Lower Mill, Mill Lane, Cheadle,

Cheshire

Archaeological Investigation

Interim Report

Oxford Archaeology North

April 2008

JCS Homes Ltd

OA North Job No: L9944
NGR: SJ 855 890

CONTENTS

SUMMARY

JCS Homes Ltd has recently submitted a planning application to Stockport Metropolitan Borough Council (SMBC) for the redevelopment of Cheadle Lower Mill in Cheadle, Cheshire (centred on NGR SJ 855 890). The application site is of considerable historical and archaeological interest, and is entered on the Greater Manchester Historic Environment Record database (2515.1.0 – GM3232). In particular, the site is known to have been occupied by a corn mill from at least the late 12th century, and was converted for use as a textile bleaching works in 1874. A period of rapid development then ensued, although the bleach works closed during the early 1930s, and the site was acquired by the Standard Chemical Co. The site has been derelict since 1996, and the component buildings have deteriorated considerably during the last 12 years.

In order to secure archaeological interests, SMBC placed an archaeological condition on the planning permission, which required an appropriate programme of archaeological investigation to be devised and carried out in advance of development. In November 2007, Oxford Archaeology North was commissioned by Halliday Meecham Architects Ltd, acting on behalf of JSC Homes Ltd, to devise and execute an appropriate programme of archaeological works. Following consultation with the Greater Manchester County Archaeologist, who provides archaeological advice to SMBC, it was recommended that in the first instance an English Heritage Level II-type survey of the extant buildings, coupled with historical research into the development of the site, was required in advance of any demolition.

The survey concluded that the majority of the buildings occupying the site had been remodelled to varying degrees during the 20th century, although some historic fabric survived in the buildings that are to be retained as part of the development. The survey was followed by a programme of intrusive investigation, comprising the excavation of several targeted trail trenches that were intended to establish the presence or absence of buried archaeological remains. The initial results obtained from this work demonstrated that buried archaeological remains survived *in-situ* across the southern part of the site, which merited further investigation in advance of development. The extent and location of the evaluation trenches placed in the northern part of the site was restricted by stockpiled demolition material, although the excavation of two short trenches revealed archaeologically sterile deposits; the north-western part of the site, however, awaits evaluation.

Significant remains of the former corn mill and the bleach works, including the well-preserved remains of two 19th-century waterwheels, were exposed in the southern part of the site during the course of the further investigation. This has led to a temporary suspension of the archaeological fieldwork whilst the options for the consolidation and long-term management of the waterwheels are considered. This report presents an interim statement on the results obtained to date from the programme of archaeological work, and highlights those elements that require completion. These include the excavation and detailed survey of the waterwheel pits, and the excavation of an evaluation trench in the western part of the site. An archaeological watching brief will also be required to monitor any work carried out on the buried culverts across the site.

ACKNOWLEDGEMENTS

Oxford Archaeology North (OA North) would like to express its thanks to Bryan Walker of Halliday Meecham Architects, and Frank Moran of JCS Homes Ltd, for commissioning and supporting the project. OA North is also grateful to Norman Redhead, the Greater Manchester County Archaeologist, Paul Hartley and Emma Curle of Stockport Metropolitan Borough Council, and Frank Galvin of Stockport Museum, for their advice and support. Particular thanks are expressed to Tim Booth, representing the Mills Section of the Society for the Protection of Ancient Buildings (SPAB), for examining the remains of the waterwheels, and to Pat Seddon for sharing her extensive local knowledge of the local area and its history. Thanks are also expressed to the staff of Cheadle Library and the Local Studies Unit at Stockport Library for their assistance with the documentary research.

The building survey was undertaken by Chris Ridings, Liz Murray, Chris Wild, Karl Taylor, and Sean McPhillips, and the documentary research was carried out be Ian Miller. The evaluation and subsequent excavation was directed by Claire Gardner, who was assisted by Liz Murray, Ellen McInnes, and Will Gardner, and all survey requirements were carried out by Chris Wild. The report was compiled by Ian Miller, Chris Ridings, and Claire Gardner, and the illustrations were produced by Mark Tidmarsh and Marie Rowland. 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 JCS Homes Ltd has recently submitted a planning application for a residential development at Cheadle Lower Mill, Cheadle, Cheshire. The site is occupied by a cluster of derelict structures that were used from 1874 to the 1930s as a textile bleaching complex, and thereafter as a chemical works. The proposed scheme allows for the retention of some historic fabric, although the demolition of several buildings on the site will be necessary as part of the proposed scheme.

1.1.2 The site is entered on the Greater Manchester Historic Environment Record database (2515.1.0 – GM3232), and is of some archaeological significance. In order to secure archaeological interests, Stockport Metropolitan Borough Council (SMBC) placed an archaeological condition on the planning consent, which required an appropriate programme of archaeological mitigation to be devised and carried out in advance of development. Following consultation with the Greater Manchester County Archaeologist, who provides archaeological advice to SMBC, it was recommended that in the first instance the scope of archaeological investigation should comprise an English Heritage Level II-type survey of the surviving buildings on the site (English Heritage 2006), coupled with an appropriate level of historical research. It was intended that the historical research would aid an interpretation of the results obtained from the building survey, and also inform a decision as to the extent of any further archaeological investigation that would be required in advance of development. The precise scope of works was specified in a Project Design that was devised by OA North in November 2007, in close consultation with the Greater Manchester County Archaeologist (*Appendix 1*). Following the formal approval of this Project Design, the building survey and associated historical research was carried out in November 2007.

1.1.3 Following on from the survey, and the subsequent demolition of several buildings across the site, modern concrete surfaces were removed under close archaeological supervision and the underlying deposits were evaluated to establish the presence or absence of buried archaeological remains, and establish their significance. Initially, large areas in the southern and western parts of the site were stripped of modern overburden, revealing that extensive buried structural remains survived *in-situ*. Following consultation with the Greater Manchester County Archaeologist and representative of SMBC, it was recommended that more detailed archaeological excavation of the exposed remains was carried out in advance of development. This was undertaken by OA North between December 2007 and January 2008, and revealed buried remains of considerable archaeological importance. In particular, the well-preserved remains of two waterwheels were exposed *in-situ*. Two small trenches were also excavated in the northern part of the site, although these failed to yield any remains of archaeological interest. The north-western part of the site, however, awaits investigation.

1.2 SITE LOCATION AND GEOLOGY

1.2.1 The application site lies *c* 0.7km to the north of Cheadle village, at the western end of Mill Lane (NGR SJ 855 890). The site occupies an area of land on the eastern bank of the Micker Brook, some 0.8km to the south of its confluence with the river Mersey. Whilst being on the southern fringe of a region defined as the Manchester Conurbation (Countryside Commission 1998, 126), the site lies within the administrative district of Stockport Metropolitan Borough, which forms part of the county of Cheshire.

1.2.2 The solid geology of the area comprises Carboniferous sedimentary material and a series of Permo-Triassic rocks, consisting mainly of New Red Sandstone (Hall *et al* 1995, 8). The overlying drift incorporates Pleistocene boulder clays of glacial origin, and sands, gravels, and clays of fluviatile/lacustrine origin (Ordnance Survey Geological Survey 1970).

Plate 1: Recent aerial view of Cheadle Lower Mill prior to redevelopment

2. METHODOLOGY

2.1 BUILDING SURVEY

2.1.1 The building survey comprised an English Heritage Level II-type survey (English Heritage 2006), and included a drawn, descriptive and photographic record of the buildings. All work was carried out in accordance with the Project Design (*Appendix 1*), and was consistent with the relevant standards and procedures provided by the Institute of Field Archaeologists (IFA), and generally accepted best practice.

2.1.2 ***Descriptive Record:*** written records using *pro-forma* record sheets were made of all principal elements of the buildings, both internal and external, as well as any features of historical, architectural and industrial significance or pertaining to its past or present use and function. Particular attention was paid to the relationships between areas of the buildings where their development or any alterations could be observed.

2.1.3 ***Interpretation and Analysis:*** a visual inspection of the buildings was also undertaken to English Heritage Level II standard, which included a systematic account of the origin, development and use of the buildings.

2.1.4 ***Instrument Survey:*** floor plans of the buildings were 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 digital survey data was 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. The drawings were used to illustrate the phasing and development of the buildings. Detail captured by the annotation included such features 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).

2.1.5 ***Photographic Survey:*** a photographic archive of the building was compiled, consisting of both general and detailed interior photographs, which were captured using both digital and colour slide 35mm formats. General photographs of the exterior elevations were also taken in digital and 35mm format.

2.2 EVALUATION TRENCHING

2.2.1 Following on from the selected demolition of the derelict buildings, the modern concrete surfaces across the site were stripped under close archaeological supervision, and targeted areas were investigated for the presence or absence of buried archaeological remains. The uppermost levels of overburden/demolition material were removed by a machine fitted with a toothless ditching bucket, to the top of the first significant archaeological level.

2.2.2 Machine excavation was then used to define carefully the extent of any surviving foundations and other remains within each of the trenches. Thereafter, structural remains were cleaned manually to define their extent, nature, form and, where possible, date. All information identified in the course of the site works was recorded stratigraphically, using a system adapted from that used by the Centre for Archaeology of English Heritage, with sufficient pictorial record (plans, sections and both black and white and colour photographs, the latter in 35mm and digital format) to identify and illustrate individual features.

2.2.3 All structures encountered during the course of the excavation were recorded three-dimensionally by EDM tacheometry using a total station linked to a pen computer data logger, the accuracy of detail generation being appropriate for a 1:20 output. The resultant digital plan was enhanced by manual survey on site using AutoCAD within the pen computer, whilst selected components of the works were hand-drawn at a scale of 1:20. The positions of the evaluation trenches were located with respect to surrounding landscape features, and were also recorded using the total station.

2.3 EXCAVATION

2.3.1 Following on from the evaluation, and the County Archaeologist's recommendation for further work, an Updated Project Design was submitted in advance of targeted excavation. The objectives of this programme of work were redefined thus:

- expose and record in detail the external walls of the corn mill and associated structures;
- expose and record in detail any internal features of the corn mill;
- identify and record any remains pertaining to the corn mill's power systems. In particular, the exact location and configuration of the waterwheel(s) and associated water-management features, and the position of the documented steam engine;
- expose and record in detail any buried structural remains pertaining to the bleach works;
- potential below-ground remains of Roman activity on the site;
- potential below-ground remains of a medieval water-powered corn mill.

2.4 FINDS

2.4.1 All finds recovered were bagged and recorded by context number, processed and stored according to current standard practice based on guidelines set by the Institute of Field Archaeologists.

2.5 ARCHIVE

2.5.1 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 Stockport Museum on completion of the project. In addition, a copy of the report will be forwarded to the County Sites and Monuments Record (SMR), and a summary sent to the National Monuments Record (NMR).

3. BACKGROUND

3.1 HISTORICAL BACKGROUND

3.1.1 The following section presents a summary historical background of the general area to place the results of the archaeological investigation into a local and regional context. A detailed account of the development of the study area is also presented, and is followed by a technological summary of corn milling and the bleaching industry.

3.1.2 ***Early Origins:*** the character and date of the earliest human activity in Cheadle is unknown, although several artefacts of Roman date have been discovered in the area. In particular, two Roman coins were found in 1972 a short distance to the north of the application site on the western bank of the Micker Brook, and another two coins were discovered in the immediate vicinity in 1981. These findspots lie close to a shallow point on the Micker Brook, raising the possibility that this had been an ancient ford, or crossing point. However, firm evidence for the nature of Roman activity in the area is lacking, and represents an archaeological research objective of high local importance.

3.1.3 ***Medieval Period:*** by the mid-12th century, the manor of Cheadle was held by a family of that name. It was situated in the Hundred of Macclesfield, and comprised the townships of Cheadle Bulkeley, Cheadle Mosley, and Handforth, incorporating a cumulative total of 6230 acres; the township of Cheadle Bulkeley comprised 2100 acres, whilst Cheadle Moseley occupied 2350 acres (Bagshaw 1850, 168). The medieval economy of Cheadle was based firmly on agriculture, and particularly the raising of beef and dairy cattle, and other livestock including sheep, pigs and poultry. (Hilton nd, 127).

3.1.4 The earliest reference to a corn mill in Cheadle is provided by a charter dated *c* 1185-1200, which refers to land held by Durandus 'neare the mill'; this is thought to have been Cheadle Lower Mill. In 1326, the manor was divided into Cheadle Bulkeley and Cheadle Mosley, and Cheadle Lower Mill became the manorial mill of Cheadle Bulkeley; Lower Mill was 'doubtless on the site of the old mill of the Bulkeley's mentioned in 1349 as being worth 13s 4d per annum' (Moss 1970, 139-40). The manorial mill of Cheadle Moseley was Cheadle Higher Mill, which was in operation from *c* 1599 to 1901 (Reid 1979, 22). Further evidence for medieval activity on the application site during this period is provided by a bronze ring of a probable 14th-century date, which was discovered in 1980.

3.1.5 ***Post-medieval and Industrial Period:*** the economy of Cheadle continued to be based largely on agriculture through the post-medieval period, although handloom silk weaving emerged as an important industry locally during the 18th century (Hilton nd, 129). After the death of James Viscount Bulkeley, the manor was sold under an Act of Parliament in 1756 to the Rev Thomas Egerton and, in 1806, it was conveyed to John Worthington (Pigot and Co 1828, 13-4).

3.1.6 By 1733, Cheadle Lower Mill had 'three watertorne milne and milnes…the kiln…sluices, dam and ware. A record dated 1753 indicates that the mill changed ownership at that date, and it was sold again some three years later to a John Renshaw, who also purchased other manorial lands and Cheadle Hall; Renshaw is the earliest known occupant of the mill. Around 1780, it was enlarged and, by 1784, had been equipped with five pairs of grinding stones (Reid 1979, 24). The position of the mill is shown on a small-scale plan of the area produced by William Stopford in *c* 1800, although the actual buildings are not depicted.

3.1.7 Cheadle Lower Mill was occupied during the early 19th century by Daniel Handforth, who is listed in trade directories for the 1820s as a corn miller in Cheadle (Pigot and Dean 1821, 334; Pigot and Co 1828, 14). Whilst Handforth is not listed specifically in association with Lower Mill, he is identified as one of two corn millers in Cheadle, the second being Charles Bostock. Handforth is not listed in directories subsequently, although Bostock is identified as the miller at Cheadle Higher Mill (*eg* Bagshaw 1850, 170), implying that Handforth had occupied Lower Mill.

3.1.8 By 1834, Lower Mill was occupied by Elizabeth Jowett, who is recorded as a corn miller (Hayes 2004, 13). Elizabeth was succeeded by her son, William Jowett, who is listed in trade directories as a corn miller at Cheadle Lower Mill until the 1870s (*eg* Post Office Directory 1864, 441). The Census Returns for 1851 record William Jowett as residing at the mill, together with his wife, mother, and two servant girls, and also state that William Jowett employed four men. William Jowett is similarly listed as the landowner and occupier of Lower Mill in the tithe apportionment for Cheadle Bulkeley of 1844 (SK/2/K/19), which also identifies him as the owner of the adjoining messuage, garden and buildings, yard stables and coach house, a small plantation, and the road to the mill, which is presently Mill Lane. Interestingly, he is also listed as the owner of two fields referred to as 'crofts', suggesting that they were used for bleaching cloth. In total, his holdings amounted to just over four acres, for which he was charged 3s 4d.

