



**REEDS HOLME
MILL,
BURNLEY ROAD,
RAWTENSTALL,
LANCASHIRE**

**Archaeological Building
Investigation**



Oxford Archaeology North

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Allied Textiles Ltd

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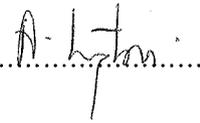
National Grid Reference: 380900 424537

Prepared by: Chris Wild
Position: Project Officer
Date: September 2012

Checked by: Ian Miller
Position: Senior Project Manager
Date: September 2012

Signed........

Approved by: Alan Lupton
Position: Operations Manager
Date: September 2012

Signed........

Oxford Archaeology North

Mill 3
Moor Lane Mill
Moor Lane
Lancaster
LA1 1GF
t: (0044) 01524 541000
f: (0044) 01524 848606

w: www.oxfordarch.co.uk
e: info@oxfordarch.co.uk

© Oxford Archaeology Ltd (2012)

Janus House
Osney Mead
Oxford
OX2 0EA
t: (0044) 01865 263800
f: (0044) 01865 793496

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SUMMARY

In August 2012, Oxford Archaeology North (OA North) was commissioned by Allied Textiles Ltd to undertake a programme of archaeological building investigation to support a prior notification application for the demolition of the former Reeds Holme Mill, near Rawtenstall, Lancashire (centred at NGR 380900 424537). The mill was established as an integrated cotton-spinning and weaving factory in the mid-nineteenth century, and whilst the site expanded during the second half of the nineteenth and twentieth centuries, the majority of the original buildings survive extant. A current survey of Lancashire's textile-manufacturing sites has concluded that Reeds Holme Mill is potentially of 'high significance', reflecting the extent of surviving historic fabric.

Following the guidance and advice provided by the Lancashire County Archaeology Service (LCAS) in their capacity as archaeological advisor to Rossendale Borough Council, it was recommended that an archaeological building survey of the historic elements of the site was carried out to inform the method statement for demolition. The scope of the archaeological works required was specified in a Written Scheme of Investigation that was devised by OA North in consultation with LCAS. This allowed for an English Heritage Level 2/3-type survey of the buildings, coupled with an appropriate level of historical research.

The building investigation was carried out in August 2012, and identified three principal phases in the development of the site, with two phases of subsequent smaller structural modifications during the twentieth century. The historic fabric comprised three main elements: a three-storey spinning block; a weaving shed; and a stable block, all of local sandstone construction. The original three-storey spinning block was of non-fireproof construction, and had an internal double-beam engine house. A small boiler house appears to have been laid transversely at the eastern end of the mill, leading to a large octagonal-section chimney. A small weaving shed was placed opposite the preparatory block of the main mill building, although the principal function of the complex appears to have been cotton spinning at this time.

Extension work carried out in 1864-7 changed the complex to a fully integrated cotton mill, enlarging the mill to the Burnley Road street frontage. The power plant was seemingly remodelled to supply the increased demand for power, with a four-bay boiler house added at the eastern end of the three-storey mill, with the existing boiler being replaced by a Green's economiser. The power of the engine may have been increased by the addition of a high-pressure cylinder. A stable block also appears to have been added to the complex at this time. This had an ornate gateway at its western end, controlling access into the complex from Burnley Road.

The third major phase of construction comprised the further expansion of the weaving shed, which included a shallow basement, increasing the warehousing capacity of the complex significantly. The addition of engineering workshops above the eastern end of the weaving shed appears slightly later in date, and represents the final alteration of the integrated textile mill complex. Further remodelling was undertaken throughout the twentieth century following the cessation of spinning and weaving, as the buildings were adapted for textile-finishing processes.

ACKNOWLEDGEMENTS

Oxford Archaeology North (OA North) would like to thank Stewart McGuffie of Allied Textiles Ltd for commissioning and supporting the project. Thanks are also due to Doug Moir of the Lancashire County Archaeology Service, and Rachel Fletcher of Rossendale Borough council, for their advice and support, and to Anthony Pilling for sharing his specialist knowledge of historic textile mills.

Chris Wild conducted the building investigation, and Ian Miller carried out the documentary research. The report was compiled by Chris Wild and Ian Miller, and the illustrations were produced by Mark Tidmarsh. The report was edited by Ian Miller, who was also responsible for project management.

1. INTRODUCTION

1.1 CIRCUMSTANCES OF THE PROJECT

1.1.1 Allied Textiles Ltd has submitted an application to Rossendale Borough Council for prior notification of the demolition of the former Reeds Holme Mill on Burnley Road, Rawtenstall (centred on NGR 380900 424537). In response to the application, Rossendale Borough Council has requested that an archaeological record of the mill complex was compiled as part of the method statement for demolition. Following consultation with the Lancashire County Archaeology Service, in their capacity as archaeological advisor to Rossendale Borough Council, it was recommended that the archaeological record should be consistent with an English Heritage Level 2/3-type building investigation. This allowed for an accurate measured survey of the historic mill complex, coupled with a written description and a detailed photographic record, supplemented by an appropriate level of historical research.

1.1.2 A current survey of Lancashire's textile-manufacturing sites has indicated that Reeds Holme Mill is potentially of 'high significance', as it seemingly retains a considerable proportion of its historic fabric. The earliest elements of the mill complex were erected during the mid-nineteenth century, and included a three-storey cotton-spinning block with a large internal engine house and a detached, square-section chimney. There is some evidence to suggest that the mill also had some capacity for weaving cotton goods, although this was seemingly carried out on a small scale. The complex was expanded considerably in 1864-7 in the wake of the Lancashire 'Cotton Famine', providing the mill with a large weaving capacity. The weaving shed was extended in the last quarter of the nineteenth century, and ancillary buildings including additional warehousing and workshops were also constructed. Major additions to the site were also completed during the second half of the twentieth century, enabling modern textile-finishing processes to be carried out in purpose-built structures. These buildings remain in use for coating fabrics, and were excluded from the remit of the archaeological survey, which was intended primarily to provide a detailed record of the nineteenth-century structures to mitigate their ultimate loss through demolition.

1.2 SITE LOCATION

1.2.1 Reeds Holme Mill lies on the eastern side of Burnley Road at Reeds Holme, situated some 2.25km to the north of Rawtenstall, Lancashire (centred at NGR 380900 424537). The southern boundary of the site is formed by the Edge End Clough, a small watercourse and tributary of Limy Water, which flows through Reeds Holme on the western side of Burnley Road. The site lies at a height of approximately 193m above Ordnance Datum.

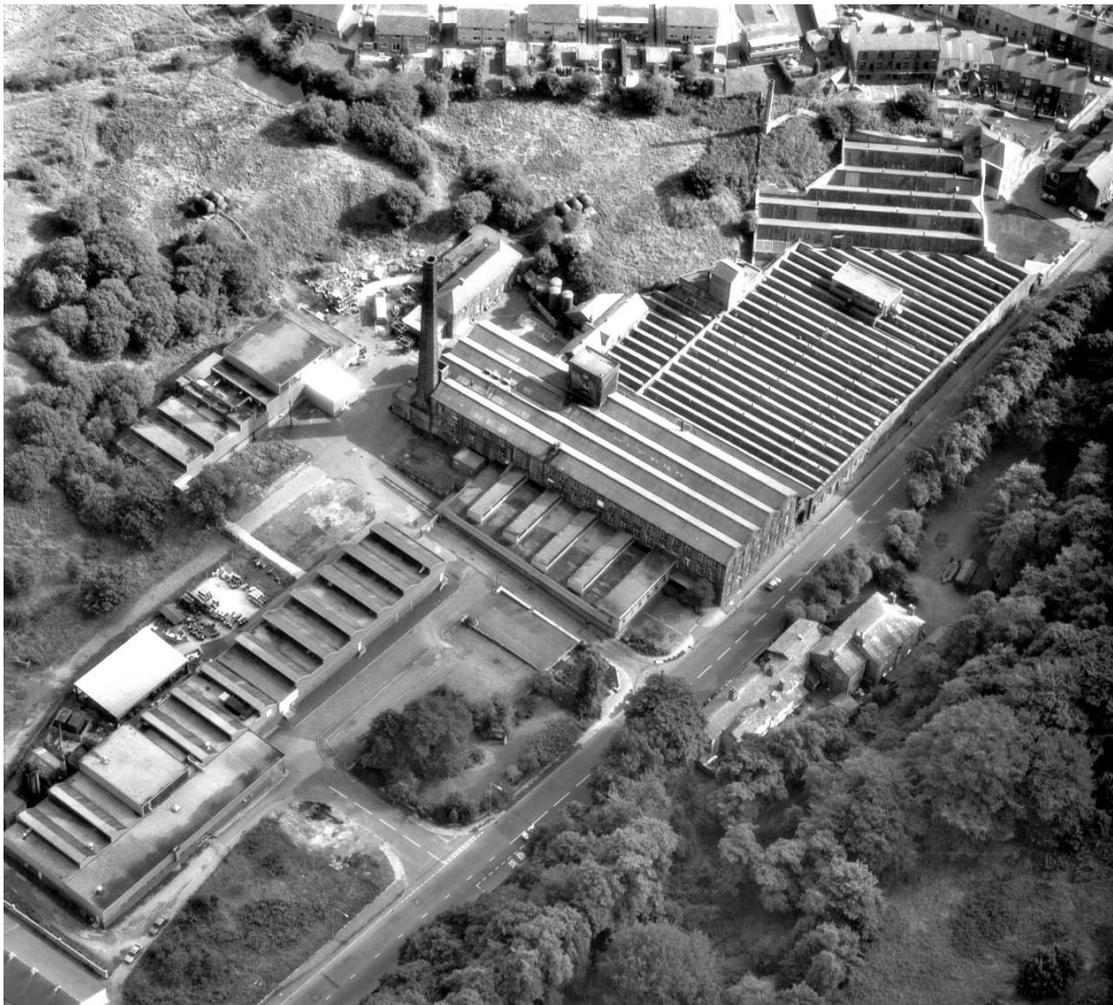


Plate 1: Aerial view of Reeds Holme Mill in 1989, looking south-east, showing the modern textile-finishing plant to the north (bottom left) and the adjacent Holmes Shed mill to the south (top right)

2. METHODOLOGY

2.1 BUILDING INVESTIGATION

- 2.1.1 The building investigation aimed to provide an understanding of the historic fabric and key architectural features of the former mill complex, and to provide an archive record of the component structures prior to demolition. It has provided a drawn, photographic and textual record of the buildings to English Heritage (2006) Level II standard. Records were made of all principal structural elements, both internal and external, as well as any features of historical or architectural significance. Particular attention was paid to the relationship between the earliest and latest parts of the building, especially those that would show their development and any alterations. All work was carried out in accordance with the Written Scheme of Investigation (*Appendix I*), and was consistent with the relevant standards and procedures provided by the Institute for Archaeologists (IfA), and generally accepted best practice.
- 2.1.2 **Photographic Survey:** a photographic archive of the buildings was compiled, consisting of both general and detailed interior photographs, which were captured using both digital and black and white 35mm formats. General photographs of the exterior elevations were also taken in digital and 35mm format.
- 2.1.3 **Instrument Survey:** floor plans of the buildings were surveyed by means of hand-measured survey to enhance existing block plans. The drawings were used as a basis for annotation to illustrate the phasing and development of the buildings. Detail captured by the annotation included features such as window and door openings, and changes in building material and phasing. The final drawings are presented through an industry standard CAD package (AutoCAD 2004).
- 2.1.4 **Interpretation and Analysis:** a visual inspection of the exterior of the buildings was undertaken and a description maintained to English Heritage (2006) Level II. These records are essentially descriptive, and provide a systematic account of the origin, development and use of the mill complex.

2.2 ARCHIVE

- 2.2.1 A full archive of the work has been prepared to a professional standard in accordance with current English Heritage guidelines (1991) and the *Guidelines for the Preparation of Excavation Archives for Long Term Storage* (UKIC 1990). The archive will be deposited with the Lancashire Record Office in Preston on completion of the project. In addition, a copy of the report will be forwarded to the Lancashire Historic Environment Record (HER).

3. HISTORICAL BACKGROUND

3.1 HISTORICAL BACKGROUND

- 3.1.1 The administrative district of Rossendale is focused on a long, narrow valley of the River Irwell. This area formed part of the sparsely populated and densely wooded Forest of Blackburnshire until 1507, when Henry VII disafforested the valley and converted the land into copyholdings that were held in perpetuity by the 'immigrants' from Pendle who received them. One important consequence of this act was that the land was used subsequently for sheep farming, thus facilitating the start of Rossendale's woollen industry (Tupling 1927). The principal urban centres in the borough are Haslingden, Rawtenstall, Bacup and Whitworth, which all developed in the nineteenth century as a direct consequence of the growth in the textile industry.
- 3.1.2 The initial growth of the woollen industry in Rossendale was relatively slow, which was in part due to the poor communications network. The industry began to expand in the eighteenth century, with associated settlement centred on the villages of Newchurch and Goodshawfold (Goldsworthy 1965). The application of machinery in the production of woollen goods towards the end of the eighteenth century stimulated an expansion of the industry. One of the first processes to be mechanised was carding. Whilst carding engines were applied to the cotton industry in many other parts of Lancashire, the machine was applied initially to wool in Rossendale. Before the end of the eighteenth century, carding mills had been established at Rising Bridge, Baxenden and Haslingden, with the total number increasing to 34 by 1825 (*ibid*). The number of fulling mills and dye works also increased in the valley during this period, although the application of machinery to the spinning of wool was not progressed as rapidly as it was to cotton. Nevertheless, some 20 new woollen mills were established in Bacup alone during the first 30 years of the nineteenth century (Ensum nd,1), reflecting the continued importance locally of this branch of the textile industry. However, the woollen industry fell into decline from the mid-1830s; by 1840, cotton had superseded wool as the principal branch of the textile industry in Rossendale, and only a few woollen manufacturing firms remains after 1850 (Rothwell 2009, 5).
- 3.1.3 The factory-based cotton industry in Rossendale can be traced back to the late eighteenth century; by the end of the century, there were eight cotton-spinning mills in operation in Rossendale, all being water powered (Tupling 1927). By 1830, this number had increased to approximately 50, the majority of which continued to be water powered despite the widespread adoption of steam power elsewhere in Lancashire. The great increase in the amount of spun cotton that was produced by these new factories outstripped the supply of handloom weavers, leading to the development of powered weaving sheds. The first steam-powered weaving mill in Rawtenstall was Higher Mill, which started in production in 1822. Some four years later, power weaving was being used to produce cotton goods in at least four other mills, including Longholme, Waterbarn, Rockcliffe and Irwell Springs.

- 3.1.4 The date at which the mill was established is uncertain, although the site is shown as undeveloped land on the Ordnance Survey map of 1849, which was surveyed in 1844-7 (Plate 2). However, the mill was occupied in 1854 by William Lord, cotton manufacturer (Davies 1984, 104). A newspaper advertisement of the same year offered for sale a gasometer with tank and gas making apparatus, all nearly new and capable of supplying 150 lights, at Reeds Holme Mill in Rawtenstall (*Manchester Times*, 5 July 1854; *Manchester Times*, 15 July 1854).

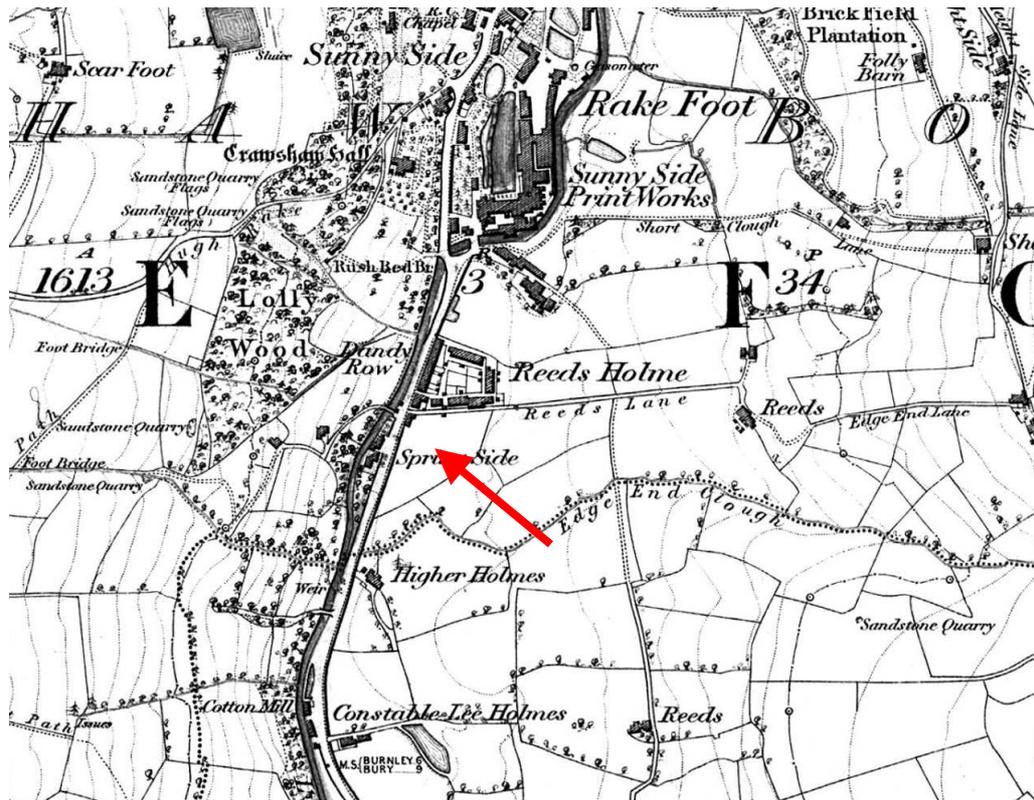


Plate 2: Extract from the Ordnance Survey map of 1849, with arrow marking the undeveloped site of Reeds Holme Mill

- 3.1.5 It seems possible that William Lord was not the sole occupier of the mill, as in 1855 the assignees of James Fenton issued instructions to sell by auction 172 patent power looms at Reeds Holme Mill. The power looms were described as being all nearly new and having 'the most recent improvements', and were offered for auction together with the winding, warping and beaming machinery (*Manchester Times*, 6 June 1855; *Manchester Times*, 9 June 1855). The mill appears to have been owned subsequently by George Haworth, described in a trade directory for 1864 as a 'cotton manufacturer'. Haworth was responsible establishing the surrounding streets of workers' housing, three of which (Tryon, Seymour and Nelson) were named after his sons (Davies 1984, 104). Haworth was also responsible for considerable reconstruction of the mill, as a newspaper article of January 1867 reports that George Haworth's 'Reeds Holme Mill will be a magnificent building when completed, and with the shed will contain 700 looms. There are now nearly 300 hands employed at the works' (*Bacup and Rossendale News*, 19 January 1867).

