generally just protected by a cover, or in drying sheds.

There is very little documentary evidence charting the history of St Anthony's Brickworks. The 1887 edition of Bulmer's *History and Directory of Newcastle* lists 'Grant and Watson, brick manufacturers, St. Anthony's Brickworks' (Davison 1986, 64), but the company is not listed in either Ward's or Kelly's late nineteenth-century directories. A notice in the London Gazette on August 5 1887 records the dissolving of the partnership between '... James Grant and James Watson, carrying on business as Brick Manufacturers, at St. Anthony's, in the county of Northumberland ... The business for the future will be carried on by the said James Watson ...'

The first permanent structure to be built at the site was the brick-drying shed constructed some time between the submission of the planning application in 1886 and the publication of the 1898 Ordnance Survey map. The construction of the shed suggests that the scale of brick production had increased, presumably due to the introduction of mechanisation stimulated by increased local demand for the products. It was essential to dry bricks properly to prevent cracking in the kiln, and Dobson (1886, 45) states that drying sheds in the form of steam- or flue-heated floors were used in yards where pressed facing bricks were made and where

brick-making machines were used. He notes that drying of bricks over flues could only be carried out where cheap coal was available. An account of brick manufacture in Nottingham describes drying sheds or 'hovels' as often being of simple construction, with 'open sides and a tiled roof, supported by wooden posts or brick piers... Some of the hovels have flues under the floor, the fire-places being placed in a pit sunk at one end of the hovel, and the chimney at the opposite end. These flues are made use of when the demand for bricks is so great that sufficient time cannot be allowed for drying in the open air, and also during inclement seasons. The sides of the hovel are then walled up with loose brickwork to retain the heat' (Dobson 1886, 72).

The brick drying shed at St Anthony's (Building 1) was evidently of more substantial construction than the description in Dobson's treatise. The architect's plan of the shed (fig. 20) shows that it was designed to be 100 feet by 31 feet (*c.* 30.48 m by 9.15 m) with one roughly central door on one of the long sides and two more on the other side. Three equally spaced chimneys, measuring 18 inches (0.45 m) internally, were to be provided externally at the end of the building; the drawing of the side elevation shows one of these chimneys projecting a short distance above the roof of the building (this western wall of the drying shed was recorded at the site, along with the lower parts of the three chimneys). A cross-section drawing through the side of the building shows the flues which were built parallel with the long side of the structure; the floor was laid on top. Fragmentary traces of a few of these flue walls were recorded at the easternmost surviving extent of the building. The elevation drawing of the eastern end of the building shows two rows of seven semi-circular openings; these presumably drew the air through the flues and the chimneys. The plans show that ground level at this end of the building was lower than across the remainder of the elevations; the lower openings were presumably set level with the flues. The mechanism by which hot air was introduced into the building is not known as the eastern end of the building was not within the excavated area, and no details were provided on the architect's drawing. Fires may have been lit in pits outside the building, similar to the method described by Dobson (1886, 72). In the early twentieth century, 'drying flats' at Ramsay's Fireclay works in Swalwell were heated directly underneath by 40 open fires (Davison 1986, 138).

The bricks used to build the drying shed — presumably made at the brickworks — were pressed wire-cut. The architect's plan shows an L-shaped building (separate from the drying shed), divided into a 'brick machine shed' and 'engine shed'. The machine shed measured 32 feet by 16 feet (*c.* 10 m by 4.8 m) and the engine shed 24 feet by 20 feet (*c.* 7.3 m by 6.1 m). The entire structure measured 40 feet (12.2 m) in length and had four external doors; the external elevation was to be clad in timber boarding. No traces of this building were identified within the excavated area. In early examples of brick-making machines, which were invented in the mid-nineteenth century, clay from a hopper was forced into a chamber, a piston then pushed sufficient clay for a single brick though the die, and the clay was cut off by wire (Brunskill 1990, 25). In later examples, a continuous supply of clay was fed into the machine by an Archimedes screw and the extruded clay was fed along a bed of rollers on a table on which a set of wires cut off a batch of bricks at a time. Steam-driven extrusion machinery had a set of overhead wire cutters which could produce around ten bricks in just a few minutes. These larger quantities created a need for quicker and more efficient drying methods to keep up with production.