3.1.9 The layout of the study area is shown on two maps from the mid-19th century: a Poor Union survey of 1840, and a tithe map of 1844. These show the corn mill to have comprised several buildings, situated on the southern bank of a meander of the Micker Brook. The scale of the maps, however, is too small to furnish any detail of individual buildings, and the position of waterwheel(s) employed is unclear. By 1856, a 20 horse-power steam engine had been installed to supplement the water-power system (Hayes 2004, 13), although little is known about the type of engine used, or its position within the mill. The principal building is depicted on a photograph taken in *c* 1864 (SLS 22345), which also shows the mill yard at the end of Mill Lane (Plate 2).

3.1.10 The layout of the mill during the early 1870s is depicted on the Ordnance Survey 25": 1 mile map of 1872 (Fig 2). This shows a linear range of buildings, marked as a corn mill, situated along the southern bank of a meander of the Micker Brook. There is some evidence to suggest, however, that the mill had actually ceased to operate as a corn mill by 1872, and may have been derelict at that date (*3.1.11 below*).

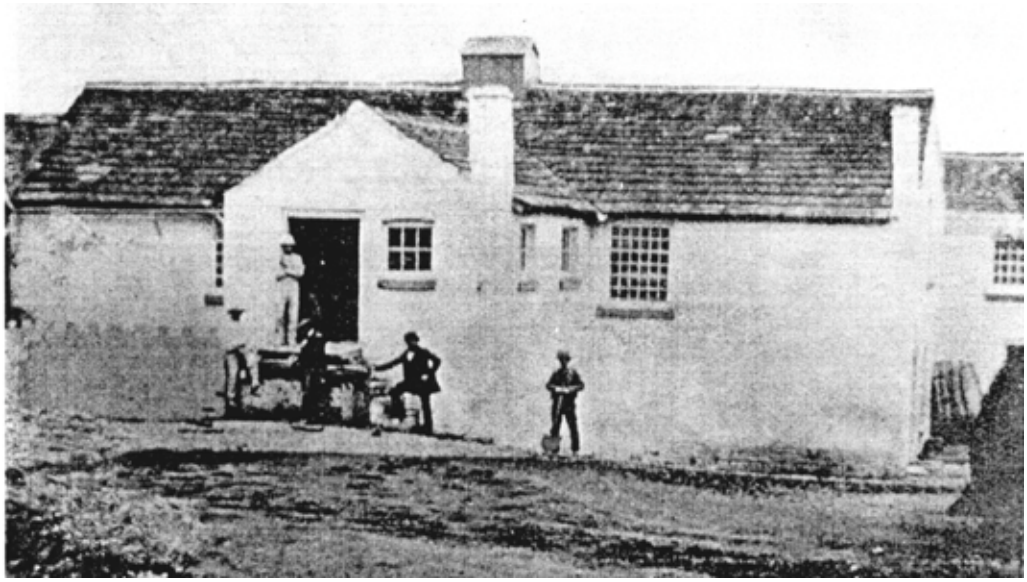


Plate 2: The south-facing elevation of Cheadle Lower Mill in c 1864 (SLS 22345)

3.1.11 ***Cheadle Bleach Works:*** in 1874, the mill was sold to William Mosley junior, a bleacher from Salford. The deed of 12th January 1874 releasing the rights was between William Jowett, who is described as a cotton broker in Liverpool, and William Mosley the younger (CRO D1931/31). The detail provided by this document implies that William Jowett had ceased milling corn at Cheadle by the early 1870s, and that the mill may have been vacant at the time of his negotiations with William Mosley; W Jowett is listed as 'Esquire' at Springfield House in a trade directory for 1874, and is not mentioned specifically as a miller (Morris and Co 1874).

3.1.12 By 1875, William Mosley had redeveloped the site as a bleach works (Sykes 1926, 35). Mosley had formerly been the manager of Robert Heywood's Crescent Bleach Works on Adelphi Street in Salford, established in 1838, where he had presumably gained an in-depth knowledge of the bleaching industry. It seems that his father, William Mosley, had also been engaged with the textile finishing industries, and is listed in trade directories for the 1840s as a bleacher, residing a Wilton Place in Salford (*eg* Pigot and Slater 1841, 126).

3.1.13 William Mosley junior appears to have maintained a presence in Manchester following his purchase of Cheadle Lower Mill, and occupied premises at 28 Brown Street during the 1870s (Post Office Directory 1878, 473). Within five years, he appears to have relocated his Manchester office to 85 Mosley Street (Slater 1883, 69), once described as being 'without exception, the most elegant street in Manchester' (Butterworth 1823, 258). Mosley was also a subscriber to the Manchester Royal Exchange (Slater 1863, 170). Despite his evident business connections with Manchester, however, Mosley resided in Springfield House, occupied formerly by William Jowett and situated adjacent to the bleach works (Kelly 1896, 182; Kelly 1902, 195).

3.1.14 In order to extend the premises for his bleach works at Cheadle, William Mosley diverted the natural route of the Micker Brook and built over the original watercourse. This arrangement is shown clearly on a map produced in 1886 (Fig 3), which depicts a large and irregular building complex, a large part

of which corresponds broadly to the configuration of the corn mill, suggesting that elements of the building had been incorporated into the bleach works. It is possible that the bleach works adapted its predecessor's means of producing power, and that the machinery was driven initially by a combination of water and steam power. However, this may have been a short-lived arrangement, as Ordnance Survey mapping of 1898 shows the works to have been expanded considerably, with the addition of a suite of buildings erected to the north (Fig 4). According to Hayes (2004, 13), the council for Cheadle put pressure on local factory owners to reduce any reliance of water power during the later 19th century, and offered to build the required chimney if the owner installed a larger steam plant. In addition to steam power, the bleach works is reported to have manufactured its own electricity, although the date at which this was installed is uncertain (Hilton nd, 26).

3.1.15 Comparison of the Ordnance Survey 25": 1 mile map of 1898 (Fig 4) with the subsequent revision, published in 1910 (Fig 5), implies that the works had been little altered. The layout of the site at this date is also shown in considerable detail on an inventory plan (BAA 393a), produced by the Bleachers' Association Ltd in 1910 (Fig 6). This plan identifies the processes carried out in each of the component buildings on the site, and provides a comprehensive list of their fixtures and fittings (*Appendix 2*). According to Hilton (nd, 146), part of the factory was rented to a silk manufacturer, and another part to The Croft Laundry during the early 20th century, although there are no references to either of these businesses in trade directories up to 1914 (*eg* Kelly 1902; Kelly 1914).

3.1.16 The next edition of Ordnance Survey mapping, published in 1934 (Fig 7), shows the site to have undergone some remodelling. In particular, the building forming the northern part of the complex had been expanded with a large addition to the western elevation, and a new structure erected immediately to the north of the chimney in the south-western part of the site.

3.1.17 The site closed as a bleach works in the late 1930s, and in 1939 the Bleachers' Associated rented part of the premises to James and Albert Horsfield, who established the Standard Chemical Co. The Horsfields had been associated closely with the textile chemical industry, and started the manufacture of specialised materials for local textile markets in Lancashire, Yorkshire and the Midlands (Hilton nd, 146). During the Second World War, the Standard Chemical Co was concerned largely in supplying textile firms engaged in equipping the armed forces. This lucrative market placed the Standard Chemical Co in a good position to capitalise on the post-war boom in textiles, and the company opened new laboratories in the early 1950s to answer demands for more scientific methods of processing textile goods. Pilot plants were installed for the testing of new materials, and Standard Chemical Co took over the site completely during the 1960s. This allowed the company to diversify into the manufacture of laundry and dry cleaning chemicals, and resulted in the production of a series of specialised detergents and finishing agents soluble in a cleaning solvent that could be applied to all types of fabric.

3.1.18 By the 1970s the company was manufacturing over 200 different products, under the brand names of Sovatex, Sufatol, and Atolex (Hilton nd, 146).

Sovatex was a solvent scouring and spotting agent, anti-foaming agent, softening and anti-static agent, and waterproof and re-texturing agent. Sufatol and Atolex were both sulphated fatty alcohols, detergents, pastes, and liquids for textile wet processing. The company also secured a contract from the UK Atomic Energy Authority to manufacture and supply radio-active decontaminate agents. The expansion of the firm necessitated some remodelling of the works, although the extent is undocumented.

3.1.19 In 1991, the firm was taken over by Thor Chemicals Ltd, which thereby inherited Cheadle Lower Mill. The following year, the chimney was reduced in height. The factory closed in 1995, and the buildings, although extant, have since deteriorated considerably.

3.2 BACKGROUND TO WATER-POWERED CORN MILLS IN CHESHIRE

3.2.1 The corn mills of medieval England were built for the benefit of the local lord of the manor, who derived a regular source of income from the tolls levied on the milling of grain (Holt 1988). Watermills began to be developed from their medieval forms during the late 16th and early 17th centuries, reflecting the changes in land ownership after the dissolution of the monasteries and improvements in standards of living. Numerous mills were built during this period, and many of those existing were enlarged or rebuilt using more durable materials (Watts 2000 37).

3.2.2 The majority of the surviving corn mills in Cheshire, such as those at Acton, Brereton, Church Minshull, and Arley, are three or four storeys in height, although there is a five-storey mill at Dunham Massey, and Stretton, Huxley, and Bate Mill are all two-storey examples. Many of the known mills in Cheshire were of brick construction with slated roofs, although mills built entirely of stone survive at Nether Alderley and Donnington. Earlier mills were almost certainly of timber construction on stone footings (Norris 1969, 36), and it seems likely that Cheadle Lower Mill was originally of that form, and remodelled in brick in the 18th or 19th century. It is unknown how many storeys the remodelled mill comprised, and whilst the photograph of *c* 1864 (Plate 2) appears to show the principal building to have been of two storeys, it is possible that a lower storey, built into the bank of the river valley, is not captured in the image.

3.2.3 A mill would typically contain the gearing on the ground floor, driving the milling machinery on the first floor, with the upper floors providing storage. The two-storey mill at Stretton contained a granary sub-floor in the roof (Norris 1969, 53); containing the granaries on the upper floor was a characteristic features of Cheshire mills, whilst those elsewhere in the county had separate buildings for grain storage (*op cit*, 38). Many mill sites in Cheshire incorporated a mill house, a drying kiln, cart shed and stables, and often piggeries.

3.2.4 The typical drive in a medieval water-powered corn mill was from the pit-wheel, a face gear mounted on the shaft of the waterwheel. The pit wheel meshed with a trundle, which was attached to the stone spindle (Plate 3).

Before the development of gearing, the only way to increase the capacity of a corn mill was to add a second waterwheel and associated millstones. These are many examples of mills with two waterwheels, and several variations to their layout, dependant on site-specific conditions (Watts 2000, 40).

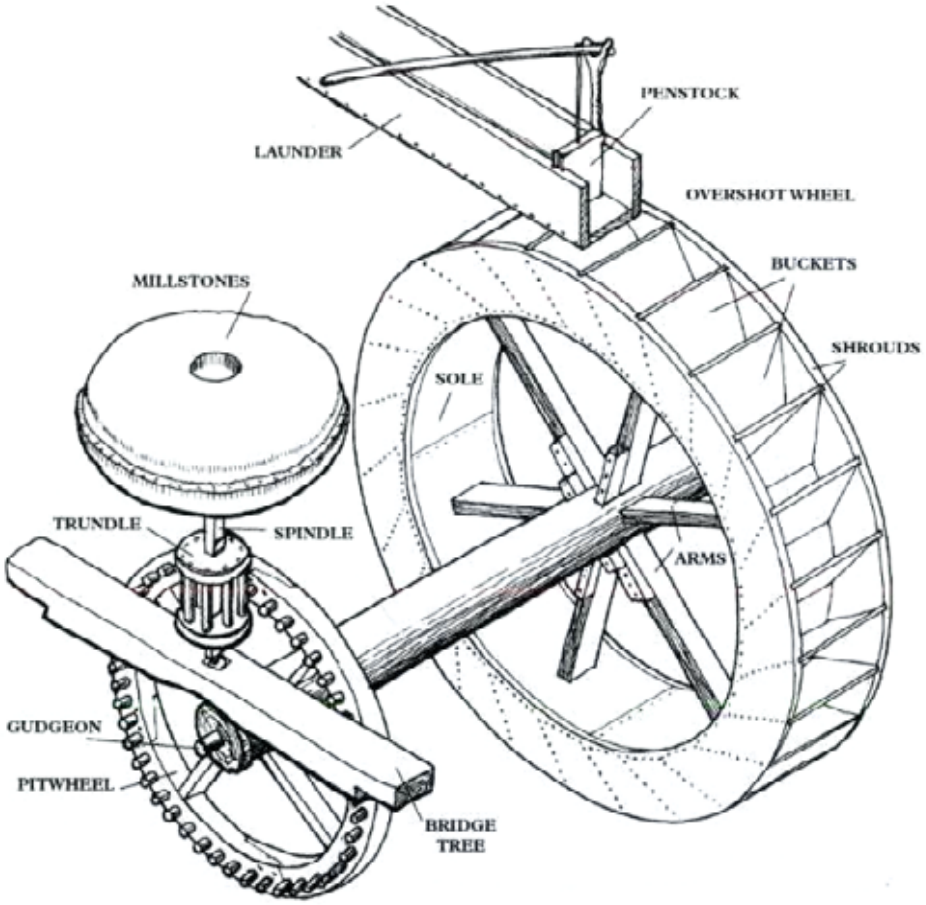


Plate 3: Reconstruction of the working parts of a medieval corn mill (taken from Watts 2000)

3.2.5 During the 18th century, spur gearing became more widespread, allowing more pairs of millstones to be driven, in addition to ancillary machinery such as hoists; John Smeaton's designs for a watermill at Halton, Lancashire, produced in 1754, show three pairs of millstones and spurwheel drive. By this system, the bevelled teeth of the pit wheel powered a similar gear known as a 'wallower', which was mounted on the upright shaft. A large spur wheel, referred to as the great spur wheel, was also mounted on the upright shaft, above the wallower (Plate 4). The great spur wheel turned the stone nuts, which were connected to the millstones on the floor above. By the 1770s, this was a fairly common arrangement, with the upright shaft also carrying a crown wheel from which layshafts were driven to power a hoist or dressing machinery (Watts 2000, 88).