- 3.1.6 It seems that Haworth may have leased space in the mill, as William Slater and Richard Hayhurst, described as cotton spinners at Reeds Holme Mill, were declared bankrupt in 1868 (*Daily News*, 20 May 1868). The entire mill complex may have been occupied subsequently by George Haworth. In 1879, it was reported that the mill housed 16,000 spindles and 400 looms (*Bacup and Rossendale News*, 22 November 1879), whilst a subsequent article that was printed in a local newspaper some six years later stated that 20,000 spindles and 465 looms were in operation at the mill with a labour force of 300 (*Bacup and Rossendale News*, 10 October 1885).
- 3.1.7 In May 1886, a fire was discovered at JE Haworth's Reeds Holme Mill, although 'the servants of the firm succeeded in subduing the flames before serious damage was done' (*Bacup and Rossendale News*, 1 May 1886). An additional weaving shed with a capacity for 200 looms and a new warehouse were added to the site shortly after this fire (*Bacup and Rossendale News*, 24 July 1886). The resultant increase in machinery is apparent in an entry in a trade directory for 1891, which accredits Reeds Holme Works with housing 21,000 spindles, spinning coarse and medium counts of both twist and weft yarn together with fine counts of weft, and 660 looms, producing sheetings, twills, domestics and T-cloths (Worrall 1891, 143).
- 3.1.8 The extent of the mill at that date is shown on the Ordnance Survey 25":1 mile map of 1893 (surveyed in 1892), which provides the earliest plan of the site (Fig 2). Curiously, it is referred to as 'Reeds Holme Works' rather than 'mill'. It is depicted as a large complex with a rectangular block forming the northern boundary, with an irregular-shaped block lying to the south. The two blocks are separated by an entrance from Burnley Road that provided access to the mill yard at the eastern end of the complex. The rectangular block, almost certainly representing the spinning mill, is shown to have incorporated a chimney in its north-eastern corner, presumably indicating the location of the mill's steam-power plant. The southern boundary of the site was formed by the Edge End Clough, immediately beyond which lay another cotton mill referred to as Holmes Shed. The same footprint is depicted on the next edition of Ordnance Survey mapping, which was published in 1911 (Fig 3).
- 3.1.9 In June 1925, the mill was taken over by Robert Henry Pilling, at a cost of £50,900. However, Pilling filed for bankruptcy in June 1931 (*Rossendale Free Press*, 1931), and the mill was advertised subsequently for sale. According to one article, the mill housed 9,176 twist ring and 7,152 weft ring spindles and 662 looms, and was withdrawn from the sale as the highest bid was only £5,000 (*Bacup Times*, 12 March 1932). However, it was advertised again later in the same year. The sale notice provides an illuminating description of the component buildings and the machinery that they housed (Plate 3). The three-storey main mill, measuring 240ft long by 76ft wide, was used for carding, preparing, ring spinning, winding, warp and chain beaming, cross balling, dry taping, warp dressing and splitting. The weaving shed measured 202ft long by 142ft wide, and contained 671 looms. Power to the mill was provided by a pair of McNaughted beam condensing steam engines, with the steam being raised in a bank of four Lancashire boilers.

FOR SALE BY PRIVATE TREATY
(With or without Steam Power Plant, &c.).

"REEDS HOLME WORKS," Rawtenstall, Lancashire.

PARTICULARS.

The **LAND** forming the Site of the premises contains an area of about **TWO ACRES** and is **FREE FROM GROUND RENT.**

The **WATER SUPPLY** for condensing purposes is by means of a goyt in the River Limy on the opposite side of Burnley Road, as reserved by a Conveyance dated the 29th day of January, 1931, and made between the Vendors of the one part and The Honourable Herbert William Brooks of the other part, and also from a Lodge situate on land adjacent to the Mill.
The right to take water therefrom will be reserved.

The **BUILDINGS** (having frontage of about 400ft. to the Rawtenstall-Burnley Highway) are of exceedingly substantial stone construction, partly fireproof, one, two and three storeys in height, having a total floor space of about 11,000 sq. yards, in good repair and condition, electrically lighted throughout; the **MAIN MILL** of three storeys being installed with the "Witter" Automatic Sprinkler and Fire Alarm.

The **MAIN MILL**, 240ft. long x 76ft. wide, is used for Carding, Preparing, Ring Spinning, Winding, Warp and Chain Beaming, Cross Balling, Dry Taping, Warp Dressing and Splitting, and as Staircase, Sprinkler Tank Tower and Steam Power Houses.
Brick-built Fuel Economiser House, 31ft. long x 16ft. wide.
Stone-built Chimney, about 60 yards high.

ONE STOREY (and part basement) WEAVING DEPARTMENT, etc., viz. :-
WEAVING SHED (containing 671 looms) av. 202ft. 0in long x 142ft. 0in. wide, with **FIRE-PROOF BASEMENT** 93ft. 0in long x 26ft. 0in. wide.
Size Mixing, Tape Sizing and Drawing-in Departments, Mechanics, Smiths and Joiners' Shops, etc. 120ft. 0in long x av. 60ft. 0in. wide x one and two storeys high.
Yarn and Cloth Warehouse and New Stores Room, etc. 120ft. 0in. long x 30ft. 0in. wide x one storey (and part basement) high.
Excellent Suite of Offices with Lavatory and W.C.
Two-storey Stables, Harness Room and Motor Garage with Loft over and Lime Pit at the rear.
Masons' and Painters' Wood-built Sheds, W.C.s, &c.

The **STEAM GENERATING and POWER PLANTS, etc., include :-**
Three LANCASHIRE STEAM BOILERS, each 30ft. 0in. long x 7ft. 6in. diameter, by Alfred Anderton & Sons.
One DITTO, 30ft. 0in. long x 8ft. 0in. diameter, with Turbine furnaces, by Heaton & Son, 2in. Water Injector, Green's 192-pipe Fuel Economisers.
Pair of McNaughted BEAM CONDENSING STEAM ENGINES with 2 H.P. cylinders 31in. diameter, two L.P. cylinders 38½in. diameter, 7ft. stroke (1 H.P. 720 at 85 lbs., 27 r.p.m.).
30 H.P. Engine with Benn's Condenser for Dynamo and Horizontal Engine 14in. cylinder, 24in. stroke, driving Mechanics' Shop.

The **MILLGEARING**, 4,300ft. of 7in. to 1½in. Mild Steel and Wrought-iron **SHAFTING**, Counter driving ropes and Counter belts, Steam and Water services, 4 Cage Hoists, 2 Self-landing and 2 Barrel Hoists.

Electric Lighting Plant with Royce's two-pole Dynamo, 100 volts, 360 amps, Switchboard and 600 Cord Pendants.
and the
"Witter" AUTOMATIC SPRINKLER INSTALLATION of 480 heads,
together with
15 ton Motor Lorry Weighbridge with plate 16ft. x 8ft. wide, by W. & T. Avery, Ltd., 1919, Hot Water Boiling Apparatus and Lavatory Fittings.

Piecemeal Sale of MACHINERY & PLANT
(On **WEDNESDAY** and **THURSDAY**, November 30th and December 1st, 1932).
Consisting of 9,176 Twist and 7,152 Weft Spindles, 671 Looms (sheeting, check, cross rod and plain),
And ACCESSORY PLANT, Loose Utensils, Office Furnishings and Effects
as detailed in Catalogue.

Sale to commence each day at Eleven o'clock prompt.

Vendors' Solicitor: **WM. EATON,**
27, King Street, Manchester.

Auctioneers: **SALISBURY & HAMER, F.A.I.,**
Blackburn and Manchester.

Plate 3: The sale notice of 1932

- 3.1.10 The mill was purchased eventually by JB Broadley for £3,250. The event was recorded in the local press: 'Reedsholme Mill, Rawtenstall, one of the largest cotton mills in the district, has been acquired by a Stackstead's firm, Messrs JB Broadley Ltd, slipper binding manufacturers of Farholme Mill. The mill has been closed for about two years, the last tenant being Mr RH Pilling who ran it for the manufacture of cotton' (*Bacup Times*, 7 October 1933).
- 3.1.11 The footprint of the mill at this date is captured on the Ordnance Survey map of 1930 (Plate 4; Fig 4). The footprint of the principal buildings is shown to have been the same as that shown on earlier mapping, although some slight alterations can be discerned. In particular, a narrow structure linking the north-eastern corner of the weaving shed with the spinning block had evidently been constructed by that date.

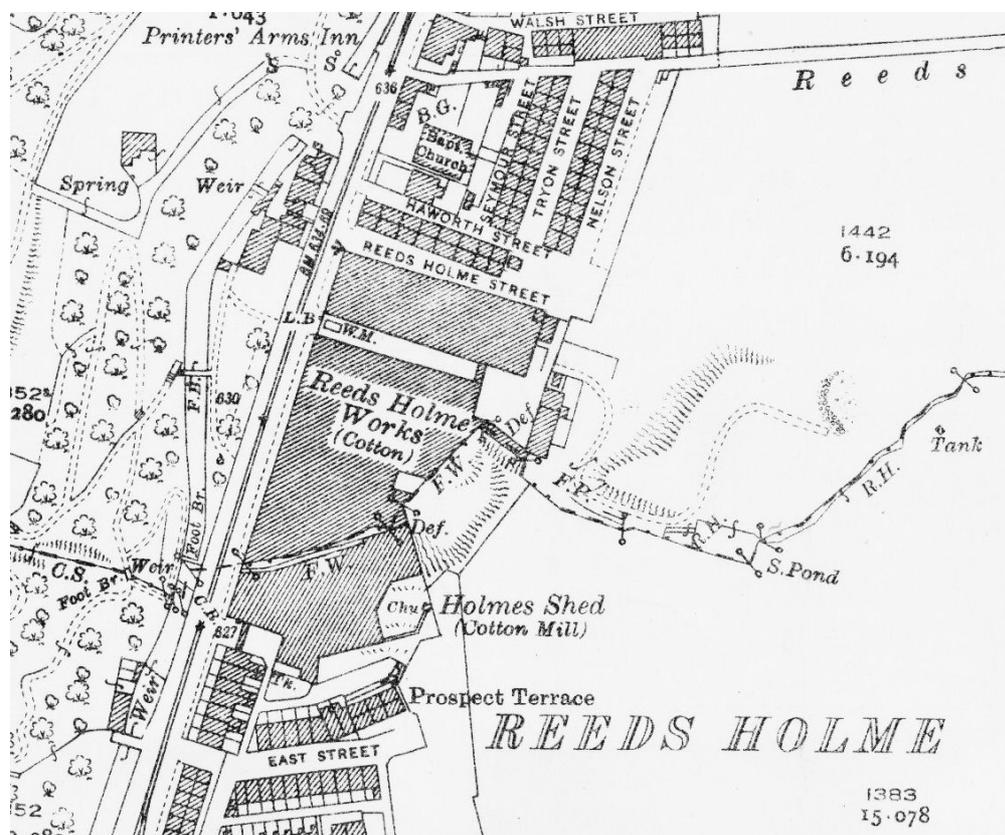


Plate 4: Extract from the Ordnance Survey 25": 1 mile map of 1930

- 3.1.12 In April 1934, part of the mill was leased to Messrs RE Ormerod, slipper manufacturers of Waterfoot, who were seeking new premises after their Carr Lane Works was gutted by fire (*Bacup Times*, 14 April 1934). Ormerods occupied the three-storey block, with Broadley occupying the weaving shed.
- 3.1.13 The firm of JB Broadley continued to prosper throughout the late 1930s and during the Second World War, during which they proofed balloon and dingy fabrics for the Ministry of Aircraft Production. In the 1950s, the firm invested in the development of synthetic footwear fabrics in polyurethane (PU) and polyvinyl chloride (PVC) finishes. This proved to be extremely successful, and led to substantial growth of the company. During this period, JB Broadley took over the three-storey block that had been leased to Ormerods.

- 3.1.14 The footprint of the mill depicted on the Ordnance Survey map of 1963 is shown as essentially the same as that shown on earlier mapping, although some slight alterations to the weaving shed can be discerned. However, plans for extensions to the mill were announced by JB Broadley in the early 1960s. It seems that an extension of the site had been an aspiration for many years, as JB Broadley Ltd had purchased land adjacent to the mill complex during the early 1940s. A deed of conveyance, discovered during the archaeological survey, details the sale of a small plot of land, equivalent to approximately 477 square yards 'situate at the rear of Reeds Holme Works', in May 1942. A larger plot, in excess of 11 acres and including Reeds Holme Farm, was purchased in October 1944 for the sum of £1,100. The conveyance included the right to take water from a tank on the north-easterly side of the land, and conduit it to the works via underground pipes.
- 3.1.15 The planned extension was to be 100,000 square feet, and would house the finishing and inspection and dispatch departments, together with a new quality-control laboratory (*Rossendale Free Press*, 29 June 1968). The new building became known as the Cunliffe Works after John Cunliffe Jackson, who had been a managing director at JB Broadley from 1926-60, and chairman of the firm from 1946-65. The construction of this building, which was placed to the east of the spinning block, commenced in February 1965.
- 3.1.16 Another new extension for polyurethane coating fabrics was designed by Peter Nuttall & Associates (Plate 5), was opened in 1973. This new building was known as the Rushbed Works, and became the main plant for transfer-coated products (*Rossendale Free Press*, 23 June 1973). This was placed to the north of the existing complex, and necessitated the demolition of the workers' housing established by George Haworth in the 1860s. The footprint of the new building, together with the Cunliffe Works of 1965, is depicted on the Ordnance Survey map of 1977.



Plate 5: Nuttall & Associates design for the new factory extension that was built in 1973

3.1.17 In November 1979, a fire broke out in the boiler house, causing damage estimated to be £30,000 (*Rosendale Free Press*, 24 November 1979). Another fire broke out in May 1980, following the explosion of an oil tank, causing damage estimated at £2,000 (*Rosendale Free Press*, 31 May 1980). In January 1981, JB Broadley Ltd installed a new coating machine at a cost of £50,000 (*Rosendale Free Press*, 10 January 1981). The following years brought a decline in the local footwear industry, which impacted upon JB Broadley's profit margins. The company went through several changes of ownership, including a management buy-out by four resident directors, but was eventually amalgamated with Allied Textiles in June 1989. The site remains in the ownership of Allied Textiles.

4. RESULTS

4.1 INTRODUCTION

- 4.1.1 The historic buildings comprising Reeds Holme Mill comprise three major structural elements: a three-storey spinning block; a weaving shed, with attached workshops; and a two-storey stable block (Fig 2). The spinning block incorporated an internal engine and boiler house, and retained an attached octagonal-section stone chimney (Plate 1).
- 4.1.2 The structures appear to represent two main phases of construction, with both the spinning block and weaving shed being extended in 1864, which included the erection of a gateway fronting Burnley Road that incorporates a datestone. A further increase to the weaving shed in the late 1880s enlarged the site beyond its extant size, although the majority of the complex survived modernisation through the twentieth century; the only losses to the historic fabric included the reduction of the stone-built chimney, and a part of the weaving shed that had formed the southern part of the mill complex.

4.2 SPINNING BLOCK

- 4.2.1 The original element of the three-storey spinning block comprised 18 x 7 bays, with a quadruple span roof (Plate 6). The building was of local sandstone construction, and given the large number of sandstone quarries within the locality, it is most likely that the stone was sourced within the immediate vicinity. The external walls comprised dressed, rusticated blocks laid in regular courses and bonded with a pale lime-based mortar. The windows had projecting rubbed sandstone sills and flat one-piece rusticated lintels, except the round-headed windows of the engine house and stair tower, which had dressed block arches with projecting keys (Plate 7). The corners of each elevation had projecting dressed quoins (Plate 6), and all doorways had dressed external jambs.
- 4.2.2 The wall thickness diminished on each floor, from 2'8" (0.81m) at ground-floor level, through 2'6" (0.75m) at first-floor level, to a much narrower 2'1" (0.63m) on the upper floor (figs). Internally, the walls were of dressed block to 3'6" (1.07m) high above each floor level, with rendered sandstone rubble above (Plate 8), apart from the upper floor which had a 3' (0.91m) high brick plinth in Stretcher Bond (Plate 9), strongly suggesting that it was only a single skin facing to the stone wall.



Plate 6: Spinning block from Burnley Road, with quadruple-span roof and dressed quoins



Plate 7: Eastern end of spinning block, showing the large arched windows of engine house



Plate 8: Sandstone plinth below rendered rubble walls, first floor, spinning block



Plate 9: Brick plinth below rendered rubble walls, second floor, spinning block

- 4.2.3 The main block, to the west of the stair tower and engine house, was of non-fireproof construction, with 7" (0.18m) diameter cast-iron hollow cylindrical columns supporting large-scantling timber beams (Plate 10) below a planked ceiling, undersealed with lath and plaster (Plate 11). Each column was fluted above an astragal, and had a decorated channel-section saddle above a wide rib, carrying the timber beams above, which were stop-chamfered either side (Plate 12). Each column head incorporated a crush box, protecting the timber beams, which must have been 'threaded' through the columns. Each beam spanned half the width of the block, being butt-jointed within the central column crush box. The central row of columns on the ground floor had bolting faces for a line shaft hanger on their southern face (Plate 12), whilst it was the northern row that carried the line shaft at first-floor level (Plate 13). At ground-floor level, the faces had T-shaped mountings for the hangers (Plate 14), which were then inter-locked and adjusted with packing wedges, whilst those at first-floor level were mounted with through bolts (Plates 15 and 16), which were used to adjust the tension and position of the hanger. It is unclear why two separate mounting methodologies were applied, requiring adaptation of the casting mould for the columns.
- 4.2.4 A blocked aperture in the east wall at first-floor level (Plate 16) represented the position of a large bevel gear, which would have translated power from the upright shaft, to a horizontal drive shaft. This upright shaft was placed adjacent to the northern column row, 23' (7.01m) from the north wall, with an exposed trimmer in the ceiling above, forming part of the housing for the shaft as it passed between the floors of the spinning block. The centrally placed line shaft at ground-floor level could either have been driven by a belt from the upright shaft, or by a horizontal drive shaft, powered by a bevel gear within a footstep bearing for the upright shaft. Subsequent remodelling had removed any evidence for this arrangement, but given the position of blocked apertures in the external south wall, and on a corresponding alignment within the external wall of the weaving shed, it is almost certain that a horizontal drive shaft ran along the wall face and into the weaving shed, the power to the central line shaft at ground-floor level being translated via a smaller bevel gear. Furthermore, it is from the positions of these substantial elements of ironwork that the wall of the engine house has been removed, strongly suggesting that they defined the extent of the remodelling.



Plate 10: Ground floor of spinning block



Plate 11: Detail of lath and plaster ceiling on the ground floor of the spinning block



Plate 12: Detail of ground-floor columns in the spinning block



Plate 13: First floor of spinning block



Plate 14: Bolting face on ground-floor column in the spinning block



Plate 15: Casting for through bolts opposite bolting face on first-floor column in the spinning block



Plate 16: Blocked aperture in east wall of spinning block at first-floor level, with ceiling trimmer above, and line shaft brackets on the adjacent column

4.2.5 On the upper floor the massive cast-iron top bearing for the upright shaft survived *in-situ* (Plate 17). This wall box incorporated T-shaped mounting holes within bolting surfaces for vertical and horizontal bearings, as well as curved rebates for bevel gears translating the vertical drive horizontally along the east wall. A 3' (0.91m) wide end bearing box mounted within the wall face 7'8" (2.35m) to the south housed the eastern end of the upper floor line shaft (Plate 18), which rather than being attached to bolting plates on the columns, was carried by hangers bolted to the soffits of each beam, placed 4' (1.22m) to the north of the central column row (Plates 18 and 19). In the western five bays, an additional line shaft was placed in a corresponding position to the north of the northern column row, presumably to drive further machinery, the line shaft almost certainly being driven by a belt from that to the south. The columns of the upper floor again differed slightly from those below, in that they did not incorporate crush boxes, which would have been unnecessary as no weight was applied directly above the upper columns. Instead, they had flat bolting plates to the beams (Plate 19), with the butt-ended joints clearly visible above the central row (Plate 18).



Plate 17: Top bearing for upright shaft in the spinning block, with recesses for bevel gears



Plate 18: Top bearing and offset line shaft end bearing, second floor of the spinning block

- 4.2.6 The roof was open to the rafters, but joist sockets in the east wall of the main block demonstrate that this bay, at least, originally had a loft. This may explain the use of wrought iron king rods within the braced timber trusses (Plate 19), possibly as a means of generating slightly more space within the loft. Whilst king post trusses were more common for multiple span roofs (Giles and Goodall 1992), queen post and queen strut trusses were more widely used for creating more useable attic spaces. The technology for roofs constructed fully of wrought and cast iron was also widely available by the mid-nineteenth century, although the cost may have been prohibitive for the roof space gained.