The documentary and cartographic evidence suggests that the introduction of brickmaking machinery at St Anthony's allowed the scale of production to be greatly increased during the

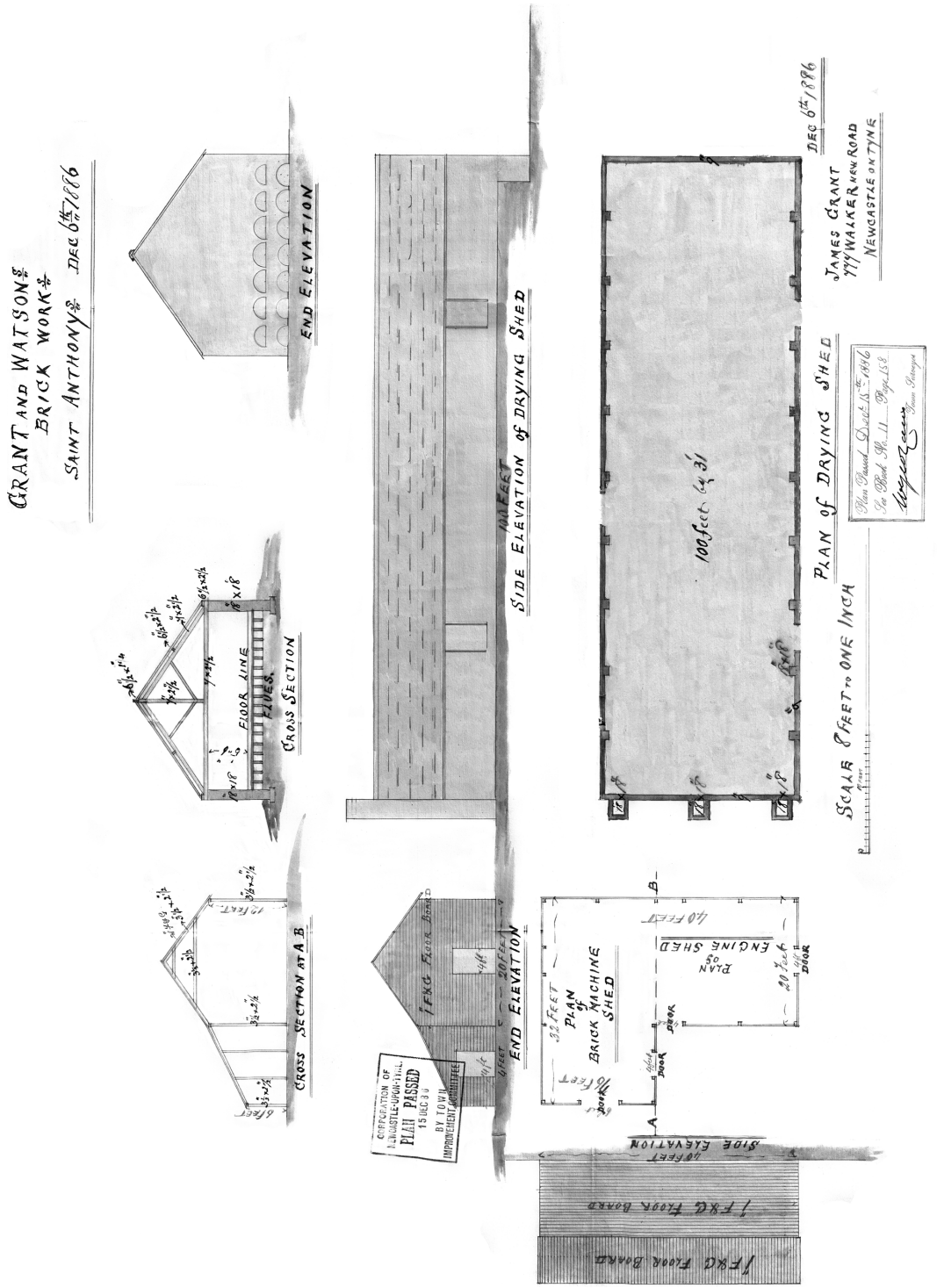

Fig. 20 Architect's drawings for proposed 'drying shed' and 'brick machine and engine shed' at 'Grant and Watsons Brick Works, St. Anthonys'; reproduced by permission of Tyne and Wear Archives and Museums (T186/11858A).

late nineteenth century. The drying shed was incorporated into a much larger complex, which in total measured 44 m from north to south by 30 m from east to west, including a new drying chamber built at the northern end of this range of buildings. There was no evidence to indicate the function of the old drying shed, which was modified for another use, or that of the new adjoining building to the north, but brick-making machines, engine sheds and a kiln (or kilns) would have undoubtedly formed part of this new complex.