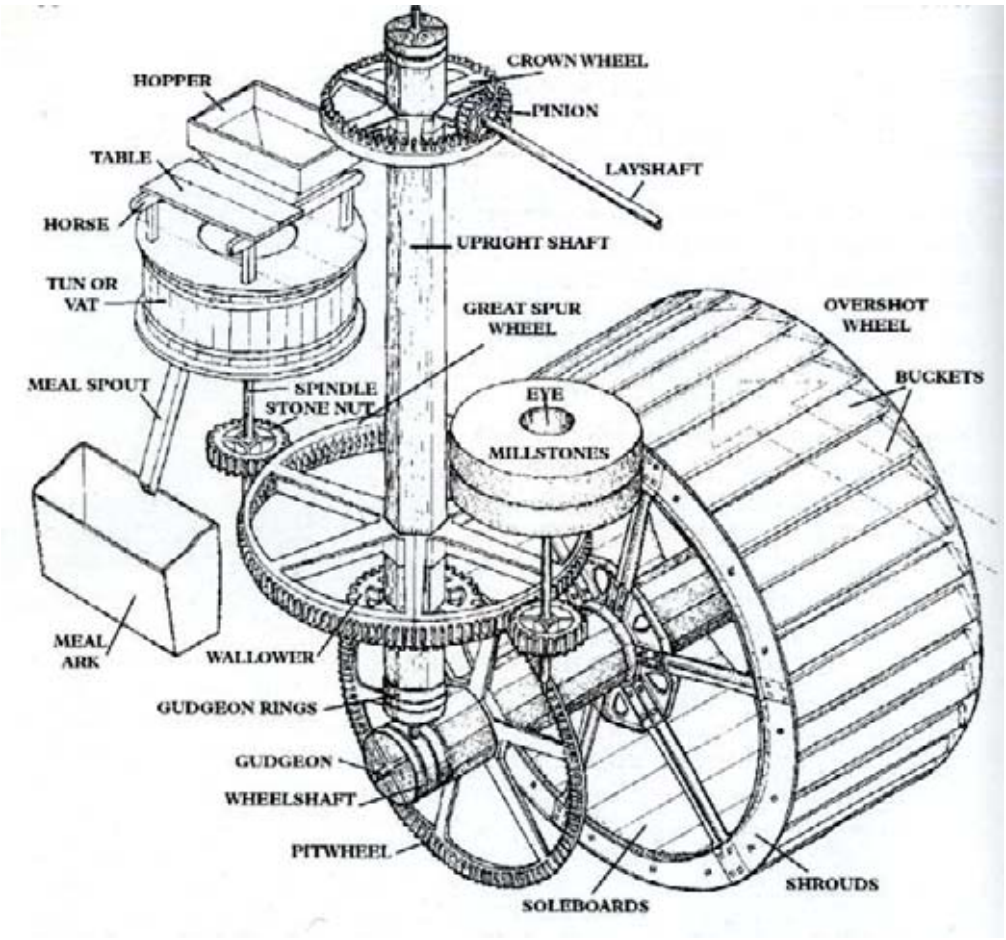


Plate 4: Typical spurwheel drive layout (taken from Watts 2000)

3.2.6 In the mid-18th century, waterwheels were built largely of timber, with fastenings and other iron fittings provided by blacksmiths. The early use of cast iron for gearing and shafting in millwork is generally attributed to John Smeaton, who introduced iron gears at the Carron Ironworks in Scotland in 1754. In 1770, Smeaton used cast iron for the rings of waterwheels at the Carron Ironworks, intending that they would act as fly wheels and provided increased momentum. By 1800, waterwheels built entirely of iron were in use, such as the 50'-diameter wheel installed by Watkin George at the Cyfarthfa Ironworks in South Wales (Watts 2000, 70). Many millwrights, however, continued to work in timber, reflecting the cost or iron castings and their transport.

3.2.7 Water power is derived from either the velocity of the water, or from its weight carried in troughs or buckets mounted on the wheel. Undershot wheels are powered by the velocity of water, and incorporate a series of flat wooden paddles, or curved iron blades, mounted around the circumference of the wheel and struck by the flow of water beneath. This type of wheel was probably fitted to the early mills in Cheshire, but had a relatively low power output (Norris 1669, 41). The weight wheels occur as two basic types: the breast-shot; and the overshot. These wheels were more efficient that velocity wheels, and were of particular value where there was a limited but constant source of water, making use of its weight rather than relying entirely on flow.

3.3 BACKGROUND TO THE BLEACHING INDUSTRY

3.3.1 'The history of bleaching is the history of civilisation' (Sykes 1926, 1). Pure white cloth is a prerequisite for dyers and printers to obtain pure colour, although colouring matter is more or less inherent in all natural fibres (Murphy 1911, 131). In order to obtain a white cloth, a method of destroying the colouring matters and removing any dirt and grease contracted during the spinning and weaving processes without damaging the natural fibres was therefore necessary. This was achieved through the bleaching process, which was an old-established industry in Lancashire long before the Industrial Revolution (Ashmore 1969, 60).

3.3.2 The traditional method of bleaching was to lay the cloths outside in the full glare of the sun, and occasionally sprinkle them with water. This process could take from six to eight months to complete (Baines 1835, 246). This ancient system of bleaching was improved upon by the Dutch, who invented a process for bleaching linens which attained a reputation so high that manufacturers sent their cloths to Holland from all parts of Europe to be bleached (Murphy 1911, 132). This process involved steeping the cloths in an alkaline lye, to which boiling potash was added. The cloths were then washed, and then steeped in shallow cisterns of buttermilk, and the bleaching was finally achieved by exposing the cloths to the sun for long periods in bleach crofts. The equipment required was thus limited to a boiling kier, and troughs of stone or wood for steeping (Ashmore 1969, 60).

3.3.3 In *c* 1770, the Dutch system of bleaching linen was introduced into Scotland, where Dr Home of Edinburgh discovered that the action of the buttermilk could be substituted with weak sulphuric acid. This proved to be a very efficient innovation, reducing the time and labour expended in the bleaching process by about a third (Murphy 1911, 132). During the same period, however, a Swedish chemist called Scheele discovered the substance known as chlorine, which he then designated dephlogisticated muriatic acid (Sykes 1926, 9). In 1785, whilst investigating the nature of this new substance, the French scientist Berthollet discovered that chlorine set free oxygen by decomposing water, and caused the destruction of colouring matters (Murphy 1911, 132). Working in partnership with James Watt, Berthollet succeeded in demonstrating the practical application of his discovery to the bleaching process in 1787, although the industry remained unconvinced.

3.3.4 In 1798, Charles Tennant invented a combination of chlorine and lime that completely met the requirements of the bleaching trade. This resulted in the introduction of bleaching powder, patented by Tennant in 1799, which was made by impregnating dry-slaked lime with chlorine gas (Murphy 1911, 133). Another major development in the bleaching industry was the introduction of mechanisation during the late 18th century: water and steam power began to be used to drive the machines, including dash wheels, washing machines, squeezers, mangles and calendars (Ashmore 1969, 61). By the middle of the 19th century, textile engineering had become a recognised branch of the engineering industry, resulting in the general improvements of bleaching plant (Sykes 1926, 15).

3.4 TECHNICAL BACKGROUND TO THE BLEACHING PROCESS

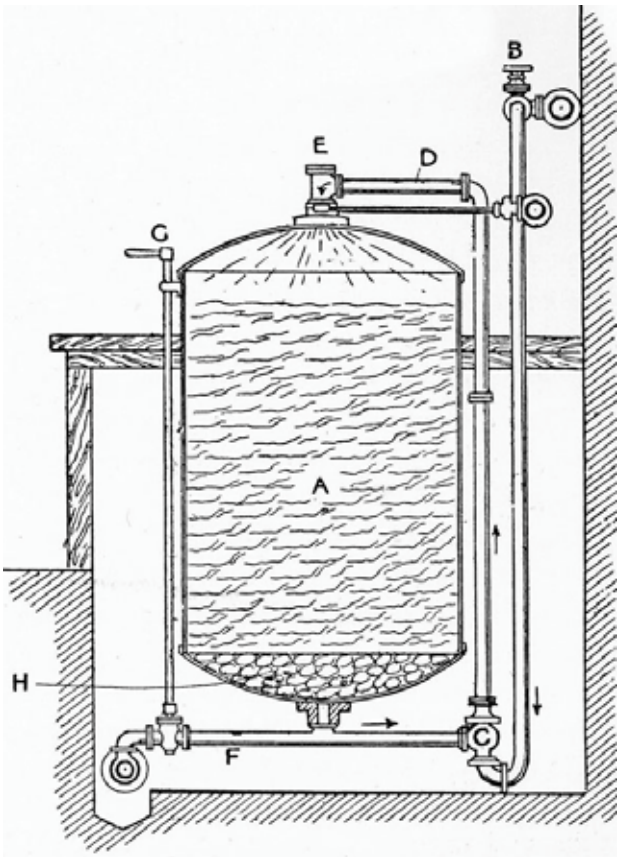
3.4.1 By the mid-19th century, bleaching had become a continuous process that was carried out in specialised factories. Whilst there was considerable variation to the layout of various bleach works, the processes carried out were the same. These processes can be demonstrated by reference to the Cheadle Bleach Works, and the details provided by the Bleachers' Association Ltd inventory of 1910 (BAA 393a).

3.4.2 Once delivered to the Cheadle Bleach Works, the grey cloth was unloaded in the Covered Cartway (Building 19 on the 1910 inventory plan), and stored in the Grey Cloth Store (upper storey of Building 23), at the northern end of the works. The first stage in the bleaching process was to sew all the cloth pieces together, end to end, forming a continuous rope of cloth that could be several miles long (Ashmore 1969, 61). This was achieved in the Grey Sewing Room (Building 20), which by 1910 contained two Singer twin-needle sewing machines (Type 31-52), and a Rayer & Lincoln rotary sewing machine. The cloth could then be moved between the various processing rooms by winches, which drew the rope of cloth through overhead porcelain eyes.

3.4.3 Prior to being subject to the actual bleaching process, any fine fibre remaining on the surface of the cloth, and frayed filaments from weaving, need to be removed in order to obtain a perfectly smooth surface; failure to remove this material would make the cloth appear cloudy. This was achieved by singeing the cloth over red-hot plates in the Singe House (Building 18). This building contained single plate singeing machine, fitted with a 54" wide copper plate that was heated by a stove underneath. Once the cloth had been passed rapidly over the hot plate, it was fed immediately through a trough of water to extinguish any sparks. It is interesting to note that this traditional method of singeing was employed at Cheadle, rather than the improved method of gassing, by which loose filaments on the surface of the cloth was removed by the flames from gas jets built into the singeing machine.

3.4.4 The cloth emerged from the Singe House via the squeezing rollers of the water trough at full width, and was passed through brass eyes set in the eastern wall of the building and into the Bleach Croft (Building 17), where it was subject to the 'grey wash' process. The Bleach Croft was one of the largest areas within the bleach works and contained numerous items of machinery, which by 1910 included three small steam engines, washing machines, a liming machine, a high-pressure kier, six open kiers, and two double chemicing cisterns.

3.4.5 Initially, the cloth was fed in the form of a twisted rope into the liming and washing machine, where it was alternately impregnated with scouring liquor and squeezed dry through rollers. The scouring action of the washing machine removed some of the impurities from the cloth, although would not wholly destroy the fine waxy coating on the fibres, and achieved little or nothing towards actual bleaching. The impurities were broken down by chemical action in the liming machine, which closely resembled the previous washing machine: the cloth was fed by rollers into a trough containing a diluted lime solution, and was then extracted via the squeezing rollers. The cloth was then ready to be passed into a boiling vessel, or kier, and subjected to the further action of diluted lime solution. The object of lime boiling, a process also known as 'bowking', was to circulate the solution continuously through the cloth at a temperature of at least 212^0F. This was probably carried out at Cheadle initially in low-pressure kiers, steam-tight vessels of cylindrical shape that were heated by low-pressure steam (Plate 5). It is possible, however, that this process was carried out latterly in a high-pressure kier, which was installed in 1908. This was of mild steel construction, with a diameter of 8' and a height of 9'. On completion of this process, the cloth was passed through another washing machine to remove any soluble impurities and lime.



A, Cloth. B, Pipe for boiling liquid. C, Point of circulation. F, Let-off pipe tap. G, Tap. H, Stones in bottom of kier.

Plate 5: Section through a low-pressure injector kier

3.4.6 The next process was the 'grey sour', which involved treating the cloth with a weak solution of hydrochloric acid to dissolve any vestiges of lime and other insoluble soaps, and to remove metallic oxides. This was carried out in a machine similar in construction to the washing machine. Once completed, the cloth was washed thoroughly to discharge all the dissolved matter. However, this process did not remove all traces of fatty acids, which are not dissolved by lime but are soluble in boiling soda ash.

3.4.7 Cloth was frequently boiled twice with soda in the kiers. In the first boil, the cloth may have been treated with soda ash and resin paste previously dissolved by prolonged boiling in caustic soda, but soda ash alone was normally used in the second boil. This may have been carried out at Cheadle in the cast-iron

open kiers, but the process will have required at least 12 hours to complete (Murphy 1911, 146). Once the soda ash boil had finished, the cloth was again washed thoroughly.

3.4.8 The next stage was the bleaching, or chemicing, process, which was intended to destroy what remained of the natural colouring matters in the fibre. This was achieved by passing the cloth through a clear solution of chloride of lime, or bleaching powder. The chemic solution was prepared in the room (Building 16) adjacent to the Bleach Croft, which contained an ashlar chemic cistern, measuring 8'6" x 3'9", and 5' deep. The chemicing process was carried out in the Bleach Croft (Building 17) which, by 1910, contained two double chemicing cisterns of stone construction, with each compartment measuring 10' x 6' x 6' 6". Once the cloth had been washed in the chemic solution, it was allowed to lie for several hours whilst the chemical reactions took place. In order to complete the decomposition of the natural colouring matters and remove the liberated hypochlorous acid, the cloth was passed through a dilute solution of sulphuric acid, a process known as the 'white sour'. This was followed immediately by a final washing in clean water, which rendered the cloth perfectly pure. The cloth was then passed through a pair of specially padded squeezing rollers, and thence into either centrifugal driers or a range of drying cylinders. Building 4 and 4A contained a horizontal drying machine and multi-tubular heaters (Plate 6). In essence, a drying machine comprised a series of steam-heated copper cylinders. The drying process was completed in the Hanging Stove (Building 3).