4.2.7 Another unusual feature of the roof is that the valleys were not placed directly above the columns (Plate 19). Whilst the four spans of the roof are symmetrical, the placement of the column rows is not, with the outer bays being far significantly wider than the two central bays. This arrangement was probably undertaken to maximise the useable space for the different sizes of a range of preparatory machines, principally carding, roving and slubbing, with the column lines being reciprocated on the upper floors for structural strength. The narrow longitudinal bay width may possibly be explained by the relationship of the roof and the column rows, with the larger number of columns it required than might be expected of a structure of this date, being employed to support the roof. The roof latterly had a metal sheet covering (Plate 7), but given the mill's proximity to the local sandstone quarries, it probably had a stone flag roof originally, which would have increased the load on the columns significantly.



Plate 19: Bolts protruding from soffit for line shaft hangers, with further hanger attachment bolt holes in beam face

4.2.8 The upper floor retained its original floor, comprising narrow tongue and grooved boards above the wider ceiling planks of the first floor. The interlocking tongues and grooves were applied to all four edges of each plank (Plate 20), demonstrating the high quality of the floor, which was probably of maple, and was typical of the flooring used in spinning rooms, where the operatives were generally unshod. A gap in the floor above one of the ceiling beams revealed that the joists were half-lapped onto the beams, with the wider tongue and grooved boards placed on the same alignment as the narrower boards forming the floor surface (Plate 20).



Plate 20: Detail of spinning floor construction on the second floor

- 4.2.9 The eastern three bays of the original mill building formed a preparation block, and were of fireproof construction, comprising brick jack arches supported on cast-iron beams (Plate 21). Cast-iron, square-section tie rods were also incorporated into the design, bracing the ceiling beams together. Where these arches were replaced subsequently with flat concrete ceilings at ground-floor level, the beams were exposed, showing them to be inverted T-section, fish-bellied beams, clasped around the narrowed cylindrical head of columns (Plate 22), which were otherwise similar to those in the main part of the mill to the west. Within this fireproof area of the building, the columns also incorporated bolting plates, with T-shaped wedge-housings, on the outer faces of the two central rows (Plate 22), carrying line shafting for the preparatory machinery, presumably scutchers. In the north elevation, two doors in the north wall allowed materials to be loaded directly into this primary preparation area. This would have been the most combustible area of the mill, producing large quantities of highly flammable dust, hence its fireproof construction, and its colloquial name of ‘Devil Hole’.
- 4.2.10 The bearing box for the northern of the two line shafts at first-floor level survived *in-situ*, and was flanked in the adjacent bay by a pair of inverted fish-bellied beams (Plate 23), which presumably housed the hanger for a bevel gear. A central loophole in both elevations suggested storage and primary processing was undertaken in this area, with a slender hoist, to which an electric motor was subsequently fitted, survived in the northern doorway (Plate 24). In the southern bay of the preparation block, a glazed timber partition was inserted subsequently, forming a corridor from the staircase into the eastern extension (Plate 25). Elements of flagstone flooring also survived at first-floor level, demonstrating the vertical continuation of fireproofing throughout this part of the mill. Several later apertures had been punched through the brick arch ceiling (Plate 23), to allow materials to be passed more easily between floors, whilst at ground-floor level, large sections of the brick vaulting had been replaced with flat concrete flooring (Plate 22).



Plate 21: Fireproof brick arch construction with straining rods within eastern bays of original mill, first floor, preparation block



Plate 22: Fireproof brick arch construction showing inverted fish-bellied beams, ground floor, preparation block



Plate 23: Bearing box and associated fish-bellied beams for bevel gear hanger, first floor, preparation block



Plate 24: In-situ hoist, first floor, preparation block



Plate 25: Timber partition and flagstone floor, first floor, preparation block

4.2.11 The east wall of this part of the structure was of consistent thickness with the principal elevations of the mill, and housed windows at first-floor level that, although not visible on the internal side of the wall, were retained as alcoves within the later extension to the west (Plate 26). These provide substantive evidence for the bays to the east forming a later addition to the mill, rather than just a separate structural element of the original build. Had the processing being undertaken within and above the 'Devil Hole' required the wall thickness observed in order to protect the structure to the west, it would be implausible for it to then contain so many large window apertures.



Plate 26: Blocked window apertures in external face of original gable wall, first floor, preparation block

- 4.2.12 The two bays between the spinning and preparatory/storage areas housed the access and power arrangements. The principal, workers' entrance into the mill was through a round-headed doorway within the south elevation, access to which was afforded via a cobbled passageway from the street frontage (Plate 27). After the expansion of the mill in 1864, this access was further controlled through a gateway in a facade that extended the full length of the complex along Burnley Road. The doorway led into a square stair tower, also of fireproof construction, with large sandstone flags spanning the landings. The central newel was 9'6" (2.93m) square and of hand-made brick construction in two-stretcher English Garden Wall bond, within which sandstone treads for the stairs were housed. This originally housed a hoist, which was powered by the engine, the small end bearing for the drive shaft being observed at first-floor level in the dividing wall (Plate 28). The newel also presumably originally housed the main standpipe for the sprinkler system, the tank for which was housed at third-floor level, in a room with round-headed windows in the south elevation (Plate 29). The shallow upper floor of the tower housed the cast-iron water tank for the engine, which survived *in-situ*. The tower was adapted subsequently for the insertion of an electric-powered lift cage, with the front wall being rebuilt in engineering brick (Plate 30), and the electrical headgear replacing earlier winding gear above second-floor level.
- 4.2.13 In the western part of the stair tower, a 4'6" (1.37m) wide 9' (2.74m) deep room was placed on each floor. A 2'6" (0.76m) wide doorway provided access from the spinning block at each floor level (Plate 31), whilst 3' (0.91m) wide doorways from each landing, and at ground floor level, were all blocked subsequently (Plate 30). The room had an intact floor at each level, and whilst it was not possible to establish the nature of the flooring, it would appear that they blocked a small hoist, with principal access from the landing, but with a narrower access directly from the spinning floor.



Plate 27: Main entrance into spinning mill, with alley to gated entrance on Burnley Road



Plate 28: In-situ small end bearing for hoist, first floor, stair tower

4.2.14 The quarter-turn staircase had a blocked doorway between ground- and first-floor level, from the eastern landing into the engine house (Plate 32), which lay immediately to the north within the main structure. This presumably provided the principal access into the engine house, up to deck level, with access to the cylinder head, and beam floors almost certainly being provided by internal ladders. A window on the first landing between the first and second floors was blocked subsequently, but undoubtedly provided light to the cylinder-head deck in its original form.



Plate 29: Round-headed windows and late sprinkler tank, fourth floor, stair tower

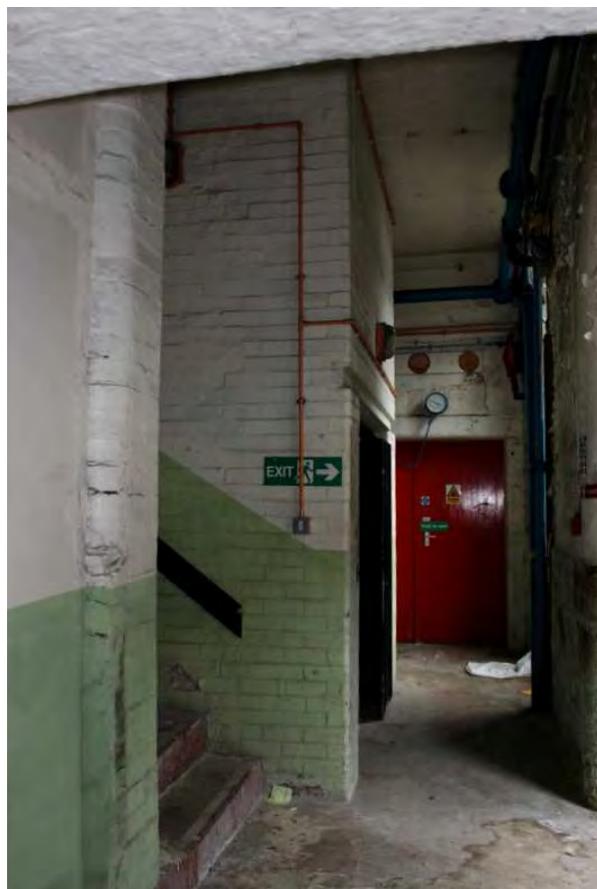


Plate 30: Rebuilt newel wall within stairwell, and blocked hoist entrance (left), ground floor



Plate 31: Doorway from spinning floor into probable hoist tower, first floor



Plate 32: Blocked doorway from stair tower to deck level of engine house

- 4.2.15 Whilst both the engine and its bed were removed, presumably in the mid- or late twentieth century, significant evidence for its arrangement was retained within the fabric, although much was obscured by a late internal rendering of the structure, and the removal of the dividing walls between the engine house and the main structure on either side at ground-floor level. The north elevation of the two-bay wide engine house retained two large round-headed windows spanning the first and second floors (Plates 7 and 33). These not only demonstrate that the engine was of double-beam design, but also that the bed was erected to approximately first-floor level, the ground floor, which would have been almost entirely filled with the massive blocks of the engine bed, not requiring daylight, and therefore placing the windows only at first-floor level. The flywheel was placed centrally between the two main blocks of the bed, in the northern part of the engine house, with a pinion wheel driving the first motion shaft into the main spinning block to the west, just below the ceiling level of the ground floor, adjacent to the northern column row. The cylinders were housed at the rear of the engine, adjacent to the stair tower, with the condensers placed within recesses within the engine bed at ground-floor level. Thus the majority of the engine structure was placed in the southern part of the engine house, allowing maximum lighting through the tall windows in the north wall.
- 4.2.16 The ceiling above the engine beams retained two large cross beams (Plate 34), which would have been used to carry the load of the engine during installation and maintenance. The tie bolts for the top bearing of the upright shaft, placed on the opposite side of the wall, were located immediately below these beams, and provided the only evidence for the position of the primary motion shaft within the engine house (Plate 34). The ceiling of the northern bay of the engine house was not required for functional lifting, and had a false lath and plaster ceiling with decorative cornice and a central ceiling rose with leaf motif (Plate 35). This provided a fine example of the architectural embellishment frequently undertaken within such structures, even within relatively utilitarian buildings. Engine houses became the feature-pieces of textile mill complexes after around 1825 (Giles and Goodall 1992), presumably as owners wanted to showcase their newer and larger engines, as a measure of their wealth and success. Decorative plaster ceilings were common from this time, as at Old Lane Mill, Halifax, erected by 1828 (*ibid*), whilst column decoration within the engine house, and the entablature beam they supported would have had at least the same measure of ornamentation as those within the remainder of the structure. Whilst these had all been removed, the wall sockets for the entablature beam, constructed of large ashlar sandstone blockwork, were visible in the external elevations of the engine house at third-floor level (Plate 18), and further similar sockets presumably related to the structure of the beam floor, and of the principal attachment points of the engine itself.



Plate 33: Large round-headed windows and decorative ceiling, engine house



Plate 34: Lifting beams below engine house roof, with tie bolts for the rear of the top bearing of the upright shaft immediately below



Plate 35: Detail of decorative plaster ceiling within north bay of engine house

- 4.2.17 Several infilled square apertures in the dividing wall at ground-floor ceiling level within the bay to the east of the engine house represent end bearings for the line shafting. One undoubtedly housed a primary shaft from the engine, whilst that mis-aligned with the line shafting within this part of the mill probably housed the steam pipe from the boilers to the engine.
- 4.2.18 Prior to 1893, the spinning block was extended on its eastern side with the addition of four bays (Plate 36). The southern facade of the extension was recessed slightly behind the quoined return of the original structure, whilst to the north it enveloped the square base of the chimney (Plate 37), and was keyed into the original facade. This was undertaken to such a high quality that the joint, which was probably partially concealed behind a rainwater downpipe, is not visible. However, the stonework to the east had slightly less pronounced rustication, a feature common to the other two faces of the extension. The extension appears to have been undertaken primarily to increase the capacity of the power plant, and provided accommodation for a bank of Lancashire boilers at ground-floor level. The front elevation had four distinctive round-headed arched openings, each of dressed stone, with projecting keys, each affording access to the boiler charging platforms.
- 4.2.19 Floor level within the boiler house was placed significantly below that of the road and the main block of the mill to allow coal to be off-loaded to the charging platform more easily. The boilers were 30' (9.14m) long, with the position of the damper control rods, controlling the flow of exhaust gases at the rear of each boiler, marked by pulleys attached to the ceiling beams (Plate 38). These were somewhat unusually of timber, similar to those in the western part of the mill, carried on tall 9" (0.23m) diameter columns with simple flanged heads above astragals (Plate 39), typical of the late nineteenth century, but with all but two having been removed during subsequent remodelling of the room, following the removal of the boilers (Plate 40).
- 4.2.20 The northern bay of the ground floor of the extension was partitioned from the boiler house by a substantial stone wall. At its eastern end, a short flue of refractory brick led to the base of the chimney (Plates 41 and 42). This almost certainly formed the bypass flue and an access for raking out, the main flue passing through an economiser, which was placed on the western side of the chimney, immediately to the rear of the boilers. Unfortunately, this was remodelled subsequently into an electricity sub-station. The upper part of the bypass flue appeared to have been removed, and replaced with a thin metal sheet capping (Plate 42), which formed the base of a brick tower, constructed on the southern side of the chimney (Plate 37). This suggests that the flue provided heat to the tower, which was probably used as a drying tower, with access above a further metal sheet floor from within the mill extension at first- and second-floor level (Plate 43). The structure, which was of machine-made brick (not engineering brick) construction, in four-stretcher English Garden Wall bond, was infested with pigeons at all levels, and could not be examined in any detail. It appears to have been constructed within a natural gap between the mill extension, the northern extent of which was defined by the consistent roof span width, continued from the earlier structure, the new roof being of only triple span to the south of the chimney (Plate 37).



Plate 36: Southern face of the extension to the main mill building, principally erected as a boiler house



Plate 37: Original chimney and gable of eastern extension of the preparation block



Plate 38: Pulley for damper rod at rear of boiler



Plate 39: Typical Victorian column capital in extension of three-storey mill

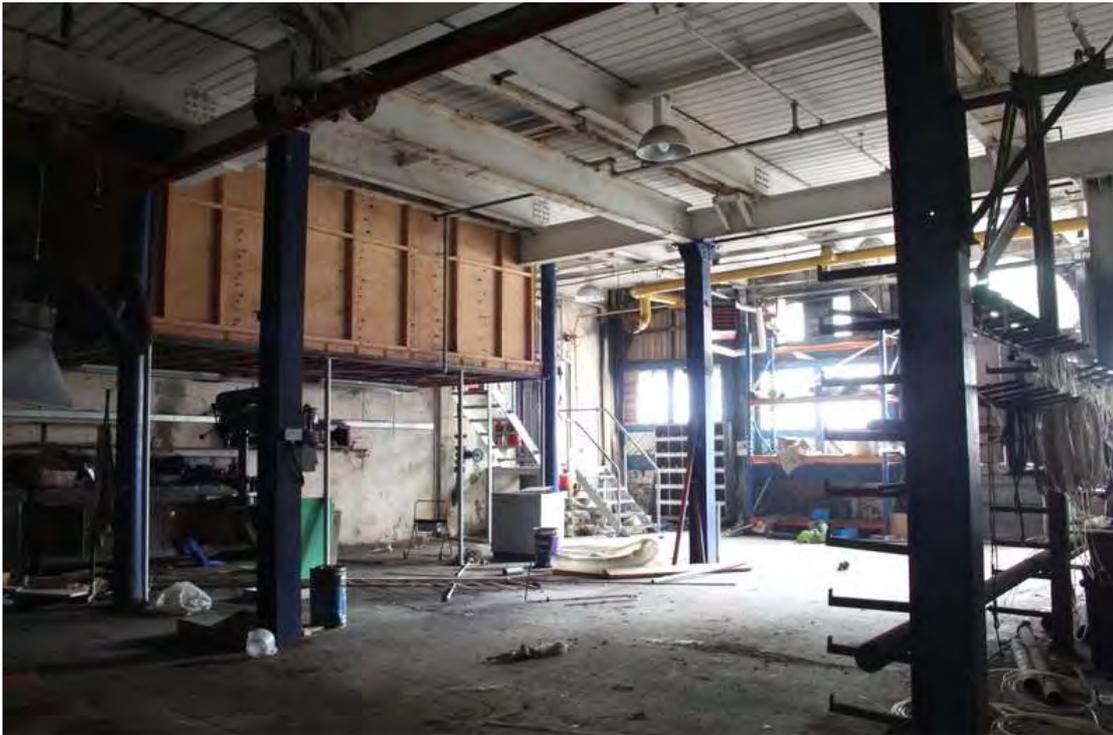


Plate 40: View of remodelled boiler house in eastern extension of mill



Plate 41: Iron door on access / bypass flue from boilers to chimney

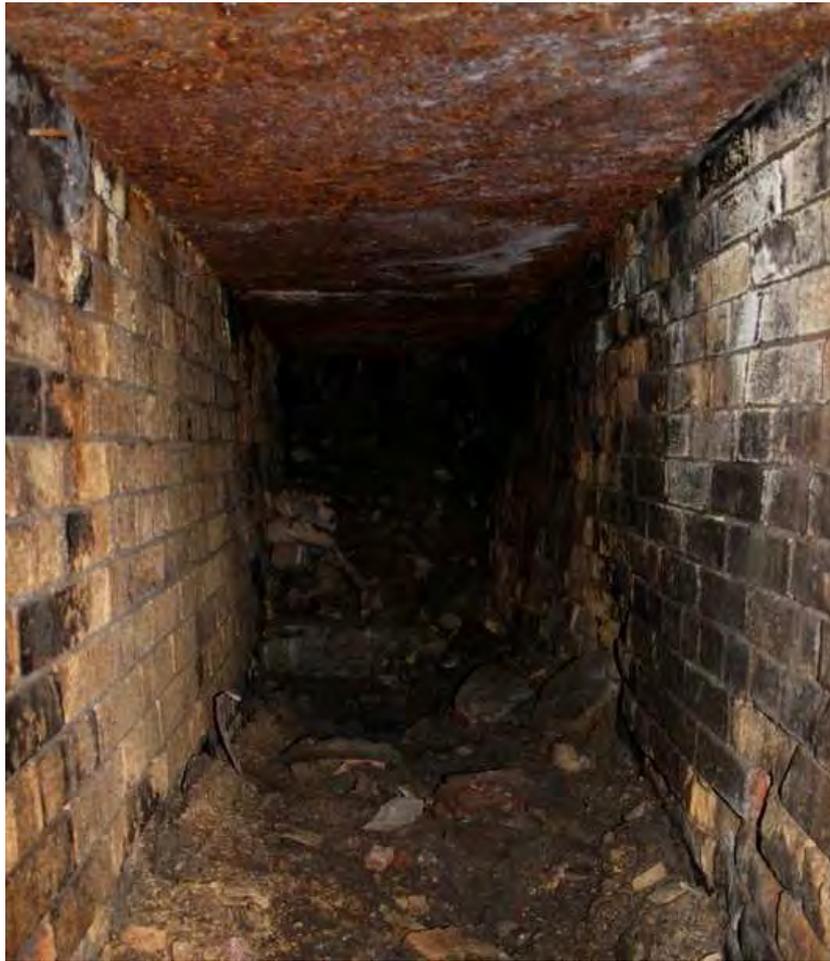


Plate 42: Detail of bypass flue



Plate 43: Ceiling beams housed in return of north wall of eastern extension of mill

4.2.21 At first- and second-floor level, the eastern extension was of similar construction to the western part of the mill, comprising non-fireproof construction with timber beams carried by fluted cast-iron columns (Plate 44). However, the arrangement of ceiling beams differed in the northern part of the extension, where the building narrowed around the chimney. Unlike the south wall, which comprised four bays, each with a window, and with transverse ceiling beams on columns rows placed at the mid-point of the intervening piers (Plate 44), the north wall, which was much shorter, contained only two windows, within wider bays than those to the south. A single transverse beam was placed between the windows, again on a different alignment than those from the south (Plate 45). In order to accommodate these offset timbers, the eastern beam was housed in the wall of the return around the chimney (Plate 43), with a perpendicular timber spanning the extension from the corner of the return (Plate 43). This was supported at its mid-point by a column, which had a T-shaped head plate, carrying both the cross beam, and the beam between the two windows of the northern part of the extension (Plate 46). The two remaining beams from the south wall were attached to the southern face of the cross beam by channel-section cast-iron brackets (Plates 43 and 46), typically used for jointing ceiling beams, particularly trimmers. Only one of these beams had sockets for floor joists suggesting its reuse from an earlier structure. The trusses above the extension were of similar width and design to those in the spinning block, but without the wrought-iron king tie rods (Plate 44). The eaves were sealed with lath and plaster, with a suspended ceiling across the northern bay, immediately above the lower purlin.