The only other documentary reference to St Anthony's brickworks is the appearance of the business in the 1903–04 edition of Kelly's trade directory of Newcastle, when it is listed under the category of 'brick and tile manufacturer' as 'St. Anthony's Company, St. Anthony's'. This demonstrates that tiles were also manufactured at the brickworks; this was a common occurrence as tiles would have been fired within the same kilns (Raistrick 1972, 75). The available evidence indicates that common or house bricks and tiles were manufactured at the brickworks, and these had been used for the construction of the buildings. However, some firebricks had also been incorporated into the flue walls. These specialised bricks were designed to withstand high temperatures and were used to build structures such as kilns and furnaces. Usage of common bricks along with firebricks in the flues indicates that the drying chamber would not have been heated to any great degree. The firebricks were presumably acquired by the manufactory to build the kiln and represent left-over building material. Firebricks from several different sources were identified and this is typical for buildings of this date in the region, and was noted for example during investigations at Swalwell Ironworks (Proctor 2010). Bricks were transported over considerable distances in the second half of the nineteenth century due to the growth of the railways and it is also possible that the firebricks may not have been bought direct from the yard but from a builder's merchants with a varied stock, depending on price and availability (John Nolan pers. comm.).

Cartographic evidence and the excavated remains show that by 1907 the brickworks had been demolished and completely rebuilt slightly to the east and south of the earlier complex. The large L-shaped range of buildings shown on the map measures a maximum of 34 m from east to west by 38 m from north to south, and two small buildings are depicted to the north. The projections along the north external wall of the northern range may perhaps represent air vents, suggesting that part of this building could have functioned as a drying room. The recorded evidence that the northern building was divided internally, as shown by the row of piers, suggests that this possible drying room occupied the northern side of the building and was 8 m wide by 34 m long — and therefore of very similar dimensions to the first brick-drying shed. As with the earlier brickworks, a range of activities would have been carried out within the rebuilt complex, but there is no evidence to be able to establish what occurred where, although the fact that a chimney is labelled on the corner of the south-eastern building suggests that a kiln was located there. The map also shows a tramway leaving the south-eastern corner of the works and running roughly south-eastwards in a cutting; this was presumably to transport the raw materials into the brickworks and the finished products out.

The brickworks are shown on the 1940 Ordnance Survey map but do not appear on the 1951 edition, indicating that the works ceased production and were demolished within this period. After the end of the First World War there was a decline in the brick industry with over half of the brickworks in the region closing (Davison 1986). A further decline after the Second World War was brought about by advances in the technology of building materials — and the subsequent drop in demand for bricks — which may have led to the closure of the St Anthony's manufactory.

CONCLUSIONS

Little survives of the industrial legacy of Walker; the riverside area has changed beyond recognition in the modern era and, with the exception of a few manufacturing and engineering premises, all traces of the extensive industrial complexes and colliery staithes have gone. The northern bank of the river is now largely occupied by an extensive park. Echoes of the industrial past do, however, resonate in many street names such as Pottery Bank, The Ropery, and Wincomblee Street, the last named after the staithes. No traces remain of the once ubiquitous coal mines and associated infrastructure, and it is only through map regression that the locations of some colliery waggonways — the vital transport routes which served the industry prior to the railways proper — can be identified. Elsewhere in the North-East, some waggonways do survive as recognisable features in the landscape, some utilised as public footpaths. Many former waggonway routes in the region that do not survive as landscape features are known and listed on county HERs based on Ordnance Survey and earlier maps, with many — such as the Walker Colliery waggonway investigated at the SCP site — being annotated on early Ordnance Survey maps as 'disused'. Map regression can be used to trace the lines of some of these routes as they often continued in use as tracks, and then as roads, some surviving within the modern street layout. However, the routes of some of the earlier and short-lived examples, such as the St Anthony's Colliery waggonway recorded at Lightfoot Centre, are not even depicted on the first-edition Ordnance Survey maps.

Brick-making and tile-making, once major industries in the North East, have declined dramatically; derelict brickworks were once to be found across the region, though many have now been demolished (Atkinson 1974, 110; Guy and Atkinson 2008, 242). Relatively little archaeological excavation of brickworks has taken place and in those instances, attention has tended to focus on the kiln, the part of the brickworks most likely to survive (Raistrick 1972, 73). No excavated examples are published from this region and the structural remains of St Anthony's brickworks recorded at the Lightfoot Centre are therefore of considerable significance, especially as the archaeological remains, along with the documentary and cartographic evidence, has enabled the development of the brickworks to be charted. This combined evidence revealed the earliest beginnings of St Anthony's brickworks as a relatively simple production site; after the construction of the first permanent structure there was piecemeal development, followed by the complete rebuilding of the complex. The two phases of drying shed investigated are of particular significance as such buildings have been subject to relatively little archaeological investigation, particularly in the North East. The discovery of the architect's plan of what was probably the earliest drying shed at the works has allowed an additional insight into the fragmentary archaeological remains; the illustration of the full ground plan, as well as the external elevations of the building, provides information that the surviving below ground remains alone simply could not.

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