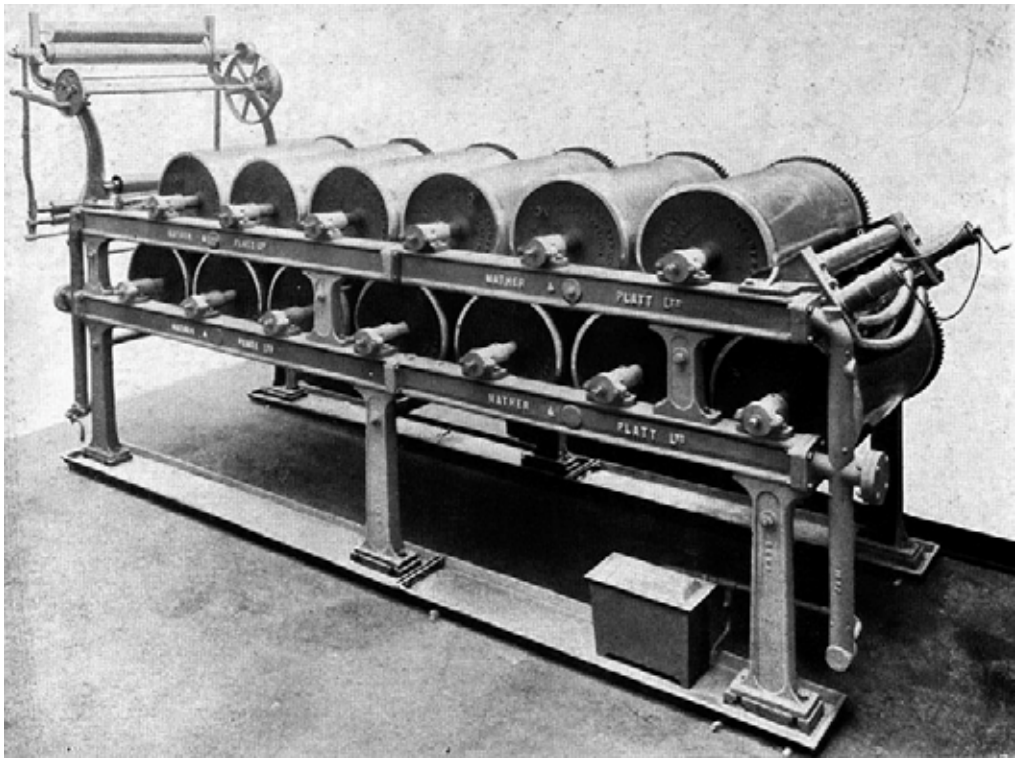


Plate 6: An early 20th-century horizontal drying machine, built by Mather & Platt Ltd

3.4.9 The processes through which the cloth passed rendered it liable to shrinkage and kinking, which was rectified by stretching machines (Plate 7). This finishing process also required the cloth to be evenly and finely damped, a

requirement fulfilled by a damping machine. These and the stretching machines were housed in Building 5 and Building 6, in the south-eastern corner of the bleach works.

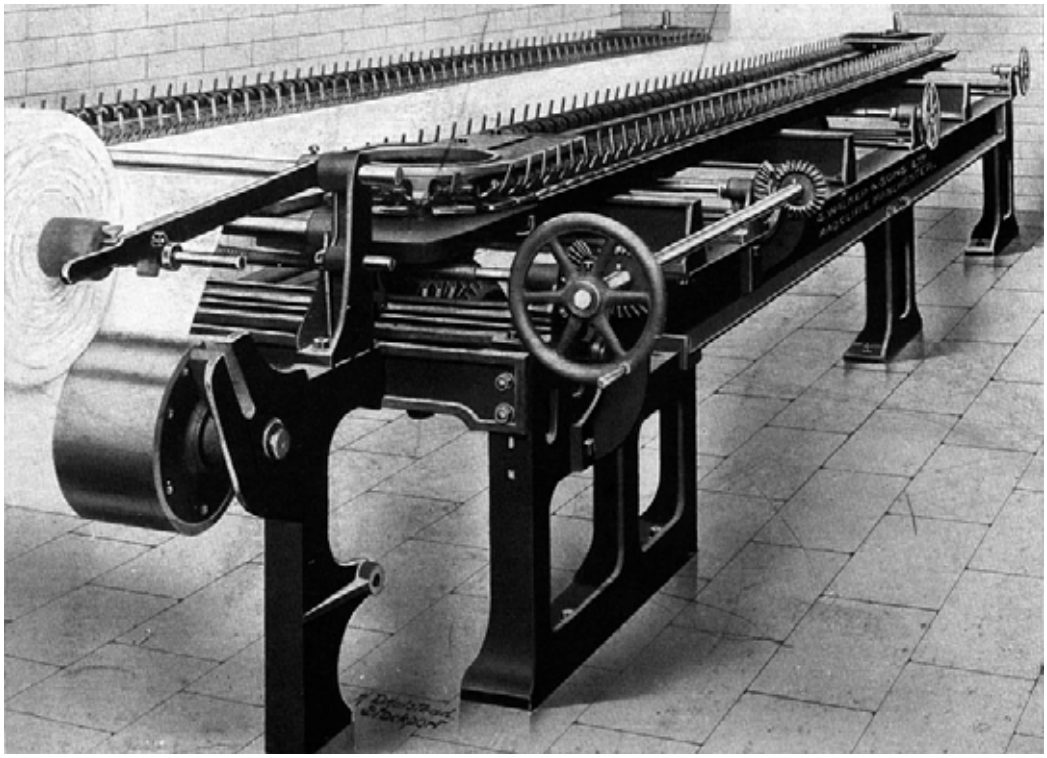


Plate 7: Early 20th-century stretching machine, built by S Walker & Sons (Manchester) Ltd

3.4.10 The adjacent rooms, Building 7 (Making-Up and Calender Room) and Building 10 (Stiffening and Mangle House) contained numerous mangles, calenders, and stiffening machines. The mangles were employed to apply filling substances to the bleached cloth. Finish was imparted to cloth by means of heated rollers running on each other with the cloth between them. These machines were known as calenders.

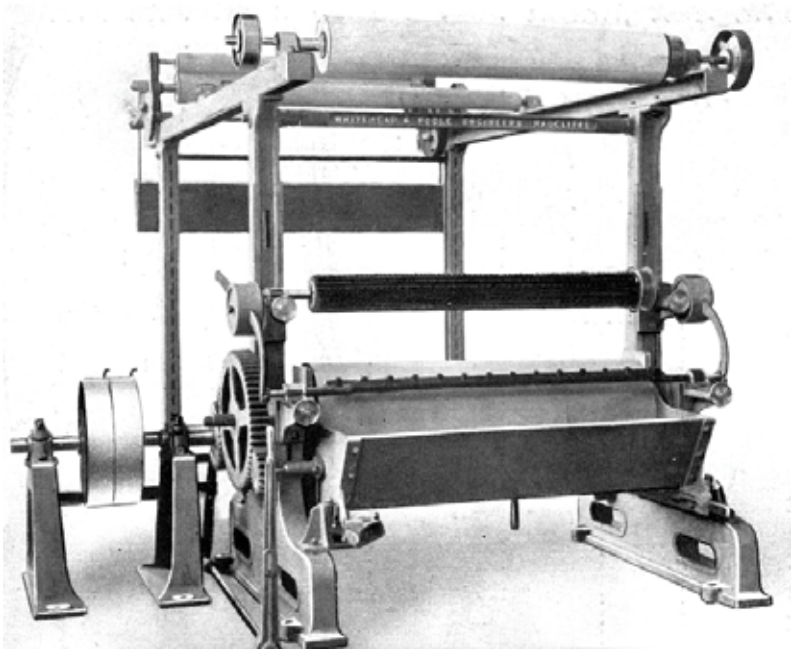


Plate 8: Back-filling mangle, by Whitehead & Poole (Manchester) Ltd

3.4.11 In order to achieve a lustred finish, a beetling machine could be employed (Plate 9). These were housed in Building 23.

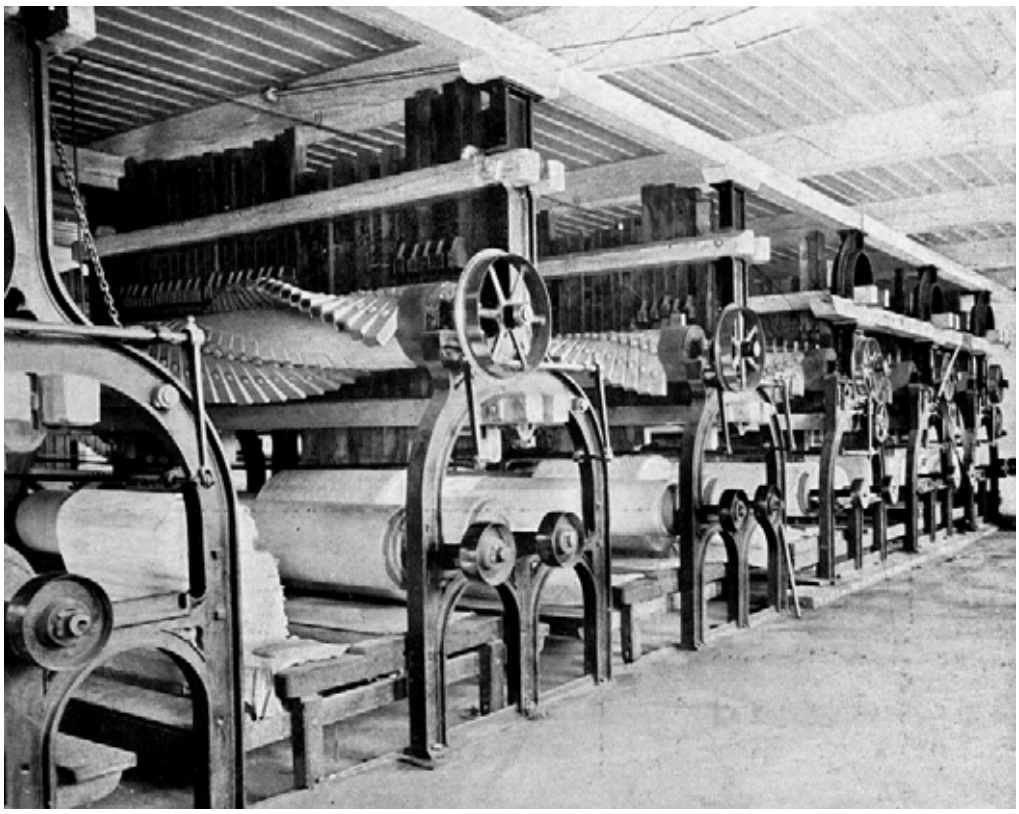


Plate 9: Beetling machines

4. BUILDING SURVEY RESULTS

4.1 INTRODUCTION

4.1.1 The study area comprised over 20 buildings, occupying an area of nearly 4,300m^2 (Plate 1). The majority of buildings were constructed from machine-cut brick with brick or sandstone dressings and slate roofs, whilst some of the later buildings were constructed from rolled steel joists and corrugated iron. Despite the relatively recent construction of the mill complex, many of the buildings were in an exceptionally poor condition, precluding safe access to the first floors in any of the buildings. Moreover, some of the ground floors were deemed equally unsafe, and only a cursory inspection was undertaken from doorways or windows.

4.1.2 The inventory plan of 1910 (BAA 393a) has proven invaluable in researching the various parts of the mill complex (Fig 6). Unfortunately, this plan does not include some of the later buildings, and a new numbering system has been employed to incorporate these (Fig 8). In order to allow an uncomplicated cross-referencing between the two, the numbers pertaining to the inventory plan are presented in italics, whilst the new numbering system is presented in bold.

4.2 BUILDING INVESTIGATION

4.2.1 ***Building 1:*** a range of buildings situated at the west end of the site, comprising three separate sections (Plate 10). During its use as a component of the bleach works, the north end of this building served as a two-storey stable block (*26*), whilst a single-storey general store room (*25*), offices and laboratory lay to the south (*24*). The condition of the buildings, particularly those lying to the south, was exceptionally poor, precluding a detailed survey.

*Plate 10: North-west-facing view of the east elevation of Building **1***

4.2.2 The fabric of the two-storey structure at the north end comprised cinnabar red, machine-cut brick laid in a stretcher bond with lime mortar, whilst the shallow-pitched roof was laid with Welsh slate, supported by king-post trusses with trenched purlins. The single-storey sections of the building to the south were similarly constructed, although their condition was considerably poorer. In addition, the front (east) elevation of the building appeared to have undergone some rebuild in modern brick, probably carried out during the site's 20th-century use as a chemical works.

4.2.3 All of the windows at the north and rear (west) elevation of the building appeared to comprise top-hung ventilator casements, and given its original use as stabling, these are all likely to be later replacements. Indeed, a pair of original segmental heads, which were visible above the casements on the first floor at the front of the building, would appear to confirm this. To the south of the building, there was a large, canted and timber-framed bay window with projecting stone sill, which appeared to be original features. Only one of the external doors remained, forming an aperture at the north-east corner.

4.2.4 The north end of the building was laid to concrete, with evidence of plasterboard partitions for lavatories, but there was no surviving evidence of its earlier use as a stable block. Similarly, later partitions had been inserted at the south end of the building, and there was little surviving evidence to suggest that the building was used as a laboratory.

4.2.5 ***Building 2:*** this two-storey building was little more than an open-walled shed of a 20th-century date, appended on to the west elevation of Building **3** (Plate 11). A series of steel stanchions (rolled steel joists) on the west elevation supported the roof, which comprised similar steel beams and corrugated iron sheeting. The floor of the building was laid to concrete, with a brick-lined service bay to the centre of the building.

4.2.6 ***Building 3:*** was similarly a 20th-century building, situated to the north of the bleach works complex, and presumably associated with the site's use as a chemical factory. The fabric of the building comprised machine-cut brick laid in an English Garden Wall bond (three to one), whilst edge-set and bullnose brick decorated the apertures and piers (Plate 11). The bowed roof was laid with asphalt, and the centre of each of the gables rose to a flat parapet, surmounted by sandstone copings. In addition, some brick repairs have been undertaken on the west elevation, following the insertion of the rolled steel joists of Building **2**.

4.2.7 Access to the building was provided by a doorway, complete with chamfered lintel on the south-west corner, whilst a single sliding door was located on the north elevation. The windows were timber-framed, top-hung ventilator casements with up to nine lights. All of these had chamfered sandstone lintels and projecting sills, whilst the jambs had lark's tongue chamfering detailed in bullnose brick. Four of these were located on the west elevation, whilst a further six and four are featured on the north and south elevations, respectively. Additionally, a pair of similar windows was also located on the first floor of the west elevation, but these had been blocked subsequently with brick.

4.2.8 Internally, the roof comprised timber slats supported by bowed lattice trusses ('Belfast' trusses) that were mounted upon stepped brick piers. The timber first floor, which was accessed by a cast-iron and timber staircase at the north-east corner of the building, had collapsed and only the steel joists and supporting stanchions survived, whilst the ground floor was laid with concrete. As in the adjacent, earlier building (Building **4**, *23*), there was a series of gulleys and machine-beds, and their layout suggests that the two buildings were used for similar purposes.

*Plate 11: North-east-facing view of the south elevation of Building **3**. The adjacent corrugated iron and steel shed (Building **2**) is visible on the left.*

4.2.9 ***Building 4:*** the two-storey building (with mezzanine) was formally the Beetling Room (Building *23*) (Plate 12), with walls constructed from machine-cut bricks laid in English Garden Wall (three to one), up to two and a half skins wide. The detail provided on the inventory plan of 1910 suggests that the building was significantly wider at its south end, which is added credence by a butt-joint at the south-east corner, demonstrating that it had been remodelled.

4.2.10 The shallow–pitched roof was in a severe state of disrepair, and little of the slate or rafters survived. However, all four of the machine-cut king-posts remained, in addition to the ridge plate and the trenched through purlins (two per pitch). The original windows appeared to have been casements crowned with segmental edge-set heads, and projecting stone sills. Four of these were situated on the north elevation, whilst a further five lay on the east elevation. The northernmost of these had been in-filled, and was only partially visible above the lintel of the inserted door, whilst a further window on the west elevation had also been blocked, evidently when Building **2** was constructed. As a result, only one casement at the north end of the elevation survived.