Plate 44: Roof construction in eastern extension of mill



Plate 45: Offset beams within ceiling construction within eastern extension of mill, first floor



Plate 46: T-shaped column capital, and hangers for ceiling beams, eastern extension of mill

4.2.22 At both first- and second-floor level, the extension retained evidence for line shafting in the form of bolts protruding from beam soffits (Plate 47) and end bearing boxes in the eastern wall (Plate 48). That on the first floor was offset from the line shaft from the main mill, with additional bolt holes showing the position of the hanger for a belt transferring power to a second shaft. This second shaft appeared to have been associated with a slender, perforated, inverted fish-bellied beam which had a sliding aperture in its soffit (Plate 47). On the upper floor the end bearing was relatively ornate (Plate 48), forming a corbel for the bearing, rather than it being recessed within the wall, again suggesting a bevel gear or horizontal drive belt.



Plate 47: Perforated fish-bellied beam with bolts for line shaft hanger on adjacent beam, eastern extension of mill



Plate 48: Ornate end bearing of line shaft, second floor, eastern extension of mill

4.3 WEAVING SHEDS

- 4.3.1 The earliest weaving shed appeared to have formed part of the initial construction of the complex, although its small size would suggest that this was undertaken on a somewhat experimental basis, rather than the mill being erected as a fully integrated concern.
- 4.3.2 The original weaving shed was irregular in plan, following the boundary of the site along Edge End Clough (Plates 2 and 3), erected on the opposite side of the spinning block to the engine house, allowing the easy transfer of power via a horizontal shaft well above head level across the track. The shed was of similar style to the spinning block, with 18" (0.46m) thick walls, dressed on their external faces, and of rubble construction internally. The building had a maximum of five bays width, and comprised a 13 span north-light saw-toothed roof, with cast-iron valley gutters supported on 5" (0.13m) diameter hollow cylindrical columns, similar in design to those of the main building, but with flat, ribbed heads above the fluting (Plate 49).



Plate 49: View of original weaving shed, with inserted partitions

- 4.3.3 The columns were placed between alternate bays on the east/west axis, with line shaft hanger brackets forming part of the channel section valley beams of the north light roof at the remaining bay divisions. This gave an arrangement of 10 x 10'6" bays (3.05 x 3.20m), with columns were placed on 21' (4.41m) centres on the east/west axis. Only the northern five rows of columns had bolting surfaces for line shafting, and these had T-shaped sockets for wedge-style adjustment, similar to those of the ground floor in the spinning block (Plate 50). A row of vertical bolt pairs, which would have housed hangers for a shaft along the west wall were observed along its entire length.



Plate 50: Column capital in original weaving shed, with line shaft bolting plate

4.3.4 The southern part of the shed was heavily remodelled in the mid- to late twentieth century, when the sheds were used for textile coating. The columns were also laterally braced by straining rods, the column capitals including a flange on either side to receive the rod ends (Plate 50). This shows a relatively high level of sophistication in the roof construction, as straining rods were often simply clamped to the valley beams. The roof itself was of asymmetrical design, with a glazed steeper north pitch allowing even lighting of the shed, without direct sunlight. Its construction was again somewhat unusual, comprising a mixture of iron and timber members, presumably to reduce cost. It comprised cast iron 12 x 9" (0.30 x 0.23m) channel-section valley beams, each incorporating 5 x 4¼" (0.13 x 0.11m) cast rectangular housings for stop-chamfered 3⅜ x 4¼" (0.08 x 0.11m) timber rafters on 7' (2.13m) centres on the southern side of each beam (Plates 51 and 52).



Plate 51: Timber rafters with sockets in cast-iron valley beams, weaving shed



Plate 52: Detail of stop-chamfered timber rafter, casting in valley beam, and lead transom

4.3.5 The north pitch was infilled with glass panes within lead transoms on 2' (0.61m) centres (Plate 52). The south pitch comprised 5 x 1½" (0.13 x 0.04m) edge-set timber rafters on 16" (0.41m) centres (Plate 53). These were birds-mouth jointed onto the gutter of the channel-section valley beams, with the entire south pitch being covered with lath and plaster. At its insertion into the western parapet wall, the roofing material comprised sandstone flags (Plate 54), and whilst these were frequently used as large flashings on mill roofs, it is probable that this represented the roofing material of the entire roof throughout most of its life. The ridge was latterly of V-section ceramic tile, although these may represent replacements. No evidence for ventilators within the ridge were observed, these probably deemed unnecessary for controlling the humidity of such a small shed.



Plate 53: South pitch of saw-toothed roof, weaving shed



Plate 54: Original sandstone flag roof tiles, western weaving shed

- 4.3.6 The valleys drained through 4½” down pipes placed along the eastern wall of the shed. These fed a further channel-section cast-iron internal gutter of 10” (0.25m) width and 5½” (0.14m) height, which was split above the third bay from the north wall (Plate 55), with the northern section draining through the parapet wall into a downpipe against the principle facade. The extent of the southern gutter remained unknown, but it presumably drained into Edge End Clough beyond the southern limit of the shed. The southern part of the shed had been heavily remodelled in the mid to late twentieth century, when it was converted for textile coating applications, with a large brick tower and several smaller units inserted along the southern side of the shed (Plate 56).



Plate 55: Northern internal channel-section roof gutter in eastern weaving shed



Plate 56: View of weaving shed roofs, with later brick structures to the rear

- 4.3.7 The west wall housed several blocked and inserted apertures, demonstrating the changing use of the structure, much of which was associated with the erection of a much larger shed on its western side in 1864. Original access was almost certainly as that retained, at the western end of the north wall, and a large blocked window in the west wall in this north-western bay matched those which were placed along the length of the north wall, and in the northern three bays of the east wall, beyond the dog-leg of the shed, suggesting that the northern part of the shed was used for warehousing and offices.
- 4.3.8 The expansion of the weaving shed appears to have quickly followed the construction of the mill, presumably as the smaller shed proved a success. It was constructed along the Burnley Road frontage in 1864, and was joined to the spinning block by a decorative arch, the keystone of which bore a stamp of that date (Plate 57). A plaque in the gable above housed a crest, and the name 'Reeds Holme Works', whilst the keystone of the arch also bore the initials H G&J; the G and H presumably standing for George Haworth. The arch would have controlled access into the mill complex, and a gatehouse/office was placed in the adjacent bay of the shed. No access was afforded directly from Burnley Road into the shed, although doorways were included into the office block in the north-west corner of the shed (Plate 58).



Plate 57: Decorative plaque and dated keystone above the entrance to the mill complex



Plate 58: Burnley Road frontage of the office block and weaving shed

- 4.3.9 The 14-bay wide extension survived to only 19 bays length, the remaining bays having been removed in the late twentieth century. As in the earlier shed to the east, each bay was supported on its north/south axis by a 5" (0.13m) diameter column with similarly fluted capital. Those in the eastern bay had cast-iron brackets attached to their western sides (Plate 59), and alternate columns in this row also had 5 x 2" (0.13 x 0.05m) hourglass-shaped cast-iron rollers clamped to the column, 7' (0.18m) above floor level (Plate 59). These were twisted to all faces, whilst a similar row of brackets, 7'6" (2.29m) above floor height on the penultimate western row of columns, were all aligned on the west face. These were secondary additions to the columns, and were also placed on the top floor of the spinning block (Plate 60), housing heating pipes, which could expand and contract on the roller. Similar rollers were used to house later pipework within the later structures to the south-east (Plate 61).
- 4.3.10 The columns of the northern 15 bays had line shaft hanger bolting plates, with T-shaped sockets, on their southern face (Plate 62), as did the extant examples in the penultimate bay. Those in the 16th bay, however, had bolting plates on both faces (Plate 63), and were placed with a different spacing to those to the north, 26' (7.92m) apart. The lateral bracing by straining rods, of these offset columns of the 16th bay was achieved by stirrups to the valley beam to the north (Plate 64). This method was also used in the northern part of the shed, where the two eastern columns of the third bay were offset. These were not only braced between the valleys by stirrups, but were longitudinally braced by a double straining rod which passed over a tensioning bar (Plate 65). This appears to represent a remodelling of this part of the shed, as the columns were of plain flanged type (Plate 65), similar to those within the boiler house extension, and those used to support a first-floor workshop inserted above the eastern weaving shed. Their insertion created more space in this part of the shed, suggesting improved access, and possibly suggests that the cellar, the entrance for which was placed almost immediately to the north, against the western wall, may also have been built at this time.



Plate 59: Heating pipe bracket with additional concave-ribbed bracket above, weaving shed

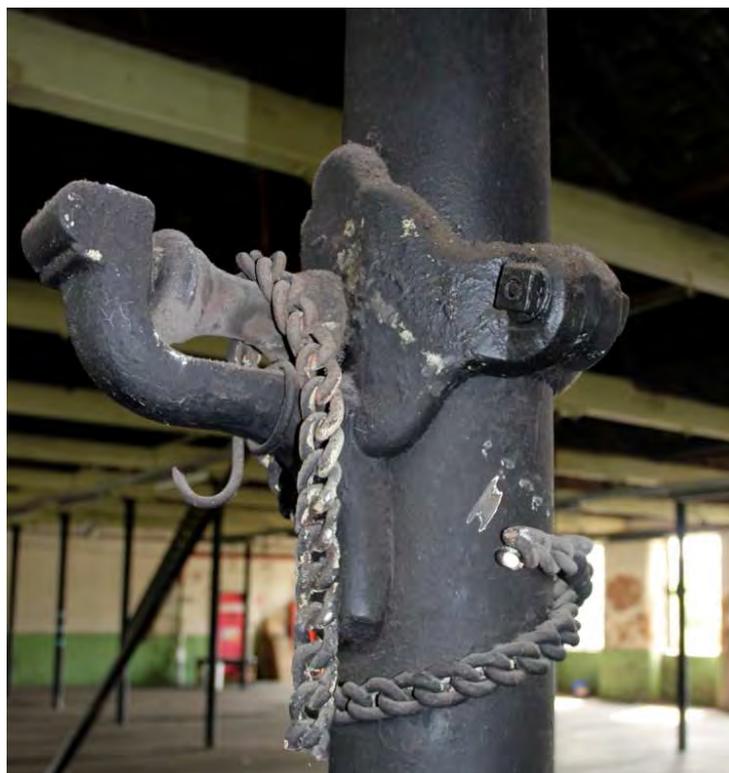


Plate 60: Heating pipe bracket with chain for attachment to the column, second floor, spinning block



Plate 61: In-situ water pipe on later bracket, incorporating similar rollers to those attached to columns elsewhere within the complex



Plate 62: Detail of weaving shed column capital with T-shaped mounting sockets



Plate 63: Detail of weaving shed column capital in 16th bay, with double bolting plate



Plate 64: Stirrup for straining bar attachment to valley beam



Plate 65: Replaced column with longitudinal tensioning bar

4.3.11 The north wall, fronting the entrance alley, had 7' (2.13m) high, 5' (1.52m) wide windows (all refenestrated) in the eastern 10 bays, suggesting use as warehousing or workshops, although no separate entrances were provided into this area of the shed. The western bay housed the controlling 'Christmas Tree' valve of the sprinkler system, and although this was of very late date, a Mather & Platt alarm bell placed on the adjacent wall face (Plate 66), suggests that the earlier control valve for the shed was placed in a similar position.



Plate 66: Mather & Platt cover plate for sprinkler system alarm bell

4.3.12 The western end of this frontage returned to a three-bay deep, two-bay wide, covered loading bay (Plate 67). This had a central 5' (1.52m) wide doorway in the east wall, but this was replaced subsequently by a narrower 2'6" (0.76m) door at the northern end of the wall. A dressed sandstone platform at the southern end of the loading bay had steps on its western side, and had a central 5' (1.52m) doorway into the weaving shed (Plate 67). A 2'6" (0.76m) dressed doorway at the northern end of the west wall afforded access into the street level office block fronting Burnley Road (Plate 67). The west wall of the loading bay also retained a small bearing box, which appears to have represented an end bearing for the northern line shaft of the shed, which continued across the loading bay, presumably to power a hoist (Plate 67). The northern four bays of the Burnley Road office block projected 6" (0.15m) further onto the street frontage than the shed to the south, housing three dressed windows and two entrance doorways (Plate 58). All were formed of high quality ashlar block, with projecting keys above fanlights to the round-headed doorways, and projecting moulded canopies above the window lintels (Plate 58).



Plate 67: Loading bay of western weaving shed

4.3.13 Two windows in the adjacent bays were almost certainly inserted when the offices were extended into the original shed with stud partitions. The office in the north-west corner had tiled flooring on a concrete base, forming a 5' (1.52m) wide corridor along the north wall, returning into a 3' (0.91m) wide corridor along the east wall, retaining herring-bone terracotta tiling (Plate 68), suggesting early twentieth-century renovation of the offices. The main office bounded by these corridors had a sprung timber floor on frogged brick sleeper walls (Plate 69), made of brick with a 'Plastic New Century Darwen' stamp (Plate 70), also suggesting an early twentieth-century date of refurbishment. The original partitions within the block were of full-brick thickness, and were rendered, with a decorative cornice to a lath and plaster suspended ceiling (Plate 71), and a dado rail being included in the manager's office, which also contained a fireplace, blocked subsequently for the insertion of a safe (Plate 72). This office had an entrance from Burnley Road, via a vestibule also affording access into the front office (Plate 69). A small office to the rear of the manager's office was probably for administration and accounts, and despite being remodelled into a corridor when the range was extended to the south, it still retained storage for accounts (Plate 73). The front office also had a suspended ceiling, incorporating a round quarter-light skylight and timber ventilation hood (Plates 69 and 74). However a row of joist sockets at window head height on the north wall suggests that this replaced an earlier ceiling. The northern bay of the office, and the weaving shed to the east had a symmetrical roof, rather than the asymmetric north-light design elsewhere. Within the weaving shed, this was covered on both pitches with a suspended lath and plaster ceiling (Plate 75).



Plate 68: Tiled floor within weaving shed office block

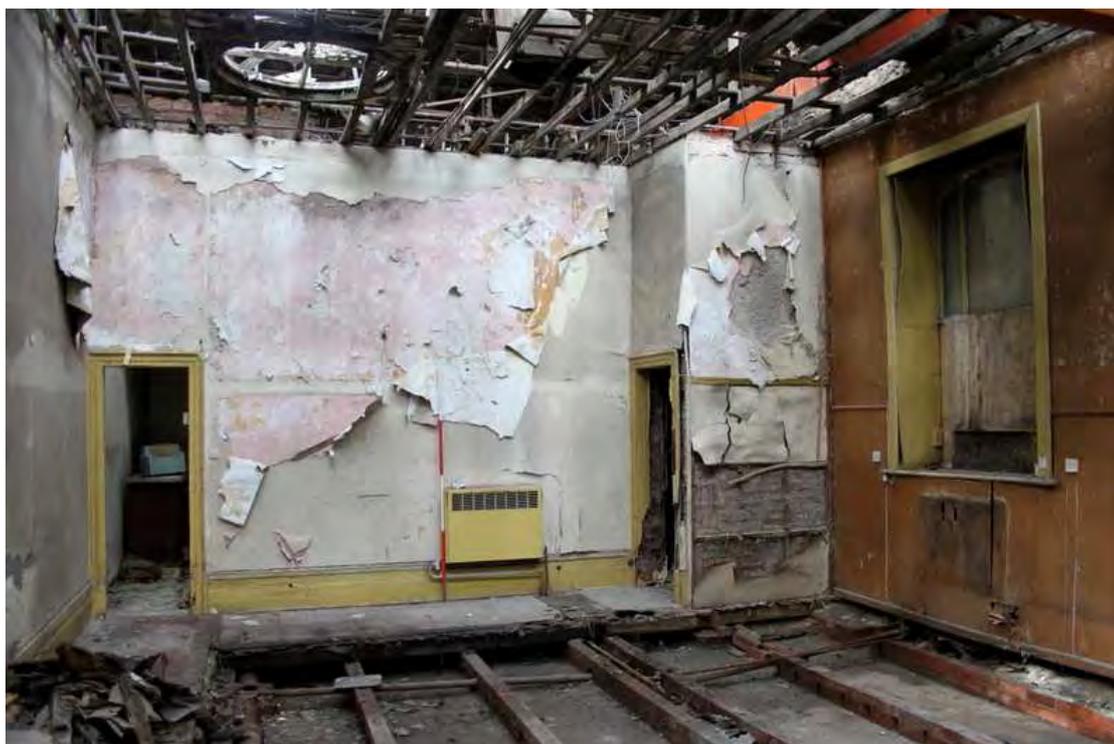


Plate 69: Sprung floor of office and entrance vestibule



Plate 70: Stamped brick from remodelled floor of office



Plate 71: Decorative cornice to suspended ceiling in manager's office



Plate 72: Safe inserted within fireplace in manager's office



Plate 73: Invoices within office block



Plate 74: Skylight and ventilation hood within main office

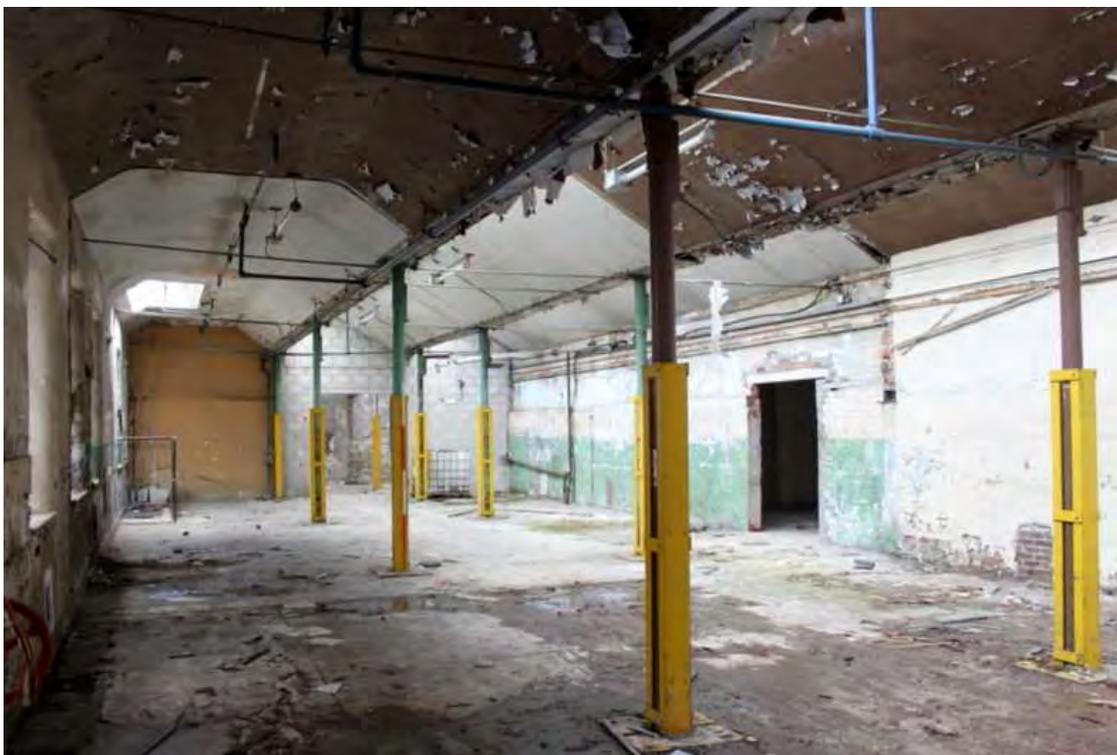


Plate 75: Suspended ceiling within north bay of weaving shed

4.3.14 The office range was extended subsequently to the south, into the weaving shed with single-skin brick partitions. Steps up from the manager's office and from the newly formed corridor to the east, provided access from the street-level office to the higher level shed, with a glazed timber partition forming the corridor between two columns along the eastern side of the extension (Plate 76). Two privies and three rooms, presumably for administrative staff were included, all probably dating from the change of use when the shed was bought by JB Broadley in the 1930s.