*Plate 12: South-facing view of the north elevation of Building **4***

4.2.11 Access into the building was provided by a door on the south elevation, which originally formed a loophole with a blocked loading door above. Additionally, the small room to the south-east corner was accessed by an inserted door on the east elevation, which replaced a brick-blocked door on the south wall. On the first floor of the east elevation, there was an inserted loading door, which cut through the segmental head of the casement below.

4.2.12 On the interior, the ground floor was laid to concrete, whilst the partial mezzanine was built from rolled steel joists and stanchions overlain with floorboards (Plate 13). The first floor was laid to floorboards (4" wide) supported by four substantial, chamfered timber beams of similar scantling to the roof trusses (Fig 9). Access to the mezzanine was obtained originally via the cast iron and timber staircase at the north end of the building, with a comparable staircase above for the first floor.

4.2.13 Although none of the machinery associated with the beetling process remained *in-situ*, there were a series of scars along the west side of the building, and a pair of mounting brackets was located on the north side of the mezzanine. A series of timber vats and iron tanks were mounted on the mezzanine floor (Fig 9), providing rationale for the drainage gulleys noted in the concrete floor below; the mezzanine and associated features almost certainly represented the building's use as part of the chemical factory.

*Plate 13: North-facing-view of the interior of Building **4**, detailing the steel mezzanine floor and iron tanks*

4.2.14 ***Building 5:*** the building was two-storeys high with machine-cut brick again the principal fabric, which was laid in an English Garden Wall Bond (four to one) up to two and half bricks thick (Plate 14). In addition, a string-course was present between the ground and first floors on the west elevation, whilst the north corners had distinctive chamfering, albeit that the north-east corner is more discreet. The slate roof was somewhat damaged, but the principal members were intact and revealed that the roof was of king-post construction with trenched through-purlins.

*Plate 14: East-facing view of the west elevation of Building **5***

4.2.15 Access to the ground floor of the building was provided by a solitary door on the east elevation, whilst a similar door, accessed by a set of external cast-iron stairs was located above. All of the windows were top-hung ventilator casements, varying in size between two and six lights, with those on the ground floor having edge-set segmental heads, whilst plain edge-set heads or timber lintels were employed throughout the remainder of the building. Originally, all of these windows appeared to have had some sort of iron shuttering, but only those on the west elevation of the ground floor had retained them.

4.2.16 In keeping with the buildings' previous function as both a mechanics' and joiners' workshop (*1*), the concrete floor was scarred with lathe and workbench mountings, whilst a pair of drainage gulleys or channels lay parallel to both the north and south elevations. In addition, a brick-blocked bearing box was located on the south-west corner of the ground floor, but little remained of any other associated power transmission features.

4.2.17 ***Building 6:*** the two-storey building, which is annotated on the 1910 plan as the Dining Rooms (*2*) for members of staff, was of a comparable build and character to the adjacent Building **5** (Plate 15). On the west elevation, there were two blocked doors, whilst a large loading door to the south of the elevation had been converted into a door. The blocking beneath the steel lintel was modern, and appeared to have been blocked within the last 20 years.

*Plate 15: East-facing view of the west-elevation of Building **6***

4.2.18 Internally, the building was two-celled and laid to concrete with plain painted brick walls. Of additional note was a modern brick wall on the east elevation, which divided the building from **7**.

4.2.19 ***Building 7 and 9:*** the former lay at the southern extent of the complex and had housed the Hanging Stove (*3*). It was constructed from machine-cut brick laid in English Garden Wall (three to one), and was two storeys high (Plate 16). Its shallow pitched roof was laid with Welsh slate, and was supported by king-post trusses with trenched purlins mounted upon stepped brick piers. The roof of Building **9** (Plate 10) to the east was collapsed, but would appear to have been comparable with that of the adjacent buildings **19** and **20**.

*Plate 16: North-west-facing view of the south elevation of Building **7***

4.2.20 Along the south elevation, there were eight top-hung ventilators with projecting stone sills and segmental edge-set heads, whilst a tall loading door was located towards the west end of the façade and a wide sliding door to the east. In addition, there were two brick-blocked bearing boxes and a timber hatch to the centre and east of the elevation into Building **9**.

*Plate 17: North-east-facing view of the south elevation of Building **9***

4.2.21 Internally, there was little of archaeological interest within the buildings. The floor level within Building **9** was significantly lower than the roadside, suggesting that an upper floor and steps were present originally, but no evidence of this survived. Building **7** was similarly devoid of any features of note, having a simple floor laid to concrete, with a timber ceiling supported by rolled steel joists and stanchions with steel gusset plates.

4.2.22 ***Building 8:*** the building was a 20th-century, two-storey boiler house, which replaced the original Boiler and Pump Room (*14* and *15*) that lay to the immediate east. Its walls were constructed from machine-cut brick laid in an English Bond one and half bricks wide, whilst bullnose brick detailed the surrounds of the doors, windows and piers. The north elevation was open (Plate 18), whilst the brick build reached first floor height only, with the upper portions of the gables being formed by corrugated iron sheeting. The original free-standing chimney, which was built in machine-cut brick in an English Garden Wall (three to one), lay at the south-eastern corner of the building.

*Plate 18: North-facing elevation of Building **8**, showing in-situ Lancashire boiler*

4.2.23 The shallow pitched roof was in a poor condition and little of the slate remained, but the rafters, purlins and steel 'French' trusses survived *in-situ*. These trusses were mounted upon three brick piers at the south wall, whilst pairs of steel joists and concrete-lined stanchions provided support at the north end of the building. Only one external door survived, which was located at the east end of the south elevation. Additionally, a door lay towards the north

extent of the east elevation, providing access in to the adjacent suite of rooms (Building **22**). Moreover, there was a blocked window at the south end of the east elevation, whilst a pipe outlet was located on the west elevation.

4.2.24 An intact Lancashire boiler was situated along the east wall (Fig 10), and the position of other boilers marked by the remains of a collapsed wall built in glazed brick. The extant boiler was just less than 28' (8.78m) long and 6½' (1.98m) in diameter, whilst the walls of the flue system, which were built in English Garden Wall were relatively intact and survived to a height of 1.2m. These walls were topped by a course of edge-set headers, which would suggest that refractory slabs were originally present and acted as the roof of the flues surrounding the boiler. In the wall above the boiler, there were the remains of the main steam pipe, which curved towards the north within the adjacent room (**22**). Additionally, to the right, there were a further three small blocked apertures, which appeared to have originally been similar pipe outlets. To the south of the boiler, there was a brick wall standing at 1.8m high, 0.34m thick and up to 5.97m long, which may have represented part of a housing for a fuel economiser (Plate 19).

*Plate 19: Looking north through the Boiler House Building **8**, showing main flue and putative economiser housing in the foreground*

4.2.25 ***Buildings 10 and 11:*** the former building functioned as the Pattern Office and Paper Store (*8*), whilst the latter served as the Loading Shed (*9*). At the time of the investigation, both buildings had been demolished, but the former was undoubtedly the same construction as Building **19**. The Loading Shed appears to have been brick-built and had a conventional pitched roof of king or queen-post construction, as evidenced by the scarring on the east elevation of Building **13** (Plate 20).

*Plate 20: Scars of Building **11** visible on the east-facing elevation of Building **13***

4.2.26 ***Building 12:*** although the building is described as the 'Grey Unloading Shed' (*19*) on the inventory plan of 1910 (Fig 6), it appeared to have actually been little more than a canopy, which straddled Buildings **4** and **13**. The scar of a roofline and the remains of steel joists protruding from the north elevation of Building **13**, are all that remained of the structure at the time of the survey.

4.2.27 ***Building 13:*** this two-storey high building functioned as the Bleach Croft (*17*), the core to the bleach works where the principle process were carried out, and was predominantly constructed from machine-cut brick laid in an English Garden Wall (three to one) up to two and half bricks wide. The west elevation and the west extent of the north elevation were built in an unusual two to one variation, complete with ventilator pattern at first floor height. Additionally, the north elevation was scarred with a roofline and purlin slots and bearing box associated with Building **12**, whilst the east elevation was similarly scarred by the remains of Building **11** (Plate 20).

4.2.28 The double-pitched louvre roof is in a poor state of repair, which is surprising considering it appeared to be a later replacement. Its four pairs of trusses were of traditional queen-post design, but the queen posts themselves were not load bearing members. Instead, the purlins were supported on the collar beams, whilst an A-frame collar brace supported the louvres above, suggesting that the roof has been replaced or modified at the very least. This is supported by the details of the 1910 inventory, which describes the building as a single-storey structure.

4.2.29 Ingress is provided by a pair of doors on the north elevation (Plate 21), whilst a further door featuring an edge-set, segmental arch has been blocked. On the east elevation, there was a large loading door at the north end, which appeared to have replaced a small blocked doorway to its immediate left. Additionally, to the south there were a pair of smaller doors, with bullnose detail and stone lintels, and these offered the only access into the toilets within the building. A wide door with a substantial stone lintel afforded access from the adjacent

Building **14**, whilst further access was also originally available from **15** and **17**, but these had subsequently been blocked with brick.

*Plate 21: North-facing elevation of Building **13**, showing ventilator-pattern brickwork. Note the pair of guide eyes built into east-facing elevation, providing access from Singe House*

4.2.30 The building appeared to have had few windows, which would account in some part for the ventilator pattern within the brickwork on the west and north elevation. Certainly, the only windows now present are the five casements on the east elevation, all of which have projecting brick sills and stone lintels.

4.2.31 The ground floor was laid to concrete, whilst a partial mezzanine, constructed from rolled steel joists and stanchions, was located at the west end of the building. As in Building **4**, this supported a series of modern iron tanks, which appeared to be associated with a series of hollow, cylindrical cast-iron columns with filleted astragal and double-flanged heads situated along the centre of the building, supporting the valley of the double-pitched roof. Steel supports had been added to provide additional strength to the cast-iron columns, which also bear the remains of a corrugated iron partition (Plate 22).

*Plate 22: Columns within Building **13***

4.2.32 Additionally, a series of blocked bearing boxes were located along the upper reaches of the south wall, but nothing remains of the drive shafts and machinery associated with them. In the east elevation, however, a pair of guide eyes survived *in-situ*, which will have provided a conduit for cloth passing into the building from the adjacent Singe House.

4.2.33 ***Building 14:*** this pair of three-storey buildings originally housing the Boiler and Pump Room (*14* and *15*), the Chemic Mixing and Starch Room (*16*), and two adjacent rooms (*12* and *13*) which were constructed from machine-cut brick with English Garden Wall Bond (four to one). Unfortunately, the upper courses and roofs were heavily fire-damaged, and the details of their construction could not be elucidated. However, it was clear from their configuration relative to the inventory plan of 1910 that they were of 20th-century origin.

4.2.34 Access to the building was provided by a wide doorway with steel lintel on the south elevation, whilst a loophole of three timber doors with chamfered stone lintels, lay further to the south. All of the windows appeared to be casements with projecting stone sills and chamfered stone lintels, and suggesting that they have replaced earlier windows crowned with segmental heads, as elsewhere. The south side of the interior could not be accessed due to the hazardous conditions caused by fire-damage, so only the area housing the Chemic Mixing and Starch Room could be surveyed during the investigation. This consisted of a narrow corridor with timber first floor above, which was accessed by a cast-iron and timber staircase towards the west end of the corridor (Plate 23). Three steam valve controls were located at the west end, whilst at the east end, there were a series of brick-blocked bearing boxes on both the north and south walls.

*Plate 23: The Chemic Mixing and Starch Room (Building **14**)*

4.2.35 ***Buildings 15, 16 and 17:*** these three buildings comprised a suite of rooms, which originally formed the Singe House (*18)*. This rectangular, single-storey building(s) was in a poor state of repair, to the extent that none of its mono-pitched roof survived. Its walls comprised machine-cut brick in English Garden Wall (three to one) and measured up to one and half bricks wide, whilst rather incongruous piers stood proud of the roof height on the front (west) extension. These probably reflect the fact that the building had been reduced in height, and the piers had been retained because they fulfilled a subsidiary function, possibly associated with the iron brackets that featured on at least two of the piers.

*Plate 24: West- and south-facing elevations of Buildings **15 - 17***

4.2.36 Access to the building(s) was provided by three doors located on the west and north elevations, but these were little more than open apertures at the time of the survey (Plate 24). A fourth door was located towards the centre of the west elevation, but the collapse or partial demolition of the wall left little trace of its existence. Two further doors were also present on the interior towards the north end of the building, but both had been blocked subsequently with brick. One of the doors provided access between the northerly and central sections of the Singe House, whilst the second led into the adjacent Bleaching Croft (Building **13**) Built into the wall above the second door was a pair of porcelain eyes, set in a wooden frame, through which the cloth had been drawn.

4.2.37 The only window to survive intact was located at the north end of the building and had a segmental edge-set arch and projecting stone sill, with a timber-framed, bottom-hung ventilator casement. At least one other window was located at the south end of the building, but this was little more than an open section of wall adjacent to the south door. In addition, a blocked hatch survived on the partition between the north and central sections of the building.

4.2.38 ***Building 19:*** this two-storey building, which originally housed the Making Up and Calender Room (*7*), had been razed by the time of the survey, and all that remained was the east elevation. However, photographic evidence from an informal survey carried out in 1999 (Plate 25) illustrates it had an asphalt and timber slat roof supported by bowed lattice trusses ('Belfast' trusses), comparable with those in Building **3**. These trusses were supported by stepped brick piers of English Garden Wall (three to one) construction, which also appeared to have been employed throughout the main build.

*Plate 25: Interior of Building **19**, taken in 1999 (reproduced courtesy of GMAU)*

*Plate 26: The collapsed roof of Building **19** in 2007, immediately prior to the survey*

4.2.39 ***Building 20:*** this two-storey structure was adjacent to the previous building and functioned as the Stiffening and Mangle House (*10*). Similarly, it had been demolished by the time of the survey, no doubt due to its poor condition. Its size, in conjunction with limited photographic evidence, suggests that is was of comparable build and character to Building **19**.

4.2.40 ***Buildings 21 and 22:*** these consisted of several two-storey rooms/buildings situated at the south end of the original bleach works complex. The inventory plan of 1910 depicts that part of the Hanging Shed (*3*), the Cylinder Drying Room (*4*), and the Starch Mixing Shed (*11*) were all housed within these present-day structures. Considering the generally poor condition of many of the buildings, the slate roof had survived reasonably well and featured queen-post trusses, with upper-king ties and flanking support struts of similar scantling.

4.2.41 The walls were again constructed from machine-cut brick laid in the ubiquitous English Garden Wall Bond (three to one), with additional piers featuring bullnose brick, supporting the queen-post trusses of the roof. A small room appeared to have been situated to the south-east. Of chief interest is the closed cast-iron kier, located at the west side of the building, which measures 2.4m (8') in diameter (Plate 27). This was not *in-situ*, and had presumably been moved from its original housing within the Bleach Croft (**13**).

Plate 27: Cast-iron kier

5. EXCAVATION

5.1 INTRODUCTION

5.1.1 A programme of intrusive archaeological investigation, although incomplete, has provided some important information on the nature, extent, and development of the site. Intrusive investigation has thus far comprised the excavation of two trial trenches in the northern part of the site, and the detailed excavation of two large areas within the southern part of the site (Fig 11).