Plate 76: Inserted brick and timber partitions enclosing original columns within weaving shed

- 4.3.15 Further south along the Burnley Road facade of the weaving shed, for a length of 14.5m, the lower 5'6" (1.68m) of the internal wall face was rebated by 5½" (0.14m) above a 7" (0.18m) sandstone block plinth. The stonework above was very ragged, clearly showing it to be an inserted rebate, the back of which comprised hand-made brick, typically 9" x 2⅞" (0.23 x 0.07m), suggesting a relatively early date. Two 7" (0.18m) diameter dog-legged down pipes went through the sill of the rebate, into an apparent below-floor chamber which had three stone-blocked arched entrances towards the southern end of the extant external elevation (Plate 77). These appear to have formed a low basement in the southern part of the shed, which early photographs show to have continued to the south to the original southern extent of the shed. Although the fall of Burnley Road from the north of the shed down the valley is not substantial, it was significant enough to allow a shallow basement to be placed from road level at the southern end of the shed under approximately one quarter of the shed. Whilst access into this basement was not gained, its construction was probably similar to a further small cellar placed adjacent to the access alley on the northern side of the shed. This was probably constructed concurrently with the western expansion of the shed, and straddled both the early and later phases of the building, comprising three fireproof brick arched bays (Plates 78 and 79). A central straight stone stair led into the slightly larger western chamber, whilst the eastern stair wall continued to form a 2'6" (0.76m) partition between the two rooms (Plate 78). Both had a single column of 7" (0.18m) diameter, supporting each ceiling beam, which comprised a 9½" (0.24m) wide inverted T-section cast-iron ceiling beam to each arch (Plate 80).
- 4.3.16 Both rooms had a 5' (1.52m) wide cellar light to the alley between the weaving shed and the spinning block (Plate 79). The cellar retained a continuous flagstone floor, which had a 1' (0.30m) wide 3" (0.08m) deep gutter around the perimeter, which presumably had a drain into an external culvert at some point. Timber rollers, which appeared to be loom beams, dumped below the stairs probably derived from machines used within the weaving shed. The eastern room had a brick structure inserted at its eastern end within the central bay (Plate 79). This was filled with radiators prior to the survey, suggesting its use as a drying room. Its construction was reminiscent of an air-raid shelter, which may have been its original function. In the centre of the north wall within the eastern part of the cellar, a 4' (1.22m) wide, 5'9" (1.75m) high passage led beneath the alley to the spinning block (Plate 81). It had white glazed brick walls, constructed in stretcher bond, with blue glazing in two of the lowest four courses (Plate 82). It conveyed a sprinkler pipe into the eastern part of the shed (Plates 81 and 83) and was crossed by a 6½" (0.27m) diameter iron pipe (Plate 81), presumably a drain. At its northern end, the passage dog legged and was blocked with glazed white brick above an 8" (0.20m) thick concrete slab and a machine made brick wall in three and five stretcher English Garden Wall bond (Plate 83). This presumably blocked an entrance from the stair tower, although there was no evidence for this surviving at ground level within the mill. Its position appears to lead directly to the bottom of the stair newel, again correlating with its use to transfer the sprinkler system from the header tank within the stair tower, and suggesting that it was blocked when the electric lift was installed. However, a light fitting at the northern end of the passage demonstrated its survival well into the twentieth century.



Plate 77: Ragged brick-lined rebate within west wall of weaving shed



Plate 78: Brick arched ceiling and stair wall within western part of cellar



Plate 79: Eastern cellar, with cellar light to alley, and inserted brick chamber



Plate 80: Detail of brick arch construction in stairwell of cellar



Plate 81: Tunnel beneath alley from eastern cellar to stair tower

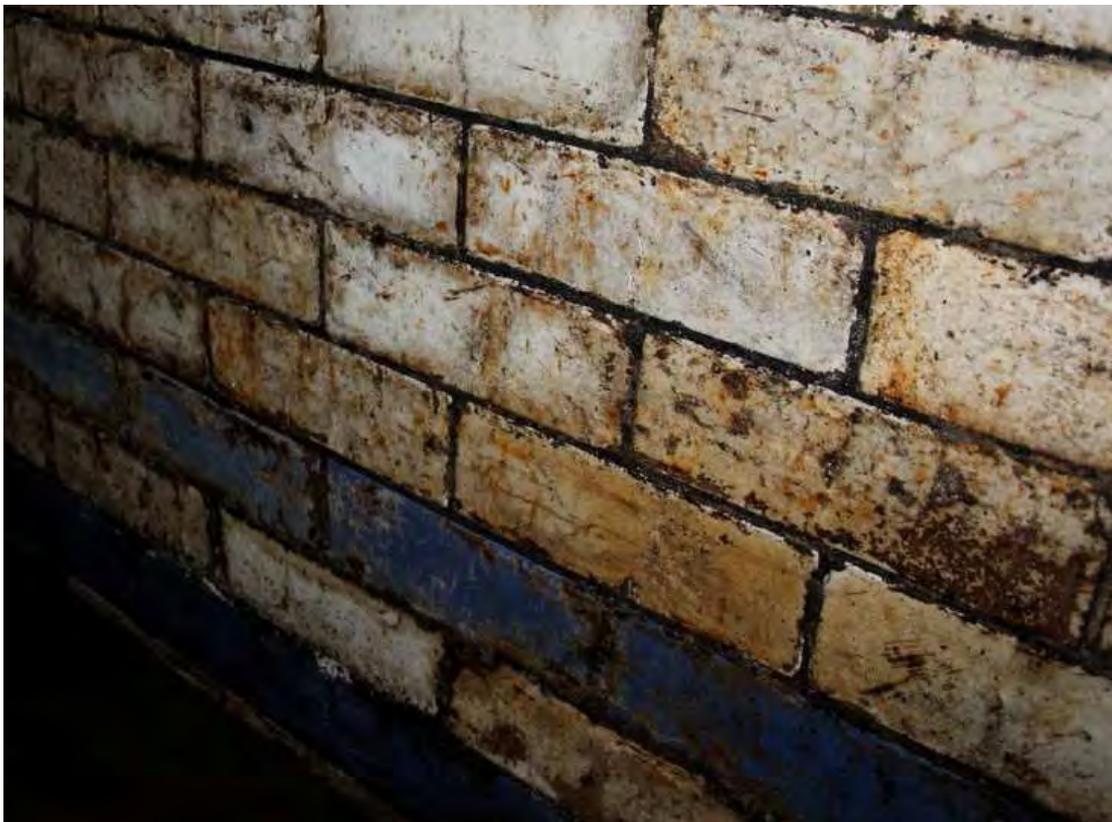


Plate 82: Detail of glazed decorative brickwork within tunnel



Plate 83: Blocking wall at northern end of tunnel

- 4.3.17 Whilst tunnels between spinning blocks and weaving sheds were often associated with power transfer, this would seem very unlikely in this case, as a very simple linkage from the engine to the enlarged shed was achieved at ground floor level. It has already been argued that a drive shaft ran directly from the upright shaft along the eastern wall of the main spinning block, which was aligned directly with the dividing wall between the two weaving sheds. Whilst this wall retained coursed stonework at parapet level only on its western face (Plate 56), demonstrating this to have originally been an external face, within the shed both walls were of random rubble construction. This wall was 6" (0.15m) thicker than those of the original shed, and would have to have been significantly remodelled to carry the main drive shaft and associated gearing required to power over 20 line shafts that were originally contained within. 14" (0.36m) wide, 18" (0.46m) high moulded sandstone corbels projected 21" (0.53m) from the wall face immediately to the south of the roof valley within each bay (Plate 84). The sandstone block, which was relatively ornate, with moulded faces and convex corbelling, ran through the full width of the wall, being placed flush with the wall face. It was supported, above and below, by dressed stone blocks in the western wall face, forming an I-shaped block of dressed stone (Plate 85), and with a further dressed block of similar length placed slightly lower in the wall above a small blocked aperture that allowed tie-down bolts to be tensioned (Plate 85).
- 4.3.18 The reason these corbels were so heavily braced within the wall was that they each not only carried the bearings of the main drive shaft, but also housed a bevel gear for individual counter shafts from the main drive shaft to power the rows of looms. It is almost certain that the majority of the wall was entirely rebuilt for the insertion of the tie-down bolts, and its thickness increased, leading to it being of rubble construction on both faces. The corbels in the first and sixteenth bays had been cut flush with the wall face, and the sandstone housing adjacent to the north wall had been cut in the position of the tie down bolt for the enlargement or insertion of a wide doorway. In the second bay, a 2' (0,61m) square bearing box translated power into the earlier shed to the east, presumably replacing the original drive shaft which entered the shed from the eastern side of the engine house. The aperture for the bearing box in the north wall of the shed was apparently removed during the enlargement of the doorway in the eastern bay, whilst that in the south wall of the spinning block was placed immediately adjacent to a skylight above a doorway, and was removed subsequently, with the stone infilling of the facade being undertaken using smaller blocks than present in the surrounding wall face (Plate 86).



Plate 84: Sandstone corbels for drive shaft bevel gears, east wall of western weaving shed



Plate 85: Housing for sandstone corbel on reverse face of wall, with tie-down bolt aperture below



Plate 86: Infilled drive shaft aperture to right of fanlight

4.3.19 The dividing wall between the sheds housed several extant and blocked apertures. A stone-blocked doorway in the 4th bay (from the northern end) appears to have provided the original communication between the two sheds, whilst the extant door to the south was inserted, replacing a 7' (2.13m) wide stone, sooty mortared doorway, blocked with stone bonded in a dark sooty mortar only 6' (1.83m) to the south (Plate 85). A man door to the south had single-piece vertical sandstone jambs, and appears original, as do two 3' (0.91m) wide doorways separated by a 2'1" (0.64m) wide pier (Plate 87). Both were blocked, but probably led to original privies, with a stone trough spanning the wall thickness 3' to the north; this had been removed prior to the survey (Plate 87), although the drain and seating for the trough were still visible (Plate 88). The privies were placed immediately to the south of the external wall of the original shed, suggesting that they were contemporary with the western shed, rather than relating to the earlier structure.

4.3.20 The roof structure in the northern 16 bays was almost identical to that in the original eastern element of the shed. The only observable difference between the two sheds was the use of V-section ceramic ridge tiles with a hollow rolled cap, and the inclusion of three rows of cowled ventilators on the ridge of each span (Plate Plates 54 and 56). However, to the south, where the column positioning also changed, the timber rafters of the northern pitch of each roof was replaced with a T-section cast-iron member, far more typical of a weaving shed roof (Plate 89). Also, at the junction with the parapet wall in this position, there was no evidence for the use of sandstone flag flashings, suggesting that the extant lead was used above Welsh slate, which formed the remnants of the extant roofing material. Whilst there is no evidence for the extension of the shed in either the east or west walls, these factors suggest a southward extension of the shed, possibly incorporating the basement, which appears to have only extended to this point from the southern side. Furthermore, whilst the columns were generally of the same design as elsewhere in the weaving shed (except those of the 16th bay), the corbels in the east wall of the shed were slightly shorter and wider, even though of generally similar style (Plate 90). It is therefore probable that the southern three bays of the extant shed represent its further enlargement, almost certainly that referred to in the local newspaper of 1886 (*Section 3.1.7* above).



Plate 87: Privy entrances in east wall of western weaving shed, with aperture for removed stone trough



Plate 88: Housing and drain for removed stone trough

4.3.21 As in the eastern shed, the valleys of the roof were drained into an internal gutter, carried on 6" (0.15m) wide, 7" (0.18m) high chamfered sandstone corbels projecting 9" (0.23m) from the wall face (Plate 77). The gutter fed the two dog-legged downpipes recessed within the western wall face (*Section 4.3.11* above).



Plate 89: T-section cast-iron rafters of weaving shed extension



Plate 90: Original drive shaft corbel (left) and secondary corbel (right)

- 4.3.22 A seven bay, dog-legged, first-floor workshop was erected above the eastern side of the weaving shed, and was of four-stretcher English Garden Wall bond construction in engineering brick, externally clad in rusticated sandstone block, matching the earlier structures (Plate 91). It was carried above the weaving shed on heavily rivetted 12" (0.30m) wide I-section steel beams (Plate 92) supported by 9" (0.23m) diameter columns with simple diminished astragals and flanged capitals, typical of the late Victorian period. The floor mainly comprised performed vaulted and ribbed concrete panels (Plate 92), although the southern bay also included a row of timber joists and some fish bellied steel plates adjacent to the south wall, which was of brick construction, and almost certainly of a contemporary date (Plate 93).



Plate 91: Dog-legged workshops added above eastern weaving shed

- 4.3.23 A concrete stair latterly afforded access to the workshops which had late stud partitions except for an earlier, possibly original glazed office in the north-western corner of the structure, constructed on a 3'1" (0.94m) plinth of full brick thickness (Plate 94). The building had two five-light windows in the east wall adjacent to a gabled hoist (Plate 91), which was mirrored on the western wall, housing a blocked offset doorway onto the weaving shed roof. The west wall had two narrower five-light windows to the north and a panelled hatch to the south which was presumably originally identical to the three, three-light windows further along the west wall (Plate 95). Beyond the hoist, the eastern wall returned 18' (5.48m) further to the east, above a dog-leg in the shed below (Fig; Plate 91). The angled southward return of this wall latterly formed a corridor to offices, and had no windows (Plate 96).

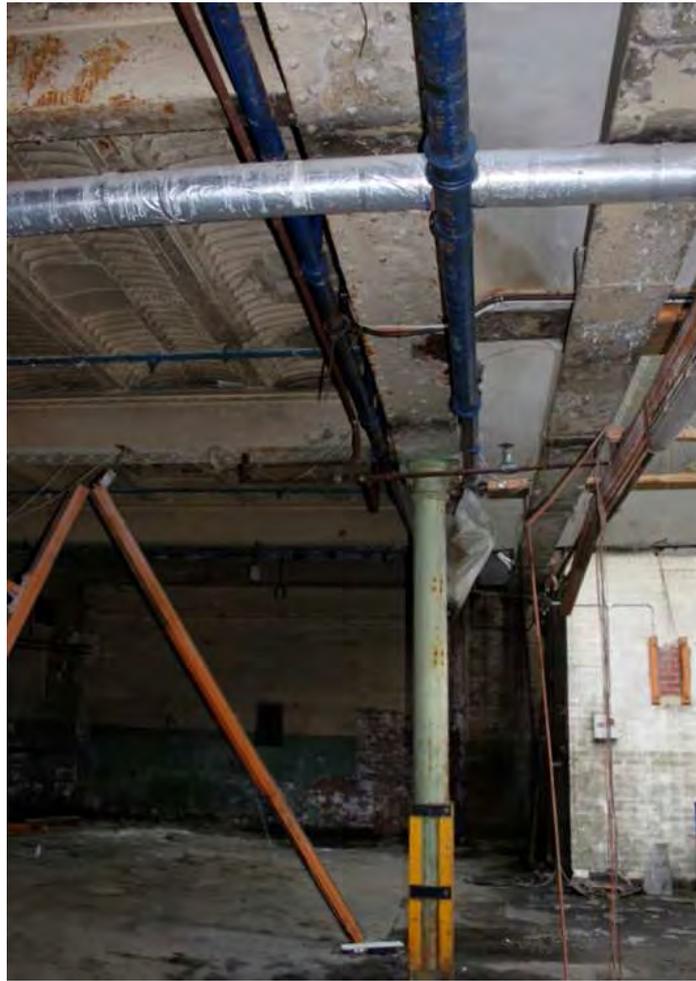


Plate 92: Rivetted I-section beams and late columns carrying first floor workshops



Plate 93: Concrete, timber, and iron sheet floor of first-floor workshops



Plate 94: Northern workshop, with partitioned office in north-west corner



Plate 95: Southern first-floor workshop

4.3.24 The roof comprised simple collared common rafter-boards (Plates 94 and 95), with a channel-section valley carried on an I-section steel beam with a second roof span in the irregular angle of the shed on its eastern side (Plate 96). The original access to the block was via a doorway in the north wall which led to a walkway to the first floor of the spinning block (Plates 36 and 97), first shown on the Ordnance Survey map of 1930 (Plate 4). It is unclear whether there was any original access to the weaving shed, although the workshops were clearly related to processes occurring in the eastern side of the spinning block, rather than in the shed below.



Plate 96: Additional roof span in above eastern side of dog-legged workshops



Plate 97: Doorway and wall scar for walkway between main mill and workshops above weaving shed

4.4 STABLE BLOCK

- 4.4.1 A relatively ornate stable block was placed to the east of the weaving sheds, beyond a small courtyard. Whilst its exact date of construction is unclear, it was of similar style to those *in-situ* by 1864, and was certainly erected prior to the Ordnance Survey first edition map of 1893 (Fig 2).
- 4.4.2 The two-storey, six-bay structure was built of local sandstone, coursed and rusticated on its principal, western elevation, but of rubble construction on the other elevations (Plates 98 and 99). The northern bay had a remodelled wide doorway in the wider western bay, originally forming the cart shed, with an office above, presumably for the head coachman. This had a hipped roof to a chimney placed on the ridge of the dividing wall to the stable block (Plate 99), which had an entrance to what was presumably a tack room and stairwell at its northern end, and an extant 4'6" (1.37m) wide doorway, providing access for the horses, towards its southern end (Fig; Plate 98). This was more decorative than that to the north, being of similar, although somewhat simpler, style to those in the Burnley Road facade of the weaving shed (*Section 4.3.10* above), and possibly suggestive of a similar date of construction. A metal fan grill to the fanlight above this doorway bore the initials 'JBB' (Plate 100), presumably inserted when the block was converted to workshops and a garage by the new owner after 1930. Three round 'ox-eye' windows above, with similar rubbed sandstone dressing and projecting voussoirs (Plate 98) were latterly decorative, although the southern two examples almost certainly served originally as pitching holes to the hayloft. Vertical windows in the south wall provided light into both the tack room and the stable block, whilst the office on the upper floor also had a square window in the northern bay of the east wall (Plate 99).



Plate 98: Western façade of stable block



Plate 99: Random rubble eastern elevation of stable block



Plate 100: JBB initialled fanlight grill above entrance into stable

- 4.4.3 Internally, the stable was of relatively high status, with timber panelling to the west and north walls, a lath and plaster ceiling and a plaster cornice adjacent to the walls and ceiling beams (Plates 101 and 102). Three feeding holes from the loft placed against the east wall, demonstrated the position of the stalls (Plate 102). The majority of the original floor was also retained, comprising 4 x 3' (1.22 x 0.91m) flagstones, with the southern 11' (3.35m) of the building retaining a cobbled stone sett floor (Plate 103). This appeared to form the floor of a 13' (3.96m) square loose box in the south-west corner of the stable, with diagonal stone channels running into a central drain within the floor (Plate 103). The southern 7' (2.13m) section of a similar 4" (0.10m) wide manuring passage survived 32" (0.81m) from the west wall. The ceiling was carried on two timber beams, each originally supported by a centrally placed 4¾" (0.12m) diameter cast-iron columns. The southern was removed subsequently, whilst the northern example retained a simple capital and head plate (Plate 104).
- 4.4.4 Two rendered wall scars in the east wall appear to represent blocked windows, blocked during the construction of a late single-storey brick shed to the east. It is unclear, given the lime-washed wall finish, whether these apertures formed part of the original construction, or were inserted during its conversion to workshops to improve the light. The building was certainly remodelled for use as an engineering shop, presumably shortly after the transfer to motor transport. Not only were all the stalls removed, but it appears that a line shaft was placed along the eastern wall, presumably to power lathes and drills. Two hangers remained *in-situ* (Plate 105), whilst the timber pads and bolt holes for three further hangers were observed (Plate 102).
- 4.4.5 A wall of full-brick thickness in six-stretcher English Garden Wall bond formed a partition to the present stair well, and appears original. The stair and northern wall appear inserted, however, but earlier than the concrete stair and doorway inserted into the east wall to give access to the late brick shed to the east. The door in the west wall appears to have originally accessed the coachman's office, which was timber panelled with a rolled cornice, and had a large fireplace with rolled sandstone mantle piece on its north wall (Plate 106), and an eight-light top vent window in the west wall, similar to those in the stable (Plate 98). Two steps afforded access down into the coach house, which had a flagstone floor and wide doorway in the west wall. This was latterly used as a maintenance garage, and it is unclear whether the braced joist ceiling was originally exposed, or represents a replacement.



Plate 101: Interior of stables with timber-panelled walls



Plate 102: Detailed of decorative ceiling, feeding holes, and line shaft hanger mountings



Plate 103: Cobble setts and drain within loose box



Plate 104: Detail of column capital, stable block



Plate 105: In-situ line shaft hangers, stable block



Plate 106: Ornate fire surround and timber panelling, coachman's office

4.4.6 The first floor was accessed by straight stair within the ground-floor corridor, although this presumably lay originally within the coachman's office. It gave access into a large open-plan room, open to the rafters above four simple braced timber trusses (Plate 107), and with two butt-ended purlins to each pitch. All walls were internally of random rubble construction, with three vertical windows in the east wall and brick lined large ox-eye windows in the front western elevation (Plate 107). A single-skin brick partition formed an office at the northern end, with a door in the north wall to an external stair (removed subsequently), and a fireplace in the western side of the brick chimney breast (Plate 108). This rose from the ground floor, and had a stone stack, dressed on its north and south faces below a tiered sandstone flag capping (Plate 109). The floor comprised transverse 7" (0.18m) boards, most of which were rotten, reducing access.



Plate 107: Hayloft above stables

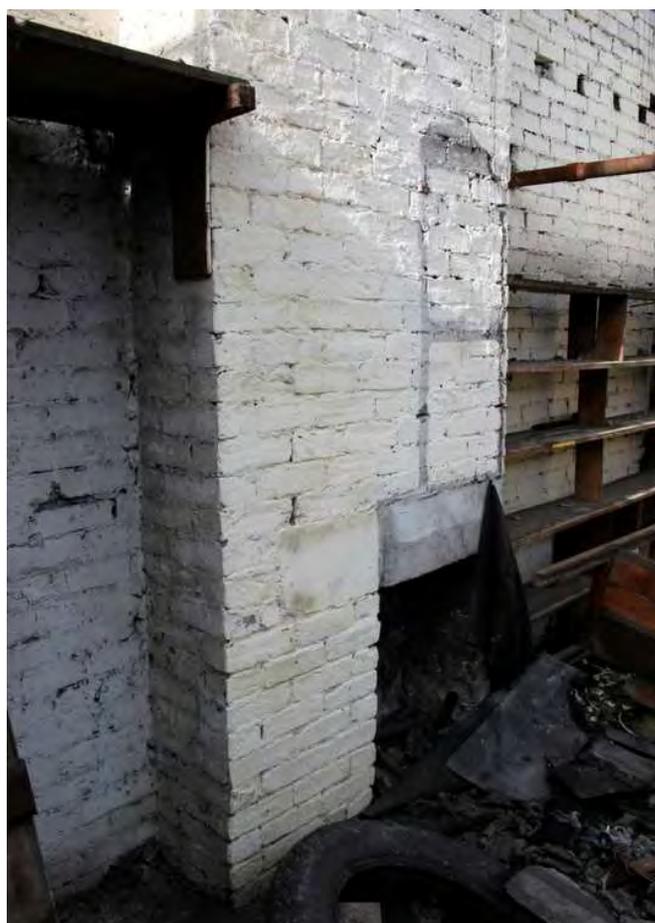


Plate 108: Fireplace within first floor office



Plate 109: Dressed stone chimney stack, above brick partition wall

5. DISCUSSION

5.1 INTRODUCTION

5.1.1 The buildings are mostly of multi-phase construction, and retain significant archaeological evidence for the processes undertaken within, and for the power-management systems employed. One of the key features of the Reeds Holme Mill complex is the variety of structures that survive, even within relatively few buildings, providing physical evidence for the complete process of mid-nineteenth-century integrated textile mill. However, whilst the survey has identified several phases of expansion within the complex of extant structures, its rapid growth and similarity of architectural styles makes the dating of these changes very reliant on the documentary sources.

5.2 PHASE 1

5.2.1 The complex originated in the 1850s, and appears to have been intended primarily as a cotton-spinning mill, but with an apparent intention to operate an integrated process if a small-scale weaving shed proved successful. The original buildings comprised the three-storey spinning block of non-fireproof construction, with an integrated engine house, housing a double-beam engine, and with a fireproof preparation block on its eastern side. A small weaving shed was placed opposite the eastern end of the mill, and its shape and placement strongly suggests that its expansion to infill the vacant site to the Burnley Road frontage was already planned at this stage.

5.2.2 The ground floor of the spinning block was probably used for machines that finished the preparatory process started in the fireproof bays to the east of the engine house. It appears that only the upper two floors were used for spinning, and whilst the inventories of 1925 and 1931 recorded ring-spinning frames within the mill, it is unlikely that these represent the original type of spinning machinery installed, as ring spinning was not adopted widely in England until the late nineteenth and early twentieth centuries. Indeed, the first known mill in Lancashire dedicated to ring spinning was built in Milnrow, near Oldham, for the New Ladyhouse Cotton Spinning Company in 1877 (Toms 1998), so it is extremely unlikely to have been used at Reeds Holme over 20 years earlier. Given the close-set nature of the east/west-aligned column rows, and the position of the the line shafting, it appears that spinning was initially undertaken on throstle frames. These differ from the more common spinning mules, in that they did not have a moving carriage, and could therefore be placed in transverse or longitudinal rows along the length of the spinning floor, whereas, with the column spacing at Reeds Holme, mules would have to have been placed longitudinally. It is most likely that they were placed transversely, as the throstles ran perpendicular to the line shafting, although it remains unclear how throstles in the southern two bays of the spinning floor would have been powered.

5.2.3 The original layout of the power plant remains somewhat unclear. Whilst internal engine houses were common within such structures, boiler houses were often detached, to reduce the risk of fire within the main structures, should they explode, or placed adjacent to the engine house, which would act as a buffer to the main structure (Giles and Goodall 1992). The position of the chimney, detached beyond the end of the original mill, is also somewhat unusual, as chimneys were only generally detached from the power plant if the topography required it, for example, to increase the draught of the chimney by placing it higher up a hillside. The site of Reeds Holme Mill was almost flat, and appears to have been virgin ground at the time of initial construction. Thus, the chimney was almost certainly placed in its extant location as the most efficient siting. This would suggest that the boilers were placed on a transverse alignment to the mill, next to the chimney, beyond the 'Devil Hole' preparation area. Whilst this would have given rise to a long steam pipe, which would have been rather inefficient in its transfer of steam heat from the boiler to the engine. It had the advantage of removing the boiler as far as possible from the non-fireproof spinning block, and if the plot boundary respected what later became Reeds Holme Street, immediately to the north of the mill, this was actually the closest to the engine that the boilers could be placed (Plate 3).

5.2.4 The space between the mill and the chimney would easily have housed two 20' (6.10m) boilers, most probably of Cornish type. This would suggest that the ground floor of the spinning block was continuous to the chimney, and that the large doorway at the western end of that length of wall represented a loading door for coal for the boilers. It is somewhat unclear as to why the boilers were not placed on a north/south alignment, and loaded more typically from the southern side, through an open-fronted boiler house, which would have allowed the chimney to have been placed in the same position. The great advantage of the siting of the boilers, was their ease of replacement during the expansion of the mill, and it is possible, that if the owners forecast the expansion of the weaving shed, they also designed the power plant in such a way that it could be remodelled to provide the increased power requirements with minimal disruption.

5.3 PHASE 2

5.3.1 Despite early reports of the sale of power looms in 1855, the venture must have become successful shortly thereafter, leading to its expansion in 1864. The weaving shed was extended along the length of its western side to meet Burnley Road, representing an extension of approximately 22,500'² (2100m²), and apparently increasing its capacity from the 172 reported in 1855 to 700. Such a large increase in power demand, turning the concern into a fully integrated mill, could have required a large increase in power generation, and unless the original engine had also been bought with expansion in mind, it would almost certainly have been incapable of supplying the demand.

- 5.3.2 The apparent desing of the early layout to afford imminent expansion would have had minimal impact on the initial construction cost, and on operating methodology, but incorporating a massively overpowered engine into such a design, in the hope that the concern would flourish, was almost certainly an unrealistic risk, that would have found financial backing very hard to secure. However, once the concern could be demonstrated to be sucessful, and warranting a huge expansion of the weaving shed, the additional financial cost of upgrading the power plant would be in proportion to that of expanding the shed. With the initial layout of the structures as they were, the work could not only be undertaken more cost-effectively that within a complete rebuild, but equally importantly, could be undertaken with minimal disruption to the output of the mill. Whilst the dividing wall between the two weaving sheds appears to have been largely rebuilt (unless the corbels were included within the original design, which is improbable), the four-bay boiler house extension could have been erected and furnished whilst the original boilers were retained in use. Again, fireproofing appears to have been incorporated even in this expansion, as the documentary sources suggest that only three boilers were installed, allowing for a further increase in capacity should it be required. The new boilers would cetainly have been Lancashire boilers, as they needed to be capable of producing higher pressure than was possible with the Cornish variant, and relatively short 30' (9.14m) boilers allowed space for an internal charging platform within the southern bay of the extension. Once these had been installed, production had to be ceased to upgrade the steam engine, during which time the original boilers could be removed, and replaced with an economiser, which would then utilise the same flue into the base of the chimney. There would presumably have been ample time to undertake the necessary remodelling of the dividing wall in the weaving shed at this time.
- 5.3.3 Rather than replace the existing engine with a more powerful alternative, which would have proven extremely costly, the existing engine was upgraded by the process of 'McNaughting'. William McNaught was a Scottish engineer, who patented the design for a compound steam engine in 1845. Four years later, he relocated to Manchester, at the heart of the textile industry, and began a business maily comprising the retrospective fitting of high pressure cylinders to existing steam engines, and exhausting them into the original cylinder, which was retained as a low pressure cylinder. Not only did this increase the power of the cylinder, it also reduced its fuel consumption, leading to a saving in running costs. The installation of a 192-tube Greens economiser, listed in the inventory of 1931, would further have reduced the running cost of the enlarged power plant, possibly making it more efficient than that it replaced.
- 5.3.4 It is probable that the stable block was also erected at this time, given the increase in the output of the mill. It is almost certain that this would have required transport to Rawtenstall, where it could either be sold, or loaded onto trains for transfer to markets or clients elsewhere. Such buildings either rarely survive later remodelling of textile-mill complexes, or are so heavily altered that they bear little resemblance to their original form, containing almost no evidence for their layout or function. That at Reeds Holme, therefore, represents a rare survival of evidence for early transport and distribution associated with a non-canal based textile mill complex.

- 5.3.5 The construction of the western weaving shed, with its tall, blank facade fronting Burnley road, afforded the opportunity for far greater control over access into the complex. This was further augmented by the addition of an ornate gateway between the new structure and the existing spinning block. Following the loom-breaker riots of 1826, security and restricted access were high priority features for any mill owner, as relationships with the workforce were often strained. Although such large scale destruction had long ceased by this date, localised disputes, and increasingly nationalised strikes were becoming more commonplace, as the workers fought for better pay and conditions. Trade unionism was finally decriminalised in 1867, showing that the period of expansion of the Reeds Holme works, was one of general unrest.
- 5.3.6 The alleyway between the new building and the mill was paved with local sandstone cobbled sets, below which was placed a central drainage culvert. Inspection covers, placed in the centre of the road, within decorative cobbling, bore the name ‘Burton & Nelson Reeds Holme Ironworks Rawtenstall’ (Plate 110), suggesting that much of the fabrication of the mill may have been undertaken on site, or in the immediate vicinity.



Plate 110: Decorative drain cover in alley between spinning block and weaving shed

5.4 PHASE 3

- 5.4.1 Further small-scale expansion of the complex appears to have been undertaken in the 1880s, with the extension of the western weaving shed to the southern site boundary. Again there is no physical evidence for this within the external walls of the shed, but the differences in column layout, roof design, drive shaft corbels, and apparent inclusion of a basement within this part of the shed, would appear to provide overwhelming evidence which tallies with the documentary sources.

5.4.2 The differing arrangement of the columns within this part of the shed imply that more technologically advanced, and almost certainly larger looms, were incorporated into the new structure, and the addition of a low basement underneath the new build offered extra warehousing for little extra cost.

5.4.3 It is probable that a fourth, slightly larger diameter Lancashire boiler was added into the boiler house at this time, maximising the potential of the previously McNaughted double-beam engine.

5.5 PHASE 4

5.5.1 Engineering workshops above weaving shed were erected prior to 1930, probably in the early twentieth century. This work was probably undertaken at the same time as the refurbishment of the office block in the north-western corner of the weaving shed, and could feasibly have been undertaken following the purchase of the mill in 1925 by Henry Pilling. It not only represents a modernisation of the complex, but also demonstrates the increasing need for laboratories and maintenance workshops, as the industry became more technologically advanced at this time.

5.6 PHASE 5

5.6.1 This relates to the ownership of the complex by JB Broadley from the 1930s, and represents the end of the integrated spinning and weaving process. The spinning block was initially given over to slipper manufacture, whilst Broadleys undertook textile finishing in the weaving shed. Initially, the office block along Burnley Road, was expanded into the former weaving shed, to provide facilities more appropriate for the new use of the structure, with further internal partitions and a tall brick-built tower being added probably quite shortly afterwards.

5.6.2 The stable block also became redundant at this time, and was converted to workshops with a parts store above, although the cartshed had been converted to a motor vehicle garage during the previous phase.

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APPENDIX 1: WRITTEN SCHEME OF INVESTIGATION

August 2012

**Oxford
Archaeology
North**

**REEDS HOLME MILL,
BURNLEY ROAD,
RAWTENSTALL,
LANCASHIRE**

**ARCHAEOLOGICAL WRITTEN SCHEME
OF INVESTIGATION**



Proposals

The following Written Scheme of Investigation is offered in response to a request from Allied Textiles Ltd for a programme of archaeological building recording in advance of the proposed demolition of Reeds Holme Mill in Rawtenstall.

1. INTRODUCTION

1.1 PROJECT BACKGROUND

- 1.1.1 Allied Textiles Ltd has submitted an application to Rossendale Borough Council for prior notification of the demolition of the former Reeds Holme Mill on Burnley Road, Rawtenstall (centred on NGR 380900 424537). In response to the application, Rossendale Borough Council has requested that an archaeological record of the mill complex is compiled as part of the method statement for demolition.
- 1.1.2 The date at which Reeds Holme Mill was established is uncertain, although it is known to have been occupied in 1854 by William Lord, a cotton manufacturer (Davies 1984, 104). By 1879, the mill housed 16,000 spindles and 400 looms (*Bacup and Rossendale News*, 1879), representing a medium-sized mill complex. An additional weaving shed with a capacity for 200 looms and a new warehouse were added to the site in 1886 (*Bacup and Rossendale News*, 1886). A current survey of Lancashire's textile-manufacturing sites has indicated that Reeds Holme Mill is potentially of 'high significance' as it seemingly retains a considerable proportion of its historic fabric.
- 1.1.3 Following the guidance and advice provided by the Lancashire County Archaeology Service (LCAS) in their capacity as archaeological advisor to Rossendale Borough Council, it has been recommended that an archaeological building survey of the historic elements of the site is carried out prior to demolition. This document presents a Written Scheme of Investigation (WSI) for the archaeological building survey.



The Burnley Road frontage of Reeds Holme Mill

1.2 OXFORD ARCHAEOLOGY NORTH

- 1.2.1 OA North is the largest archaeological contractor in north-west England, with unsurpassed experience of working in the region. OA North has the professional expertise and resource to undertake the project to a high level of quality and efficiency. OA North is **an Institute for Archaeologists (IfA) registered organisation, registration number 17**, and all its members of staff operate subject to the IfA Code of Conduct.
- 1.2.2 OA North has established itself as one of the country's leading practitioners in the field of industrial archaeology, and has generated an impressive portfolio of projects that include those completed at the Derwentcote Steel Furnace in County Durham (Cranstone *et al* 1997), the Carlton Alum Works in North Yorkshire (Miller 2002), the Pilkington's Sheet Glass Works in St Helens (Krupa and Heawood 2002), Thomas Telford's Holyhead Road in North Wales (Quartermaine *et al* 2003), and the Percival, Vickers Flint Glass Works in Manchester (Miller 2007). A large proportion of the industrial archaeology projects carried out by OA North, however, have been focused on the development of textile-manufacturing sites. In 2007, for instance, OA North completed a four-year project of conservation-based research, building survey and excavation at the Grade II Listed Murrays' Mills spinning complex in the Ancoats area of Manchester. This project culminated in the publication of a monograph on the history, development, and fabric of Manchester's oldest surviving steam-powered cotton mill (Miller and Wild 2007).
- 1.2.3 Building assessment and recording has always formed a substantial part of OA North's work, and industrial buildings have constituted a major part of the work carried out in this field. Recent projects have included the survey and recording of Pecket Well spinning and weaving mill near Hebden Bridge (OA North 2007b), the early twentieth-century Gem Mill in Chadderton (OA North 2007c), Lyons Lane Mill in Chorley (OA North 2010d), the Sandygate Mills in the Weavers' Triangle area of Burnley (OA North 2010e), Victoria Mill, also in the Weavers' Triangle (OA North 2011a), Pendle Street Shed and Reedyford Mill in Nelson (OA North 2011b), and Victoria Mill in Sabden (OA North 2011c). OA North is presently carrying out the second stage of a major English Heritage-funded project that is assessing the condition of all the surviving textile-manufacturing sites in Lancashire, and carrying out detailed research and survey of a selected sample of 50 mill sites.
- 1.2.4 All work on the project will be undertaken in accordance with relevant professional standards, including:
- IfA's *Code of Conduct*, (1999); *Code of Approved Practice for the Regulation of Contractual Arrangements in Field Archaeology*, (1999); *Standard and Guidance for Archaeological Evaluations*, (1999); *Standard and Guidance for Archaeological Watching Briefs*, (1999);
 - English Heritage's *Management of Archaeological Projects (MAP2)*, 1991.
 - *The European Association of Archaeologists Principles of Conduct for Archaeologists Involved in Contract Archaeological Work* (1998).