5.2 EVALUATION TRENCHING

5.2.1 The potential for buried remains of archaeological interest to survive *in-situ* within the northern part of the study area has been investigated via the excavation of two trenches. The trenches were targeted on areas that are shown to have been undeveloped on all the available historic maps, and were thus considered to afford the best potential to retain *in-situ* any buried remains pertaining to the medieval and earlier periods. However, neither trench provided any physical evidence for activity on the site prior to the 18th century, although the solid geology was exposed in both trenches.

5.2.2 ***Trench 1:*** this trench was aligned east/west adjacent to the northern boundary of the site, and close to the southern bank of the modern course of the Micker Brook (Fig 11). It lay to the north-east of the former Beetling Room (Building **4**), and measured 5.0m long and was excavated to a maximum depth of 3.8m. No deposits or features of archaeological interest were encountered.

5.2.3 The solid geology, comprising red sandstone, was exposed at the base of the trench, although it was at a considerably lower level than the bedrock visible on the opposite side of the Micker Brook. Similar results were obtained from the boreholes associated with the site remediation work, which indicated the bedrock to lie at an average depth of 1.2m below the modern ground surface except in the northern part of the site, where it was encountered at a depth of nearly 4m. This implies that whilst the northern part of the site had not been developed for buildings, it had been subject to considerable earth-moving works. The rationale for this apparent earth-moving is, as yet, unclear; the absence of red sandstone masonry within the fabric of any surviving structures on site suggests that the bedrock had not been quarried for stone.

5.2.4 The natural geology within Trench 1 was overlain by a thick deposit of mixed modern materials, including fragments of timber and machine-pressed bricks, suggesting a 20th-century date for deposition. It seems likely that this deposit represented a dump of materials associated with the site's use as a chemical works after 1933. This was corroborated by the programme of chemical analysis carried out as part of the site remediation, which concluded this part of the site to be heavily contaminated. In consequence, detailed archaeological recording was not carried out, and the trench was backfilled immediately.

Plate 28: Looking north-east across Trench 2

Plate 29: Looking north-west across Trench 2

5.2.5 ***Trench 2:*** this small trench was placed a short distance to the south-west of Trench 1, measured 2m long was excavated to a maximum depth of 1.05m (Fig 11). No deposits or features of archaeological interest were encountered.

5.2.6 The solid geology, comprising red sandstone, was exposed at the base of the excavated trench (Plate 28). This was overlain by a deposit of pale yellow sandy gravel, which had an average depth of 0.19m, and a deposit of grey clayey-sand (Plate 29).

5.3 AREA 1 EXCAVATION

5.3.1 Area 1 comprised an area measuring 20.1 x 8.0m, and was located along the southern edge of the site, across the footprint of the former Hanging Stove room of the bleach works (Fig 11). The exposed remains were dominated by a series of structures pertaining to the bleach works (Plate 30), which were sealed beneath a modern concrete floor associated with the 20th-century use of the site as a chemical works (Building **22**; *4.2.40 above*).

Plate 30: View looking west across Area 1

5.3.2 ***Phase 1:*** the excavation of Area 1 continued to the level of the solid geology, which had been incised at the eastern end of the excavated area by a palaeo-channel. This was aligned broadly north/south, and presumably represented a tributary to the former course of the Micker Brook, although 19th-century construction work had obscured the original channel. It was filled with a deposit of gravel (***22***), from which a fragment of worked flint was recovered. A Neolithic or Mesolithic date has been ascribed to this fragment of worked flint. No physical remains that could be attributed firmly to the medieval corn mill or associated activity were identified.

5.3.3 ***Phase 2:*** no physical remains that could be identified positively as remnants of the post-medieval corn mill were identified in Area 1. However, a single fragment of a corn-drying tile was recovered from demolition layer ***21*** (Phase 4).

5.3.4 ***Phase 3:*** the majority of the structural remains exposed within Area 1 were seemingly elements of the bleach works (Fig 12), and dated to the late 19th century, although the origin of two fragmentary walls (***06*** and ***07***) exposed at the eastern end of the excavated area remains uncertain. Wall ***06*** was aligned east/west, and was exposed for a length of 6.9m. The foundations had been cut into the solid geology, and were six skins wide, although the upper surviving courses varied between two and three courses wide. It comprised a mixture of hand-made and refractory bricks, suggesting that it was of a 19th-century date. It was abutted by north/south-aligned wall ***07***, which was three-skins wide, and had been truncated by flue ***05***.

5.3.5 Two parallel, east/west-aligned walls (***03*** and ***04***) formed the northern and southern boundaries of the excavated area. The walls were set 6.75m apart, and represented the north wall of the 'Hanging Stove' and the north wall of the Cylinder Drying Room, marked on the 1910 plan of the site (Fig 6). Both walls comprised hand-made bricks, bonded with a pinkish lime-based mortar, although patches of dark grey mortar were present at the western end of wall ***04***, implying that it had been rebuilt. Only the northern elevation of wall ***04*** was visible, as the wall lay largely beneath a concrete floor (***10***) associated with the chemical works (Phase 4). Wall ***03*** was exposed fully, and was three-skins wide. Occasional protrusions of an extra skin on the north side of the wall probably represented floor supports.

5.3.6 The fragmentary remains of five flues (***05***, ***08***, ***16***, ***17*** and ***18***) were exposed in Area 1, representing several developmental stages. All of the flues were constructed of hand-made bricks, although flues ***05*** and ***16*** also incorporated a single row of refractory bricks along their apex, seemingly acting as a keystone. The flues all had slightly different dimensions; the most easterly flue (***05***) was 1.30m wide (Plate 31), flue ***08*** was 0.88m wide, and ***16*** was 0.90m. It was not possible to determine the width of flue ***18*** accurately, as it had been largely destroyed by later development, although it appeared to have been associated with ***16***, forming a double flue. Both flues had been blocked subsequently by wall ***14***; no remains of the flues survived to the east of wall ***14***. Flue ***08*** had similarly been blocked by wall ***12***, which comprised wire-cut bricks bonded with a pale yellow/grey mortar. The largest of the exposed flues (***05***) did not appear to have been blocked, although most of the vaulted roof had collapsed and the flue was in-filled with rubble.

5.3.7 It seems likely that flues ***05***, ***08***, ***16*** and ***18*** were of a broadly contemporary date, whilst flue ***17*** appeared to represent a later modification. Flue ***17*** was partially cut through flue ***16*** on its southern side, and continued westwards towards the extant chimney. This flue was 0.93m wide, and comprised refractory bricks in a square, rather than circular form.

*Plate 31: Looking north across wall **06** and flue **05**, with wall **03** to the rear*

5.3.8 A north/south-aligned wall (***13***), parallel to wall ***12***, was seemingly built at a similar time, although it did not block any of the flues; wall ***13*** abutted the southern edge of flue ***16***, and was abutted by wall ***14***, implying a sequence of slight remodelling.

5.3.9 Wall ***15*** was aligned north/south across the western end of the excavated area, and probably represented a late stage in the development of the bleach works. It formed the eastern edge of the boiler room (Building **8**; *4.2.22 above*), and was built entirely of refractory bricks. It was clearly associated with a remodelling of the flue system, as it blocked completely the latest of the flues (***17***). It seems possible that the remodelling involved the installation of an economiser in the southern part of the boiler house.

5.3.10 A stone flag measuring 0.57 x 0.54m with iron fittings, exposed to the south and west of flue ***16*** and wall ***13***, seemingly represented a column base (***20***). However, it appeared to have been disturbed during a remodelling of the site (Phase 4), and did not survive *in-situ*.

5.3.11 ***Phase 4 (c 1900 – 1930):*** the remodelling of the site during the 20th century, presumably during the conversion of the site to a chemical works, was represented by a widespread layer (***21***) of rubble and sand deposit. This was sealed beneath concrete surfaces (***10*** and ***11***); at the time of excavation, the only surviving remnants of the chemical works were the internal concrete floors (***10*** and ***11***), a modern ceramic drain with brick surround (***09***), and a brick floor support (***19***) above flue ***18***, and a wall (***15***).

5.4 AREA 2 EXCAVATION

5.4.1 Area 2 was opened across the eastern part of the site, examining the footprint of Buildings **19** and **20**, and comprising a total area of 24.2 x 23.8m (Fig 12). The uppermost surface of the area comprised a concrete floor, which represented the remodelling of the site during its 20th-century conversion for use as a chemical works. The removal of the concrete floor revealed a flagstone surface that had formed the internal working floor of the bleach works (Plate 32). This was examined carefully prior to removal for evidence of machinery that had been fixed to the floor (Fig 13).

*Plate 32: Flagstone floor exposed beneath concrete in Building **19**, looking south*

5.4.2 Once the flagstone floor had been removed from the northern part of the area, it was excavated by machine to a depth of some 3.5m below the modern ground surface. The excavated material was entirely 19th-century backfill, presumably associated with the remodelling of the Micker Brook and associated in-filling of its original course. The only structural remains within this part of the site to be revealed beneath the floor were a large brick-built cistern and two large culverts, which had all been cut into the solid geology (Fig 13). The culverts clearly represented the main outfall for water that had been used in the bleach works, and formed a conduit for its return to the Micker Brook; the intended function of the cistern is presently unclear.

5.4.3 The southern part of the excavated area, however, contained structural remains pertaining to the post-medieval corn mill, and later adaptations for the bleach works. Of particular interest were two waterwheels and associated fittings, which probably represented the final capital investment in the corn mill before it was converted to a bleach works (Plate 33). The remains of the mill were entirely of a late 18th- or 19th-century date, with no evidence for any earlier (Phase 1) structures or activity. However, it seems likely that the documented medieval corn mill will have occupied a similar position within the site.

Plate 33: General view looking east across Area 2

5.4.4 ***Phase 2:*** the surviving structural elements of the post-medieval corn mill included the head races, two waterwheel pits and associated waterwheels and iron pit wheels, and the lower walls of the main mill building.

5.4.5 Two east/west-aligned walls (***35*** and ***36***) probably represented the remains of the corn mill; the position of wall ***36*** corresponds closely with the southern wall of the mill shown on historical mapping (Fig 11), and wall ***35*** may represent the northern wall. Both walls comprised hand-made bricks bonded with a buff lime mortar, and were exposed for a maximum length of 7.8m (Fig 12). The north wall (***35***) was exposed intermittently between the later machine beds and walls (Phase 3). Almost the entire north-facing elevation of wall ***36*** was revealed to a height of 30 courses, and had clearly been cut into the solid geology. It had been built within a wide foundation trench, which extended 0.49m to the south of the wall. Walls ***35*** and ***36*** also formed the northern and southern ends respectively of two parallel waterwheel pits.

5.4.6 The west waterwheel (***27***) survives in fair condition (Plate 34). It is a high-breast wheel, 14ft (4.26m) diameter by 7ft 8in (2.33m) wide; the diameter is as stated in an inventory of machinery at the site, but confirmation awaits safe access to the waterwheel pits. It has three sets of cast-iron hubs and shrouds, but wooden arms (eight per ring). All 40 wooden buckets and the sole boards are missing. The shaft is square in section and, as the eyes of the hubs are octagonal, there are castings keyed onto the shaft to secure the wheel. The shaft also carries a cast-iron spur pit wheel, cast in two parts, of *c* 12ft (3.65m) diameter. This gear is massively constructed with a pitch of 3in (0.07m), consistent with a date of construction between 1830-60.

*Plate 34: Waterwheel **27** and driveshaft **29*** across the top

5.4.7 Waterwheel ***27*** and its associated pit wheel (***30***) are situated towards the projected position of the northern wall (***35***) of the mill, suggesting that the pit wheel drove a lineshaft along the southern wall (***36***). It is difficult to be certain of the exact position of this, as the ground level of the bleach works was just above the top of the pit wheel, whereas the ground floor of the corn mill was possibly anything up to 2m lower. Massive cross walls with enormous stone blocks were added to reinforce the floor of the bleach works.

*Plate 35: Pit wheel **30**, connected to waterwheel **27***

5.4.8 An iron shaft (***29***) across the top of the waterwheel, slightly north of centre, appears to have been geared to the pit wheel, although it is now cut short. At its outer end this shaft carried a gear or pulley, broken off at the hubs. The shaft is likely to have been associated with a heavy square stone machine bed (***51***), situated to the west of waterwheel ***27***. This comprised three limestone blocks, which were possibly the mounting for a steam engine, known to have been installed in the mid-19th century. Two of the blocks were aligned north/south, and were mortared together to make a bed measuring 3.76m by 1.40m by 0.49m. This contained three iron rods, each 25mm in diameter with a thread gauge of 2mm, set 0.60m apart. This was extended to the west by the addition of a third block, which measured 2.47m by 0.97m by 0.34m, divided by bricks. This had two machine ties 0.65m apart with the same dimensions as those the east. The entire surface measured 3.76m by 3.23m. Machine bed ***51*** was situated adjacent to the remains of a massive stanchion, whilst the foundations to the west of this may mark the site of the engine house.

5.4.9 The east waterwheel is of the same type and diameter as the west wheel, but survives in a poorer condition. It has lost all its wooden arms, so the three cast-iron shroud rings are supported solely by debris in the pit. The central hub is broken and lies in the pit. The hubs on this wheel have square eyes, matching the shaft. The pit wheel also remains at this end of the mill, being similar in size and construction to that at the west end. It possibly also drove a lineshaft along wall ***36***, although scores in the brickwork of the wheel pit wall towards the downstream side suggest another drive. A heavy bearing at bleach works floor level suggests that a later drive from this pit wheel drove bleach works machinery.

5.4.10 The opening to both culverted tail races are evident. Alterations within these culverts suggest that the present waterwheels are rather wider than their predecessors. Map evidence shows that the corn mill was extended on its downstream side. Excavation has not found this but a wall running along the line of the west tail race may be part of it. The point where the tail races join the old river course cannot be seen but this emerges from a culvert on the east side of the site and is now heavily silted. There is also a culverted watercourse emerging from beneath an extension to the adjacent mill house. This appears to have run parallel to the east wheel pit, and may have been the site of a flood sluice though it could be the tail race from the east wheel.

5.4.11 ***Phase 3:*** the inventory produced by the Bleacher's Association Ltd in 1910 itemises the two waterwheels and associated pit wheels, implying that they remained in operation. They were supplemented, however, my numerous small steam engines. Four machine beds (***31***, ***32***, ***33*** and ***34***), each aligned north/south, were located between the waterwheels, and another two (***52*** and ***53***) were exposed to the north of waterwheel ***27*** (Fig 12). Each of the machine beds comprised a single stone block.

5.4.12 Of the four machine beds situated between the waterwheels, the eastern (***31***) and western (***34***) were the largest, measuring 0.74m and 0.70m thick respectively. The central beds (***32*** and ***33***) were both 0.40m thick, and measured between 3.00 and 3.40m long and 1.24 and 1.30m wide. Each bed incorporated four vertical iron bars, which represented the remains of machine

tie rods. The threads on the tie rods that had survived had a diameter of 1 inch (2.54cm), with a thread of 2.5mm on bed ***31*** and 3mm on bed ***34***.