2 AIMS AND OBJECTIVES

- 2.1 The archaeological building investigation will be focussed on those elements of the Reeds Holme Mill complex that will be subject to demolition, comprising the mid-nineteenth-century spinning block, weaving shed and associated power-plant features. The main research aims of the investigation will be to provide an appropriate record of the historic buildings prior to their demolition, and to ensure the long-term preservation of the archaeological information by the production and deposition of a report and an ordered project archive.
- 2.2 The required stages to achieve these ends are as follows:
- **Building Investigation:** to carry an appropriate level of historical research, and provide a drawn, photographic and textual record of all the buildings to English Heritage (2006) standards, which will provide a lasting record of the structures in their present state;
 - **Reporting and Archive:** a fully illustrated report and project archive will be produced out on completion of the fieldwork. The report will include information about the buildings' age, fabric, form and function. This will be followed by a discussion of the sequence of development, process layout and use over time, and their relationship with other buildings in the vicinity, in terms of architecture and function.

3. METHOD STATEMENT

3.1 BUILDING INVESTIGATION

- 3.1.1 **Historical Research:** a sufficient level of research will be carried out to place the results obtained from the building investigation in an appropriate historical context. The research will be collated from OA North's extensive archive of textile-manufacturing sites in Lancashire, supplemented by an examination of available cartographic sources and any relevant documents relating to the buildings.
- 3.1.2 The buildings that are to be demolished include a multi-storey spinning block and associated weaving sheds, which merit an English Heritage Level 2/3 type survey. In addition to a detailed photographic record, this level of survey will allow for the production of measured survey drawings that capture all archaeological detail. A visual inspection of the buildings will also be undertaken utilising the OA North building investigation *pro-forma* sheets, and a description will be maintained to English Heritage (2006) Level 2/3 standard. The records will be essentially descriptive and provide a systematic account of the origin, development and use of the building, which will include a description of the plan, form, fabric, function, age and development sequence of the complex.

- 3.1.3 **Photographic Archive:** a photographic archive for both levels of survey will be produced utilising a digital camera with a resolution of at least 12 mega pixels, using RAW format files for image capture, saved as 8 bit TIFFs for archive purposes. A full photographic index will be produced, and the archive of images will comprise the following:
- (i) the external appearance and setting of the buildings, including a mixture of general shots and detailed views taken from perpendicular and oblique angles;
 - (ii) general shots of the surrounding landscape;
 - (iii) the general appearance of principal rooms and circulation areas;
 - (iv) any external or internal detail, structural or architectural, which is relevant to the design, development and use of the buildings, and which does not show adequately on general photographs;
 - (v) any internal detailed views of features of especial architectural interest, fixtures and fittings, or fabric detail relevant to phasing the buildings.
- 3.1.4 In addition to the digital files, hard copies of the images will be created on paper of appropriate archival quality, and deposited as part of the paper archive.
- 3.1.5 **Site Drawings:** fire insurance plans (supplied by the client) will be annotated on site to produce the drawings. These drawings will then be used as the basis of CAD drawings, which will be included within the final report as figures:
- (i) floor plans for each building;
 - (ii) a cross-section through the short axis of the spinning block and the weaving sheds;
 - (iii) an elevation of the spinning block.
- 3.1.6 Where architects drawings are not available (*eg* for cross-sections and elevations), the following survey techniques will be applied as appropriate:
- 3.1.7 **Reflectorless Electronic Distance Measurer (REDM) survey:** the proposed elevations and cross-sections will be surveyed by means of a reflectorless electronic distance measurer (REDM). The REDM is capable of measuring distances to a point of detail by reflection from the wall surface, and does not need a prism to be placed. The instrument to be used will be a Leica TCR805. This emits a viable laser beam, which can be visually guided around points of detail. The digital survey data will be captured within a portable computer running TheoLT software, which allows the survey to be directly inserted into AutoCAD software for the production of final drawings.
- 3.1.8 Detail captured by the instrument survey will include such features as window and door openings, evidence for power transmission, outline of decorative detail, evidence for machinery, an indication of ground and ceiling level, and changes in building material.
- 3.1.9 The drawings will usually be produced at a scale of 1:50. The existing drawings will be scanned or digitised into an industry standard CAD package for the production of the final drawings.

3.1.10 **Manual Survey Techniques:** hand-measured survey techniques will be utilised to record areas that are not accessible for instrument or photographic survey. The drawings will be tied into the remainder of the survey through the use of a survey control established by the instrument survey.

3.1.11 **CAD System:** the drawings will be manipulated in AutoCAD software. The advantage of a CAD system is that it allows for efficient manipulation and editing of drawings. The adoption of a layering system has significant benefits during the analysis stage as it allows for the display of information such as feature types, fabric and phasing as necessary to the requirements of the analysis, without the necessity to produce further drawings. Finished drawings can be plotted at the required scale or sheet sizes.

3.2 REPORTING

3.3.1 **Report:** the content of the fully illustrated and integrated report on the building investigation will comprise the following:

- (i) a title page detailing site address, NGR, author/originating body, client's name and address a site location plan related to the national grid;
- (ii) full content's listing;
- (iii) a brief account of the results. This will include a description of the buildings' layout, as well as their age, fabric, form and function. This will be followed by a discussion of the sequence of development, process layout and use over time, its relationship with other buildings in the vicinity, in terms of architecture and function;
- (iv) a description of the methodology employed, work undertaken and results obtained;
- (v) a description of the archaeological background, and an account of the historical development of the site;
- (vi) copies of plans, photographs, and other illustrations as appropriate;
- (vii) a copy of this written scheme of investigation, and indications of any agreed departure from that design;
- (viii) a complete bibliography of sources from which data has been derived.

3.2.2 The report will be in the same basic format as this written scheme of investigation; a copy of the report can be provided on CD, if required. Copies of the report will be supplied to the client as requested, and further digital copies will go to the appropriate repository.

3.2.3 **Archive:** the results of all archaeological work carried out will form the basis for a full archive to professional standards, in accordance with current English Heritage guidelines (*Management of Archaeological Projects*, 2nd edition, 1991). The project archive represents the collation and indexing of all the data and material gathered during the course of the project.

- 3.2.4 The deposition of a properly ordered and indexed project archive in an appropriate repository is considered an essential and integral element of all archaeological projects by the IfA in that organisation's code of conduct. OA North conforms to best practice in the preparation of project archives for long-term storage. OA North practice is to deposit the original record archive of projects with the appropriate County Record Office.
- 3.2.5 The Arts and Humanities Data Service (AHDS) online database project *Online Access to index of Archaeological Investigations* (OASIS) will be completed as part of the archiving phase of the project.
- 3.2.6 **Confidentiality:** all internal reports to the client are designed as documents for the specific use of the Client, for the particular purpose as defined in the project brief and project design, and should be treated as such. They are not suitable for publication as academic documents or otherwise without amendment or revision.

4. OTHER MATTERS

- 4.1 **Health and Safety:** archaeological staff and visitors will respect Health and Safety provisions and site-specific safety regulations. It is the policy of OA North ('the Employer') to conform fully with the requirements of the Health and Safety at Work Act (1974), and all site procedures will be in accordance with the guidance set out in the Health and Safety Manual compiled by the Standing Conference of Archaeological Unit Managers (1997). Attention will also be paid to the requirements of more recent legislation, including the provision and use of Work Equipment Regulations (1992), the Management of Health and Safety at Work Regulations (1992), and the Construction (Design and Management) Regulations (1994).
- 4.2 In furtherance of the duty of care imposed by the Health and Safety at Work Act (1974), the Employer shall make available to his employees whatever reasonable facilities are required by particular circumstances, *eg* appropriate protective clothing, safety equipment, rest breaks for specialised tasks, etc. A written risk assessment will be undertaken in advance of project commencement, and copies will be made available on request.
- 4.3 **Insurance:** evidence of Public Liability Insurance to the minimum value of £5m, and Professional Indemnity Insurance to the minimum of £2m, will be provided prior to the commencement of the archaeological works.
- 4.4 **Project Monitoring:** the aims of monitoring are to ensure that the archaeological works are undertaken within the limits set by the Written Scheme of Investigation, and to the satisfaction of the curatorial archaeologist at the Lancashire County Archaeology Service (LCAS). The curatorial archaeologist will be given at least five days' notice of when work is due to commence, and will be free to visit the site by prior arrangement with the project director.

- 4.5 **Confidentiality:** the report is designed as a document for the specific use of the Client, for the particular purpose as defined in the project design, and should be treated as such; it is not suitable for publication as an academic report, or otherwise, without amendment or revision. Any requirement to revise or reorder the material for submission or presentation to third parties beyond the project design, or for any other explicit purpose can be fulfilled, but will require separate discussion and funding.

5 WORK TIMETABLE

- 5.1.1 **Building Investigation:** approximately one week in the field will be required to complete the Level 2/3 type building investigation.
- 5.1.2 **Report/Archive:** the report and archive will be produced within six weeks of completion of the fieldwork. OA North can execute projects at very short notice once a formal written agreement has been received from the client.

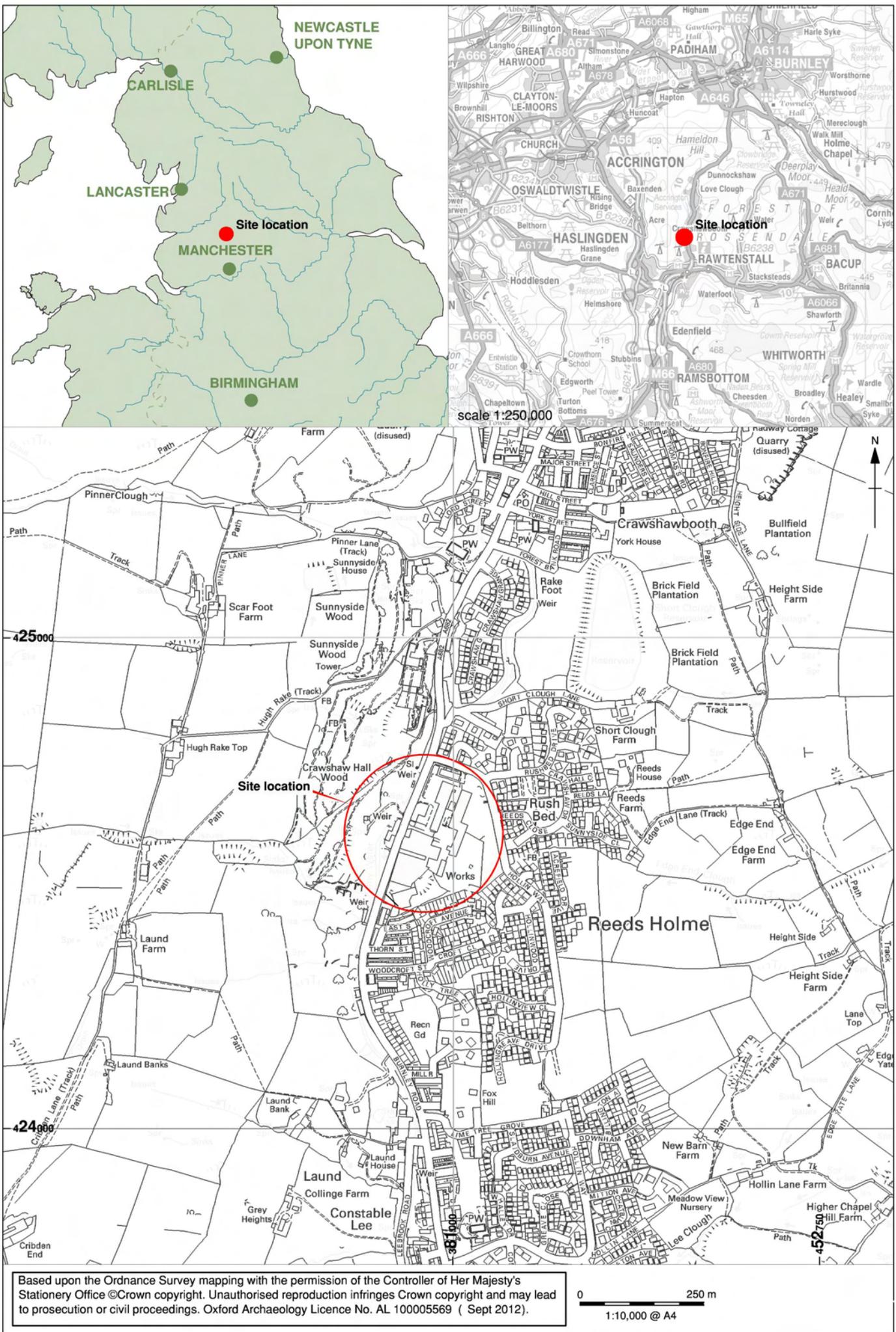
6 STAFFING

- 6.1 The project will be under the overall charge of **Ian Miller BA FSA** (OA North Senior Project Manager) to whom all correspondence should be addressed. Ian has considerable experience and particular research interests in Lancashire's textile industries. Ian managed the archaeological fieldwork, analysis and ultimate publication at Murrays' Mills (Miller and Wild 2007), and has managed numerous excavations of former textile mills throughout Greater Manchester. He is presently managing the Lancashire Textile Mills Survey, a strategic research project funded by English Heritage.
- 6.2 The archaeological building survey will be carried out by **Chris Wild BSc** (OA North Project Officer). Chris is an highly experienced historic buildings' surveyor, who has a particular interest in Industrial Archaeology, and has carried out numerous surveys of former textile-manufacturing sites.

ILLUSTRATIONS

LIST OF FIGURES

- Figure 1: Site location (NGR 380900 424537)
- Figure 2: Extract from the Ordnance Survey 25": 1 mile map of 1893
- Figure 3: Extract from the Ordnance Survey 25": 1 mile map of 1911
- Figure 4: Extract from the Ordnance Survey 25": 1 mile map of 1930
- Figure 5: Extract from the Ordnance Survey 1:2500 map of 1963
- Figure 6: Extract from the Ordnance Survey 1:2500 map of 1977
- Figure 7: Ground floor plan of Reeds Holme Mill complex
- Figure 8: First floor plan of Reeds Holme Mill complex
- Figure 9: Second floor plan of Reeds Holme spinning block