5.4.13 All four machine beds between the two waterwheels were placed upon supporting brick walls. Two east/west-aligned walls (***37*** and ***38***), comprising hand-made bricks bonded with a buff lime mortar, continue beneath all of the machine beds. The walls were eight skins, reflecting the substantial load bearing that they were designed to bear. Each machine bed also had its own north/south-aligned wall beneath the northern extent, which were of a similarly robust construction. These walls (***39***, ***40***, ***41*** and ***42***) abutted wall ***35*** and extended for a length of 1.87m, with the exception of wall ***42***, which abutted wall ***36*** and housed the eastern extent of the axle from the waterwheel (***27***).

5.4.14 Seated on the eastern edge of bed ***31*** was a cast-iron gearing box (***62***), which was 3ft (0.91m) long aligned north/south. This gearing box formed part of the power transmission system from the eastern pit wheel (***57***), and clearly represented a remodelling to the power train, presumably associated with machinery within the bleach works.

5.4.15 The large limestone block ***52*** was placed upon a brick built support. It measured 2.62m by 2.05m by 0.32m and was aligned north/south. Two rectangular grooves also aligned north/south at opposite sides of the stone contained the remnants of four metal machine ties. These were an average of 0.60m apart with a diameter of 1 inch (2.54cm) and had no visible thread. The location and height of this machine bed suggest that it was inserted later than the previously mentioned ones. Limestone block (***53***) measured 1.82m by 1.56m by 0.60m, but did not incorporate any machine tie rods. It was abutted by a surface (***54***) of re-used hand-made brick and limestone surface

5.4.16 Two drains were exposed at the western end of the excavated area, both extending beneath wall ***47***. One drain (***48***) was ceramic, and the second (***49***) was capped with stone.

5.4.17 Wall ***47*** was aligned north/south, and comprised machine-pressed bricks, suggesting that it had not been constructed before the late 19th century. Similarly, it continued to the north across the in-filled original course of the Micker Brook, indicating its construction to have post-dated the in-filling of the brook in *c* 1874. The position of wall ***47*** corresponds with the west wall of the stiffening and mangle house, shown on the inventory plan of 1910.

5.4.18 Other structures dating to Phase 3 included the surviving head races (***45*** and ***46***), which provided the waterwheels with a supply of water (Plate 36), and flagstone floor ***01***. The head race structures had been designed to be capped by the overlying flagstone floor, suggesting that these elements resulted from a single phase of remodelling.

*Plate 36: Head races **46** and **45**, looking south-east*

5.4.19 The square-section head race connected with the Micker Brook to the south, entering the site beneath Mill Lane, and had been cut into the solid geology. The head race splits into two channels at some point within the site, thus being able to supply the two waterwheels; head race ***45*** supplied the eastern waterwheel (***56***), and head race ***46*** was connected to the western waterwheel (***27***). Both of the head races had been divided longitudinally by a central brick partition, which incorporated a series of apertures to allow the free flow of water between the two channels. There is no technical rationale for the insertion of the longitudinal partition, as this would not have improved the flow performance of the water, and it was perhaps intended solely as extra support for the overlying flagstone floor in the 'Making Up and Calendar Room'. Each of the flagstones that functioned as a capping over the head race measured approximately 1.30m by 1.20m by 0.10m, and were slightly larger that the other flagstones that formed floor ***01***.

5.4.20 Flagstone floor ***01*** covered all of the machine beds between the waterwheels so the machines there must have been disused but the waterwheels still employed. As all of the brickwork is the same the races and floor were contemporary and previous head races may have followed a different route but may have been obscured by the later network of waterways.

5.4.21 ***Phase 4:*** the only remains of the chemical works at the time of the excavation was a concrete surface covering all of Area 2. This concrete essentially sealed all surviving elements of the site's water- and steam-power system.

6. DISCUSSION

6.1 INTRODUCTION

6.1.1 The programme of archaeological investigation has provided a chronological account of the development of the site from the late 18th century, and has produced some remarkable results to date. The development of the site, based on the results obtained from the archaeological investigation, may be divided into five broad chronological periods:

- Period 1: Activity prior to *c* 1780;
- Period 2: Later development of the corn mill (*c* 1780 – 1874);
- Period 3: Early development of the bleach works (1874 – *c* 1900);
- Period 4: Later development of the bleach works (*c* 1900 – 1930);
- Period 5: Chemical works (*c* 1935 – 1995).

6.2 PERIOD 1 (PRE-*C* 1780)

6.2.1 Whilst the excavations carried out to date have failed to provide any evidence for either Roman or medieval occupation of the site, a single fragment of worked flint, to which a Neolithic or Mesolithic date may be attributed (*c* 10,000 BP – *c* 4,000 BC), provides some evidence for prehistoric activity on the site. Evidence for prehistoric activity in the region as a whole is comparatively rare, and whilst only a single artefact has been discovered during the present investigation, this adds considerably to the corpus of prehistoric material known from the area.

6.2.2 The archaeological investigation has not encountered any physical remains that can be attributed to the Roman or medieval periods. However, the potential for Roman remains to survive on the site cannot be dismissed entirely, as part of the site awaits investigation via an evaluation trench. This is to be placed in the north-western part of the site, which is shown on all the available historic maps to have been undeveloped. The area is occupied currently by a large stockpile of demolition material.

6.2.3 It seems likely that the documented medieval corn mill will have occupied broadly the same location as that shown on historical mapping from the mid-19th century. However, it is clear that the excavated remains which can be identified with the corn mill shown on historical are no earlier than the late 18th century, implying that the medieval mill had been rebuilt entirely.

6.3 PERIOD 2 (*C* 1780 – 1874)

6.3.1 This period pertains to the later development of the corn mill. Whilst the building survey has concluded that none of the buildings represented elements of the mill, remarkable buried remains were exposed by excavation, and included the two waterwheels, their associated pit wheels and water-management systems, and the foundations of external walls.

6.3.2 The curved weir across the Micker Brook immediately to the south of the site remains to its full height, and is in excellent condition. The head race passed under the access road, and has been largely bricked up, although there is a small semi-circular trash grid and sluice gate control visible.

6.4 PERIOD 3 (1874 – *C* 1900)

6.4.1 The mill was sold to William Mosley junior in 1874, and by the following year he had established a textile bleaching works on the site. Prior to acquiring the mill, Mosley had been the manager of the Crescent Bleach Works in Salford, and it is evident that he acquired sufficient experience of the bleaching industry to understand the level of expansion required to make the works efficient and profitable.

6.4.2 The Micker Brook once followed a tight U-bend around the corn mill but, during the site's conversion to the bleach works, a new river channel was cut through solid bedrock to the west. The rational for this modification probably rests with a need to increase the area within the site available for development, reflecting the large space required for a 19th-century bleach works. However, the waterwheels seemingly remained in operation, implying that the old channel of the river was used partially as a tail race.

6.4.3 The map of Barnes Convalescent Home from 1886 (Fig 3) shows that Buildings **6**, **7** and **9** were built by this time, but it is unclear, which, if any, of the other buildings had been erected in the ten years since Mosley had begun his bleaching operation in the area. Moreover, of these three buildings, Building **9** stood at only part of its eventual dimensions and would later be extended, if not rebuilt entirely.

6.4.4 Subsequently, within 20 years of acquiring the land, a suite of buildings had been constructed to the north of the site (Ordnance Survey 1896). The uniformity of build throughout, even down to minor detailing on the door and window surrounds, suggests a single deliberate phase of expansion, rather than a piecemeal series of builds. Many of these structures, however, have been subject to considerable remodelling or rebuilding, and whilst their footprint represents the layout of the bleach works, the extent of surviving original fabric was somewhat limited at the time of the building survey.

6.4.5 Storage and pre-bleaching treatments were carried out in Buildings **4** and **15-17**, whilst the bleaching process itself was undertaken within **13** and **14**. The series of finishing processes including beetling, stiffening, and calendering were carried out in the buildings to the east and north of the complex (**4**, **9**, **19** and **20)**. Packing and transportation was handled within Buildings **11** and **1**

respectively, whilst various ancillary buildings provided support roles, such as the Pattern Office (**10**), maintenance (**5**) and the staff facilities (**6**). Additional buildings to the north east of the site, mainly consisting of storerooms and a greenhouse since demolished, were also built. As the expansion was deliberate and planned, there would appear to have been no further work required at the complex, until the turn of the 20th century. Few of the surviving internal fixtures and fittings recorded during the building survey could be attributed firmly to the bleaching process, although a single pair of porcelain eyes that had guided the cloth between the various rooms did remain *in-situ* (Plate 37). These were identified in the partition between the Singe House (Building **17**) and the Bleach Croft (Building **13**), situated above a blocked doorway (*4.2.36 above*).

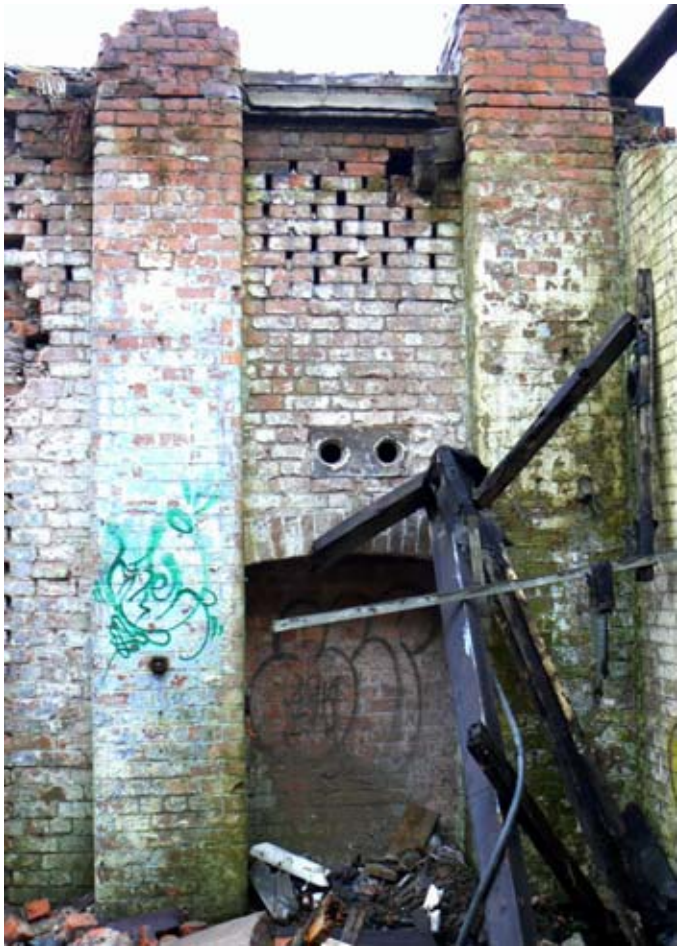


Plate 37: Porcelain eyes in the east wall of the Singe House

6.5 PERIOD 4 (*C* 1900 – *C* 1935)

6.5.1 Cartographic evidence (Ordnance Survey 1934) shows the site was expanded and remodelled during the early 20th century. The new boiler house (**8**) was built during this period, as a replacement for the original boiler and pump house to the immediate north-east. The earlier boiler room is known to have contained a Galloway boiler and two Lancashire boilers (*Appendix 2*), whilst the later building seemingly only housed two Lancashire boilers. This apparent downgrading is probably a reflection of the diminishing importance of steam power as alternative methods such as gas, and later electricity, became more prevalent.

6.5.2 Additionally, during the same years, the south wall of Building **9** was partially demolished and then rebuilt. The original Damping Shed (*6*), housed within the building, appears to have been retained during this rebuild, which would account for the retention of the dogleg at the south extent of the east elevation. Furthermore, the Singe House (**15**, **16**, and **17**) was extended to its south with a small room measuring approximately 3.5m^2, whilst the Beetling Room (**4**) was remodelled at its south-west corner, in order to accommodate the

construction of the adjacent building (**3**). In light of the building of this new structure, the door on the west elevation was inserted and the adjacent window was blocked having become superfluous to requirements.

6.6 PERIOD 5 (*C* 1935 – 1995)

6.6.1 During the mid- to late 1930s, the bleach works closed and the premises were rented to James and Albert Horsfield, who established the Standard Chemical Co. It is clear that the tanks and the mezzanines within both Beetling Room (**4**) and the Bleach Croft (**13**) were inserted following this acquisition, whilst a large door was inserted into the west elevation of the former. Additionally, the steel and corrugated iron shed (**2**) housing the maintenance bay was also built during this period. The Singe House was probably reduced from its original height during this phase, since the building was no longer being used in that capacity. It is unclear why the brick piers on the west of the building were retained, although iron brackets were observed on several of the piers, suggesting they served some function still. Certainly, there is no cartographic evidence to suggest they were supporting the trusses of a corrugated shed or comparable structure, so their presence is open to conjecture.

6.6.2 The expansion of the Standard Chemical Co during the post-war period, prompted further alterations at the site. Building **1** would appear to have undergone considerable change, particularly in the stable block, which had become superfluous to requirements. The most obvious alteration on the exterior of the building, was the insertion of the modern top-hung ventilator casements in place of the narrower original stable windows, whilst a door was added at the north end of the building. Concurrently, the stalls and feeders were evidently removed from within the building, the floors were laid with concrete, and partitions and lavatories were inserted. Similarly the laboratory and storage sections of the building at the south end were also remodelled with the insertion of several partitions, whilst the front (east) of the building appears to have been partially rebuilt. Moreover, the west elevation of Building **6** was modified during the late 20th century with the blocking of both smaller doors and the conversion of the larger loading doors into a window. Additionally, the partition on the east elevation was added, as was a first floor partition between Buildings **7** and **8**.

6.6.3 By 1991, the Standard Chemical Co had been taken over by Thor Chemicals Ltd, and the chimney was reduced in height in the following years. Within a further four years, the company had left the premises, and the abandoned buildings deteriorated rapidly.

7. WORK TO BE COMPLETED

7.1 INTRODUCTION

7.1.1 The scope and extent of archaeological fieldwork detailed in the Project Design (*Appendix 1*) has been largely completed. Several important elements of the programme, however, await completion; these elements of fieldwork are summarised below.

7.1.2 On completion of the fieldwork, all necessary reporting will be carried out. In the first instance, this will involve a final archive report, which will present in detail the analysed results obtained from the complete programme of work. Moreover, based on the results obtained to date, the significance of the findings will clearly merit the production of a paper for publication in an appropriate archaeological journal.

7.2 EVALUATION TRENCHING

7.2.1 During the course of the archaeological work carried out to date, the north-western part of the site has been used to stockpile demolished material, and has not been available for evaluation. This part of the site offers some potential to contain buried remains that pre-date the post-medieval corn mill, and requires the excavation of an evaluation trench (Fig 14). It should be noted that further detailed excavation may be required should significant buried remains be identified during the evaluation.