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Figure 1: Site location

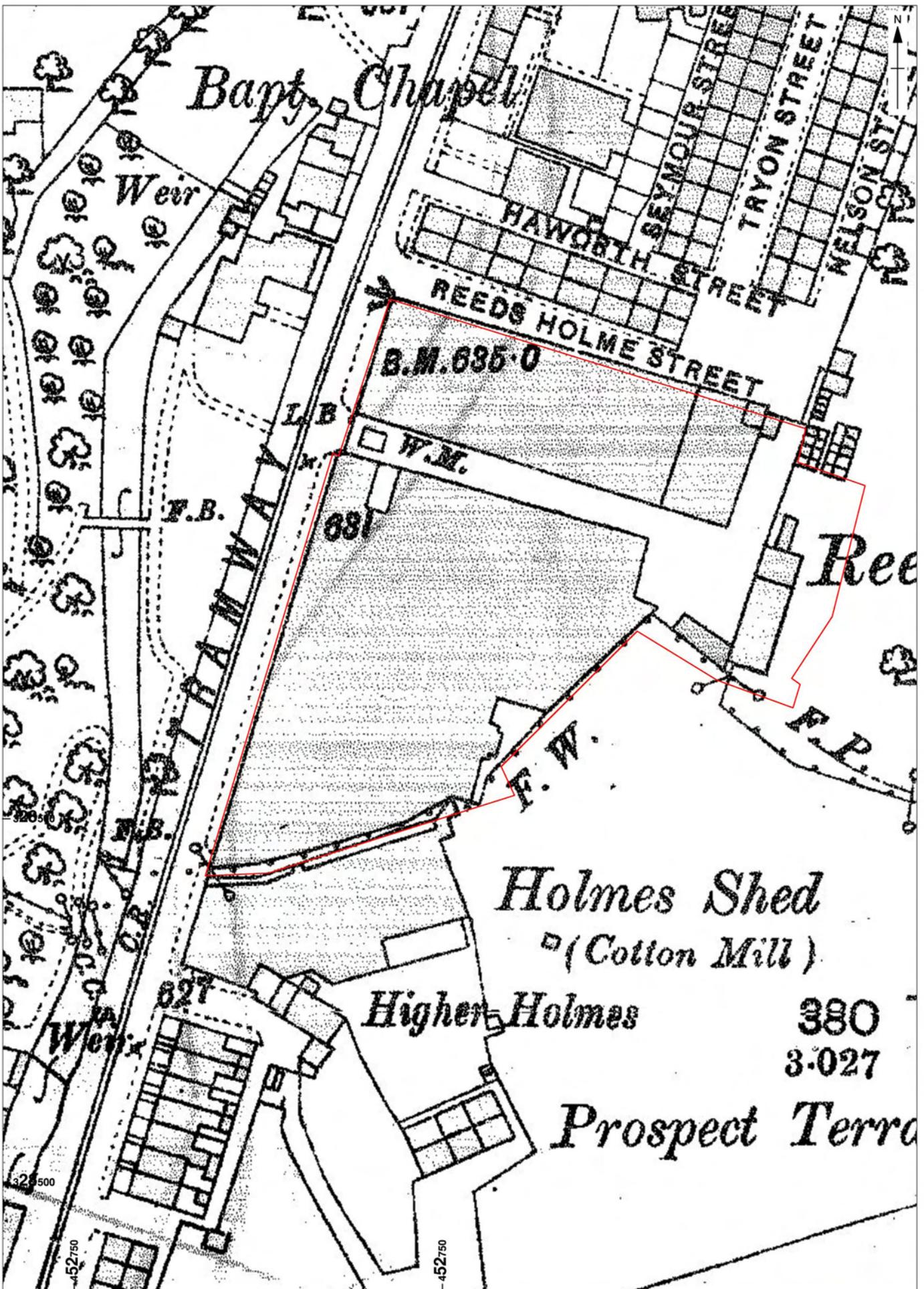


Figure 2: Extract from the Ordnance Survey 25":1 mile map of 1893

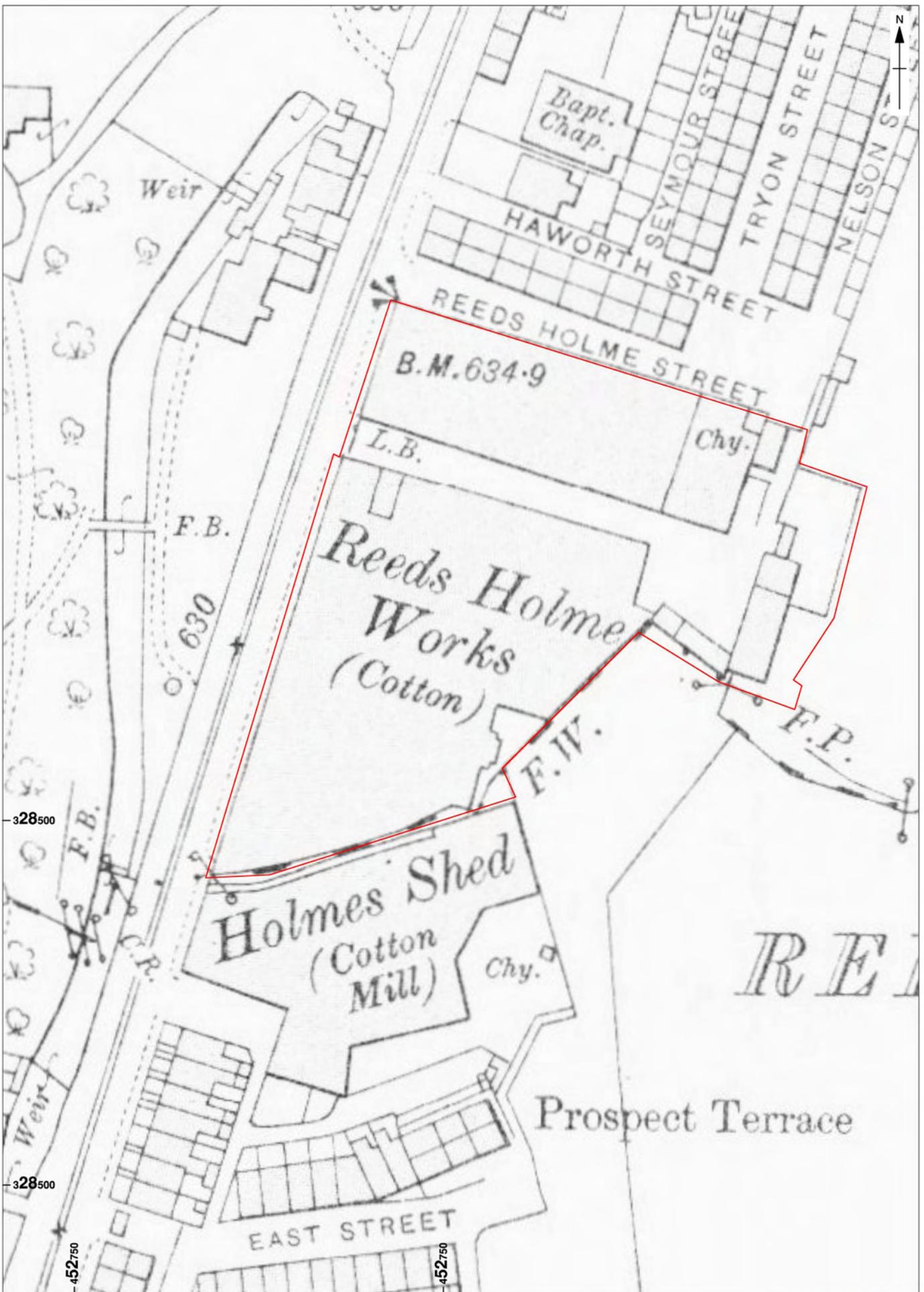


Figure 3: Extract from the Ordnance Survey 25":1 mile map of 1911



Figure 4: Extract from the Ordnance Survey 25":1 mile map of 1930

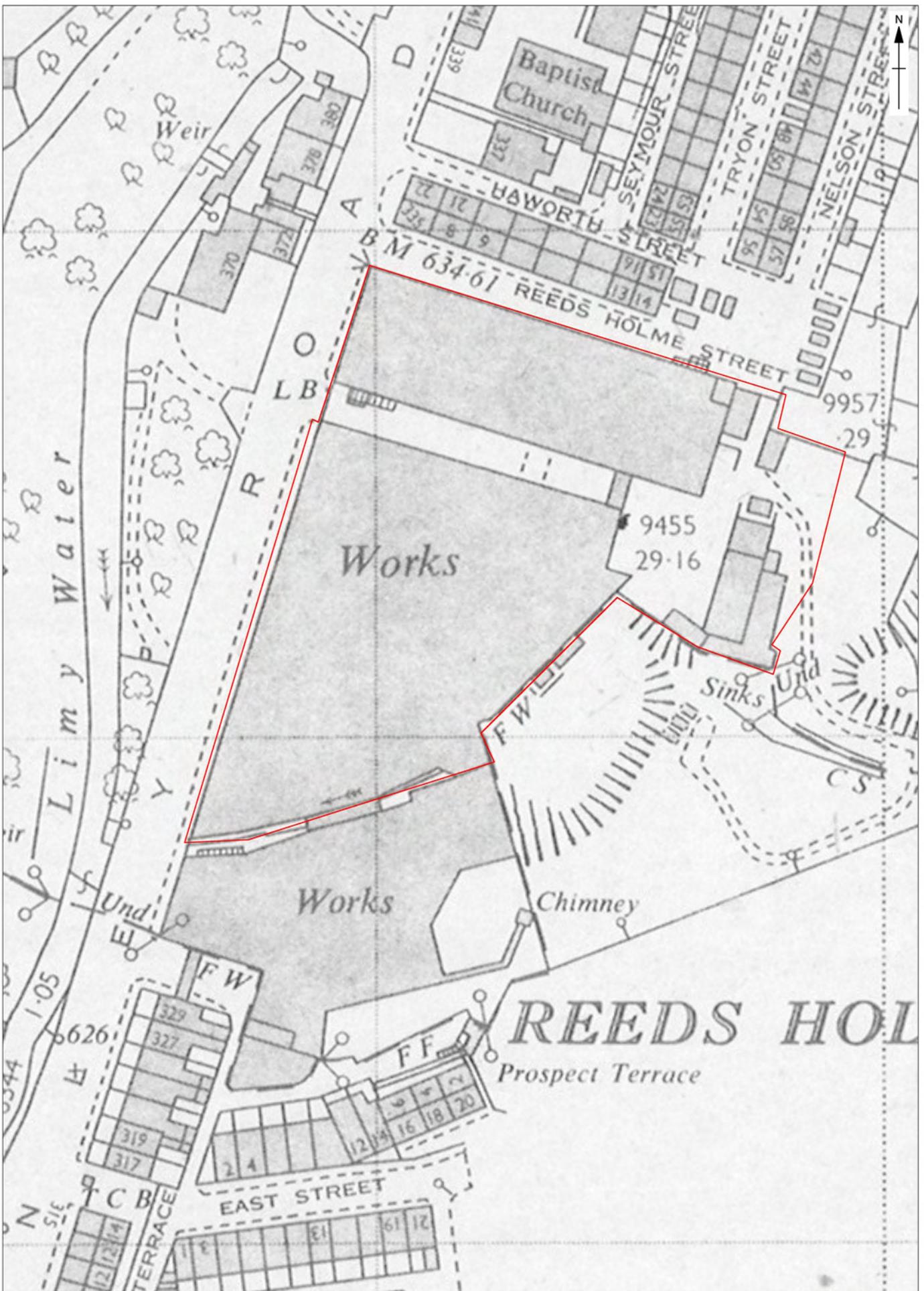


Figure 5: Extract from the Ordnance Survey 1:2500 mile map of 1963

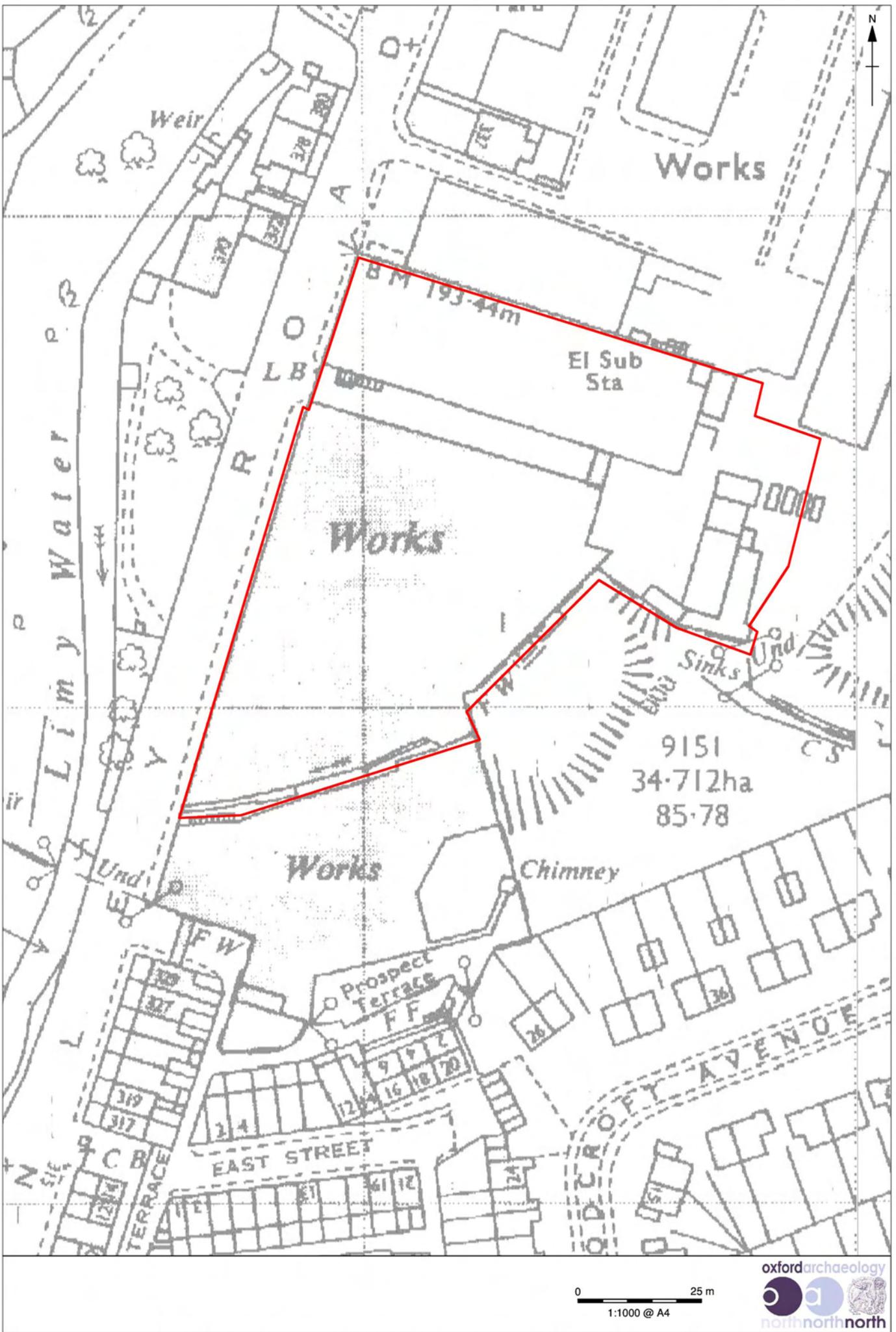


Figure 6: Extract from the Ordnance Survey 1:2500 mile map of 1977

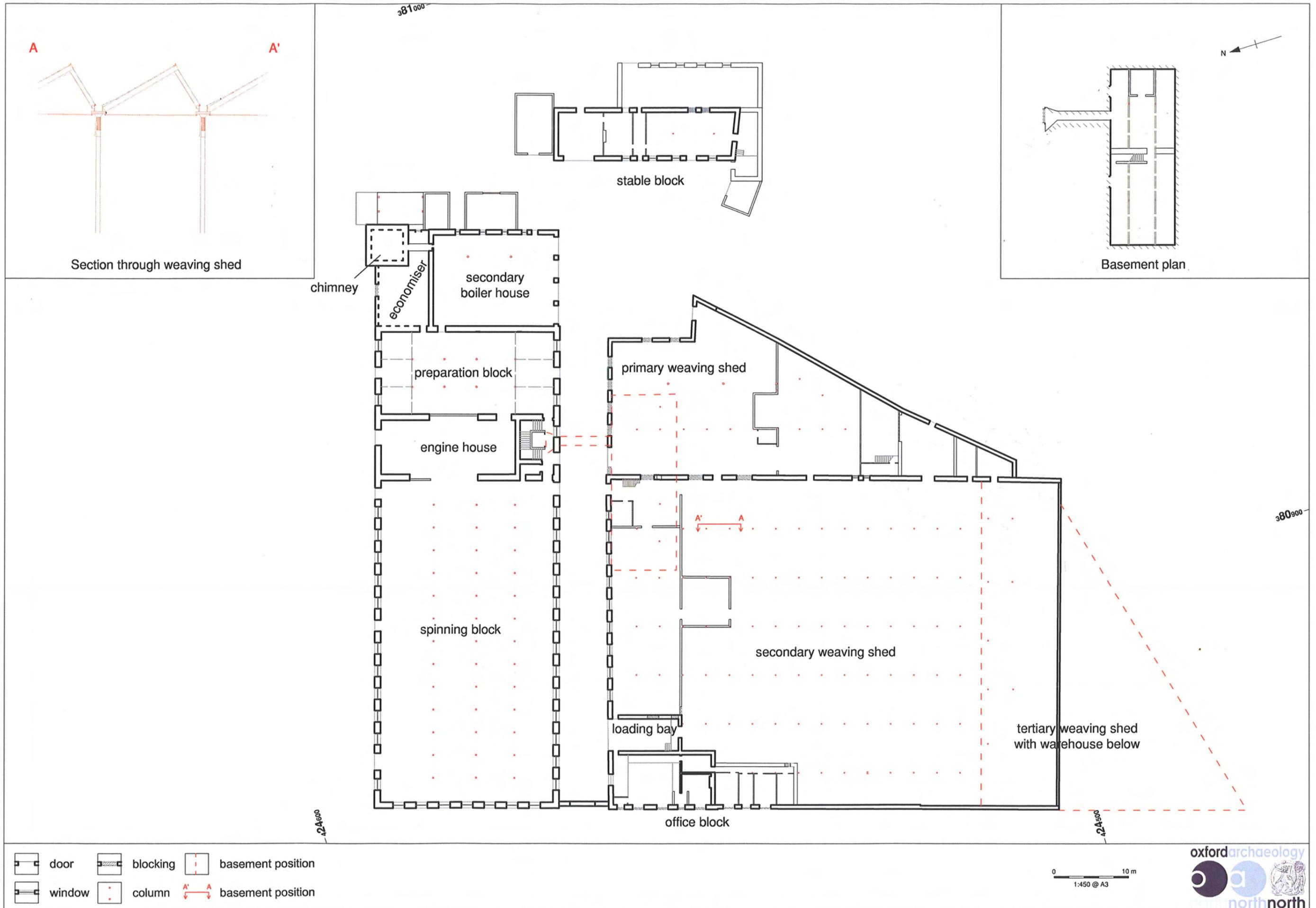
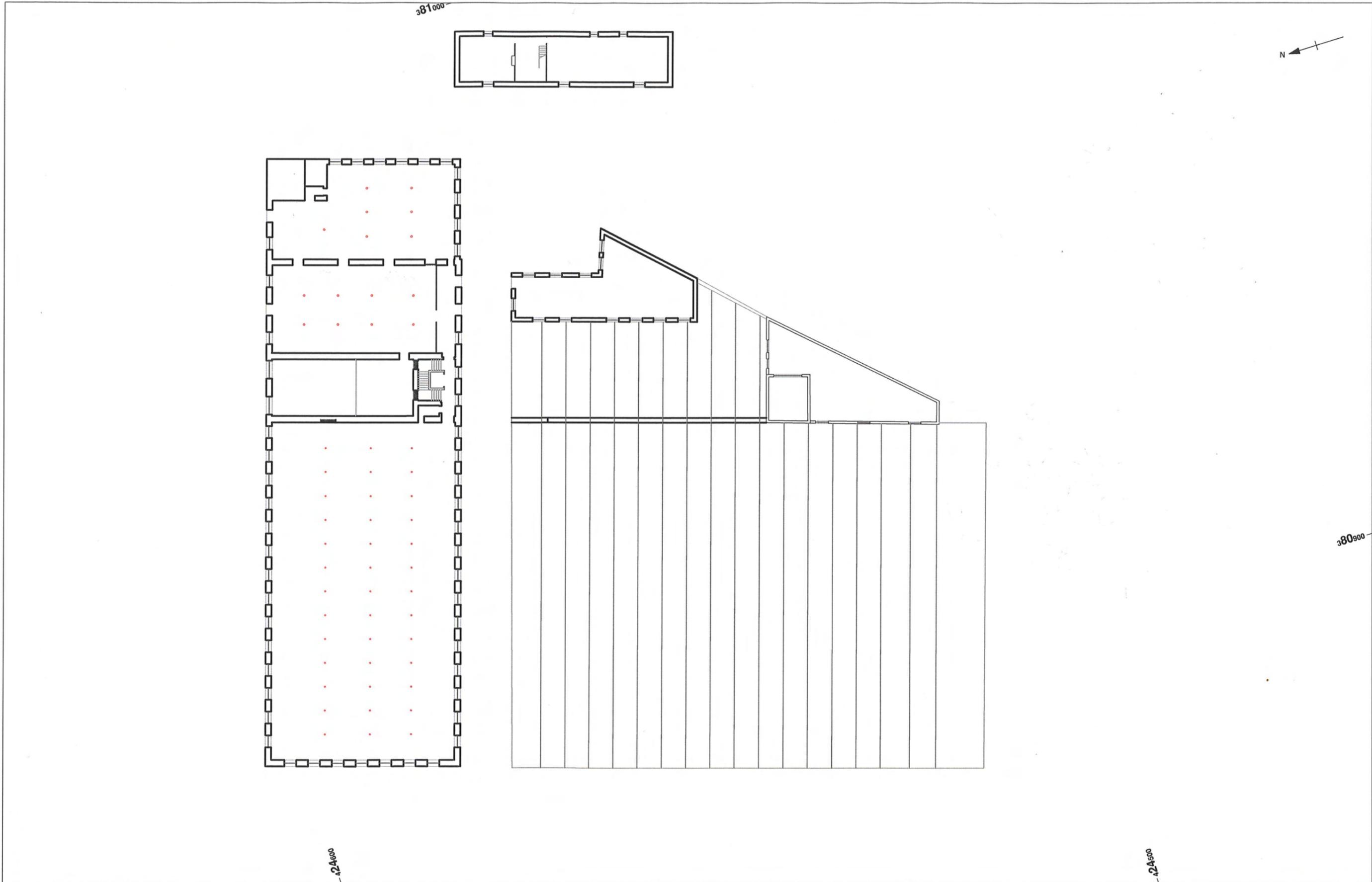


Figure 7: Ground floor plan of Reeds Holme mill complex

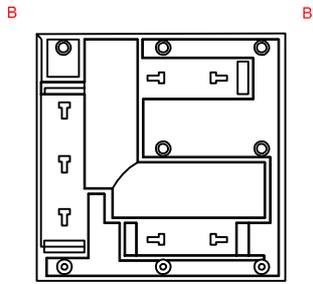


-  door
-  blocking
-  window
-  column

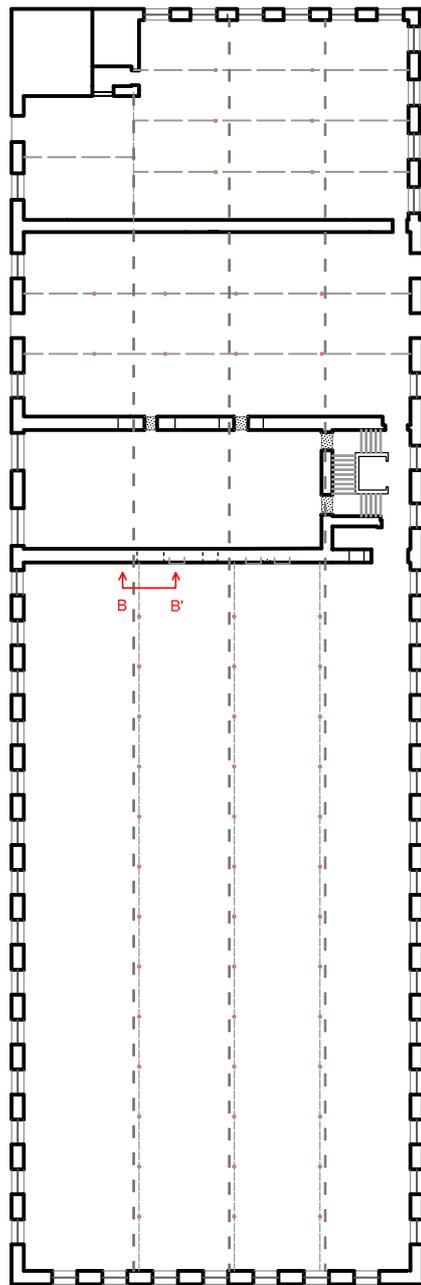
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Figure 8: First floor plan of Reeds Holme mill complex



Elevation of top bearing of upright shaft



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Figure 9: Second floor plan of Reeds Holme spinning block