7.3 SURVEY OF THE WATERWHEEL PITS

7.3.1 The discovery of the two waterwheels has led to a temporary suspension of the archaeological fieldwork whilst the options for the consolidation and long-term management of the waterwheels are considered. It is anticipated that any consolidation work will facilitate safe access into the waterwheel pits, and necessitate the clearance of debris and silt. This should be carried out under close archaeological supervision and, once completed, a measured survey of the internal elevations should be compiled to complete the archaeological record.

7.4 WATCHING BRIEF

7.4.1 A targeted watching brief will be required to monitor earth-moving works associated with the development in order to complete the archaeological record. In particular, the area beneath the stockpiled material used as an access ramp in the south-eastern part of the site is likely to overlie elements of the head race associated with the corn mill and later bleach works (Fig 14); the head race undoubtedly continues beneath Mill Lane. Similarly, the precise course of the tail races awaits clarification, and any earth-moving works to the north of the waterwheel pits should be monitored.

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APPENDIX 1: PROJECT DESIGN

Oxford Archaeology North

November 2007

CHEADLE LOWER MILL,

MILL LANE,

CHEADLE

ARCHAEOLOGICAL INVESTIGATION

PROJECT DESIGN

Proposals

The following project design is offered in response to a request from Mr B Walker, of Halliday Meecham Architects Ltd, acting on behalf of JSC Homes Ltd, for a programme of archaeological investigation at Cheadle Lower Mill, Cheadle.

1. INTRODUCTION

1.1 PLANNING BACKGROUND

1.1.1 JSC Homes Ltd (hereafter 'the Client') has recently submitted a planning application for a residential development at Cheadle Lower Mill, Cheadle, Cheshire (NGR SJ 8546 8900). The site is currently occupied by a number of buildings that were built in the late 19th century as a textile-bleaching complex. The demolition of several buildings on the site will be necessary as part of the proposed scheme, although key elements of the complex will be retained. Major structural repairs will, however, be required to all of the buildings that are to be retained.

1.1.2 The site is entered on the Greater Manchester Historic Environment Record database (2515.1.0 – GM3232), and is of some archaeological significance. In order to secure archaeological interests, Stockport Metropolitan Borough Council (SMBC) placed an archaeological condition on the planning permission, which requires an appropriate programme of archaeological mitigation to be devised and carried out in advance of development. The wording of the condition states: 'no demolition / development shall take place until the applicant has secured the implementation of a programme of archaeological work in accordance with a written scheme of investigation which has been submitted and approved in writing by the Local Planning Authority. The works shall be carried out in complete accordance with the approved details unless otherwise agreed in writing by the Local Planning Authority'.

1.1.3 This document forms the required written scheme of investigation, and has been devised following close consultation with the Greater Manchester County Archaeologist, who provides archaeological advice to SMBC. It is recommended that the appropriate scope of archaeological investigation should comprise historical research, an RCHME Level II-type survey of the surviving buildings on the site, and some targeted evaluation trenching.

1.2 HISTORICAL BACKGROUND

1.2.1 The character and date of the earliest human activity in Cheadle is unknown, although a cluster of Roman artefacts has been discovered in the area. In particular, two Roman coins were found a short distance to the north of the application site on the western bank of the Micker Brook in 1972, and another two coins were discovered in the immediate vicinity in 1981. These findspots lie close to a shallow point on the Micker Brook, raising the possibility that this had been an ancient ford, or crossing point. However, firm evidence for the nature of Roman activity in the area is lacking, and represents an archaeological research objective of high local importance.

1.2.2 The application site was occupied by a corn mill throughout the medieval period. The earliest reference to a mill in Cheadle is provided by a charter dated *c* 1185-1200, which refers to land held by Durandus 'neare the mill', thought to have been Cheadle Lower Mill. In addition, a large fragment of a

stone cross, dated to between the late 10th and 11th centuries, was discovered during the construction of Barnes' Hospital in the 1870s. This find suggests that Cheadle may have been the centre of an extensive parish, which had a church in the medieval period.

1.2.3 In 1326, the manor was divided, and Cheadle Lower Mill became the manorial mill of Cheadle Bulkeley. Evidence for medieval activity on the site was provided by a bronze ring of probable 14th-century date, discovered within the application site in 1980. Little else is known about the mill until the 18th century; a record dated 1753 indicates that the mill changed ownership at that date, and it was sold again some three years later to a John Renshaw, who also purchased other manorial lands and Cheadle Hall. In the 1780s, the mill is recorded to have had five pairs of grinding stones (Hayes 2004, 13), suggesting that it was a relatively large mill. During the early 1800s, the mill was leased and then purchased by the Jowett family, who is listed is census returns and trade directories as corn millers until the 1870s. By that date, a 20 horse-power steam engine had been installed to supplement the existing waterwheel (Hayes 2004, 13), although little is known about the type of engine used, or its exact position within the mill. The layout of the site is captured cartographically on two maps from the mid-19th century: a Poor Union survey of 1840, and a tithe map of 1844. These both show the site to have been relatively large for a corn mill, comprising several buildings situated on the southern bank of a meander of the Micker Brook. The horseshoe-shaped weir across the brook is also marked, although details of the water-management system are not shown. The scale of the maps, moreover, is too small to furnish any detail of individual buildings, and the position of the waterwheel and steam-power plant is unclear.

1.2.4 In 1874, the mill was sold to William Mosley, who established a textile bleaching works on the site in 1875 (Sykes 1925, 35). In order to extend the premises for his bleach works, he diverted the course of the Micker Brook and built over the original watercourse. This arrangement is shown clearly on a map published in 1886, which depicts a large and irregular building complex, a large part of which broadly corresponds to the configuration of the corn mill, suggesting that this was incorporated into the bleach works. It is possible that the bleach works adapted its predecessor's means of producing power, and that the machinery was driven initially by a combination of water and steam power. However, this may have been a short-lived arrangement, as Ordnance Survey mapping of 1896 shows the works to have been expanded considerably, with the addition of a suite of buildings erected to the north. According to Hayes (2004, 13), the council for Cheadle put pressure on local factory owners to reduce any reliance of water power, and offered to build the required chimney if the owner installed a larger steam plant.

1.2.5 The site closed as a bleach works in the late 1930s, and was used for a short period thereafter by the Croft Laundry Co Ltd. It was purchased subsequently the Standard Chemical Co, which was founded by James and Albert Horsfield for manufacturing and supplying detergents to the textile industry. In 1991, the firm was taken over by Thor Chemicals Ltd, thereby inheriting Cheadle Lower Mill. The following year, the chimney was reduced in height. The

factory closed in 1995, and the buildings, although extant, have since deteriorated.

1.3 OXFORD ARCHAEOLOGY NORTH

1.3.1 OA North is the foremost archaeological contractor within the North West of England, and has the professional expertise and resource to undertake the project detailed below to a high level of quality and efficiency. OA North and all its members of staff operate subject to the Institute of Field Archaeologist's (IFA) Code of Conduct, and Oxford Archaeology is one of their registered organisations (no 17).

1.3.2 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, the Carlton Alum Works in North Yorkshire, the Pilkington's Sheet Glass Works in St Helens, Telford's Holyhead Road in North Wales, and the Percival, Vickers Flint Glass Works in Manchester. A large proportion of the industrial archaeology projects carried out by OA North, however, have been focused on textile manufacturing sites. Most recently, 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. This monograph also presented the results obtained from the excavation of numerous other former textile mills in Ancoats. These included Salvin's Factory, a water-powered mill that was established during the 1780s, and New Islington Mill, which employed a steam-powered water-returning engine to drive its waterwheel.

1.3.3 OA North has also gained considerable experience of textile-finishing sites through projects carried out at Radcliffe and Adelphi Street in Salford, which involved detailed studies of bleach and dye works, and a sizing works on Piercy Street in Ancoats. OA North also gained extensive experience of a textile-printing works from its survey and excavation of the 19th-century Calprina Works in Stalybridge.

1.3.4 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, Burley Mill in Leeds, the early 20th-century Gem Mill in Chadderton, and OA North is currently undertaking a building survey of Stubbs' textile-machinery works in Ancoats.

2. AIMS AND OBJECTIVES

2.1 The principle aim of the archaeological investigation is to provide a mitigation record of the site in advance of, and during development. This record will aim to provide an understanding of the historical development of the site, and to identify significant architectural elements within the surviving building complex.

2.2 The main archaeological interests relate to the following:

- standing remains of a 19th-century bleach works
- potential below-ground remains of Roman activity on the site
- potential below-ground remains of a medieval water-powered corn mill, and its 19th-century steam-powered element
- potential below-ground remains of the bleach works.

2.3 The project aims may be achieved via the following stages:

- ***Desk-based research:*** provide an overview of the ownership, function and development of the mill complex via a rapid programme of historical research and map regression analysis. The results obtained from this research would be used to inform the subsequent archaeological investigation. The desk-based research will be coupled with a site inspection, which will relate the past landscape and surroundings to that of the present. In particular, the rock-cut channel of the Micker Brook will be subject to a visual examination for evidence of any features relating to the mill's water-management system;
- ***Building survey:*** demonstrate the building's plan, form, fabric, function, age and developmental sequence by compiling measured floor plans of the buildings, which will form the basis for annotation and phasing, coupled with a detailed written description. The principal objective of the survey will be to provide an assessment of the relative significance of the various buildings, and their component rooms, and account for their past and present use. Particular attention will be paid to identifying evidence for power and processing in the form of surviving fixtures, fittings and blocked power conduits. Further objectives will be to compile a comprehensive and detailed photographic survey of the standing buildings, identify key architectural features, and produce an account of all appurtenances associated with the buildings.
- ***Evaluation trenching:*** establish the presence or absence of any buried archaeological remains on the site and, if present, provide evidence for their character, depth, extent, and date. Should significant remains be identified which will be adversely affected by development ground works then a further more detailed phase of archaeological excavation will be required.

- ***Watching brief:*** enhance the archaeological record of the mill complex by recording buried structures exposed during the removal of modern surfacing during the development programme.
- ***Report and archive:*** produce a sufficiently illustrated report to a professional standard that satisfies the Client's archaeological obligations.

3 METHODOLOGY

3.1 ***Desk-based research:*** this would form the initial stage of the archaeological survey, and will comprise a rapid assessment of the existing documentary resource. It will include an appraisal of the data in the Greater Manchester Record Office, the Greater Manchester Sites and Monuments Record, Stockport Local Studies Library, Stockport Museum, the archives of the Bleachers' Association held at Styal Mill, and appropriate sections of county histories, early maps (printed and manuscript), and such primary documentation as may be reasonably available. Local interest groups will also be contacted.

3.2 Particular attention will be paid to cartographic sources, as these often provide important evidence of archaeological activity and transformation of the historic landscape, and a programme of map regression analysis will be undertaken. An examination of the relevant trade directories will also be undertaken, and available published and unpublished documentary sources will be examined and assessed.

3.3 ***Building survey:*** measured survey drawings of the floor plans of the existing buildings will be compiled at an appropriate scale. These drawings will form the basis for phasing and annotation. Supplementary survey detail will be undertaken by use of a Leica reflectorless total station. This is an economic, and precise tool for the recording of plans, cross-sections and elevations. A reflectorless EDM generates a laser beam and is able to extract a distance measurement by reflection from wall surfaces. The distance measurement is accurate to +-6mm and has a working range of up to 50m. The recording methodology involves tracing the laser beam around individual architectural features, and thereby generates large amounts of 3D data, which is stored within a data-logger. Using this technique it is possible for one surveyor to generate up to 2000 survey points a day, and is considerably faster than a conventional total station which requires two surveyors and has a typical maximum of *c* 600 points per day (in a building context). The technique is particularly invaluable for the recording of detail from inaccessible locations or in areas where the safety of staff may be compromised by working, for instance, on an unstable wall face.

3.4 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.

3.5 ***Written description:*** a visual inspection of the buildings will be undertaken utilising the OA North buildings *pro-forma* sheets. An outline description will be maintained to RCHME Level II-type survey. This level of recording comprises a descriptive record (RCHME 1996, 4), and will provide a systematic account of the buildings' origins, development and use. The written description will comprise:

- an analysis of the buildings' plan, form, fabric, function, age and development sequence and of the evidence supporting this analysis (illustrate with historic map sequence, reduced plans, elevations and photographs);
- an account of the buildings' past and present use and of the uses of their parts, with the evidence for these interpretations;
- an account of the fixtures, fittings, plant or machinery associated with the buildings, and their purpose;
- any evidence for the former existence of demolished structures or plant associated with the buildings;
- identification of key architectural features, including fixtures and fittings;
- a discussion of the relative significance of rooms/buildings within the mill complex and an indication of the processes involved;
- identify any inaccessible areas (due to modern render or health and safety problems) where there is a requirement to undertake a second phase survey once those areas are made secure or opened out.

3.6 ***Photographic archive:*** a photographic archive will be produced utilising a 35mm camera to produce both black and white contact prints and colour slides, and a plan showing the view point directions will be produced. Photographs will also be taken in digital format. The photographs will show:

- the buildings' external appearance;
- the overall appearance of principal rooms and circulation areas;
- any external or internal detail, structural or decorative, which is relevant to the buildings' design, development and use and which does not show adequately on general photographs;
- detailed views of internal features of especial architectural interest, fixtures and fittings, evidence of power systems, blockings or jointing relevant to phasing the building which might be vulnerable to refurbishment and demolition.

3.7 OA North will inform GMAU and the Client as soon as the building survey has been completed so that the demolition programme can proceed.

3.8 ***Evaluation trenching:*** a series of trenches will be excavated by machine using a toothless ditching bucket, followed by hand cleaning and recording. The exact number of trenches to be excavated, and their precise location, will be determined after the desk-based research has been completed, and following consultation with the County Archaeologist. However, it is anticipated that the trenches will be targeted on the early core of the mill complex, which lies beneath the extant buildings immediately to the south of the original course of the brook, and on undeveloped land in the northern part of the site as this area offers the best potential for the survival of pre-industrial remains.

3.9 All information identified in the course of the site works will be recorded stratigraphically, using a system adapted from that used by the Centre for Archaeology Service of English Heritage, with sufficient pictorial record (plans, sections and both black and white and colour photographs) to identify and illustrate individual features. Primary records will be available for inspection at all times. All contexts will be recorded using *pro-forma* sheets, which will comprise a written detailed description and interpretation of each structure and deposit encountered, and details will be incorporated into a Harris matrix. Similar object record and photographic record *pro-formas* will be used. All written recording of survey data, contexts, photographs, artefacts and ecofacts will be cross-referenced from *pro-forma* record sheets using sequential numbering.

3.10 A full and detailed photographic record of individual contexts will be maintained and similarly general views from standard view points of the overall site at all stages of the evaluation will be generated. Photography will be undertaken using 35mm cameras on archivable black and white print film as well as colour transparency, and all frames will include a visible, graduated metric scale. Extensive use of digital photography will also be undertaken throughout the course of the fieldwork for interpretative and presentation purposes.

3.11 Finds' recovery and sampling programmes will be in accordance with best practice (following current Institute of Field Archaeologists guidelines) and subject to expert advice in order to minimise deterioration. OA has close contact with English Heritage Science Advisors and, in addition, employs in-house artefact and palaeoecology specialists, with considerable expertise in the investigation, excavation, and finds' management of sites of all periods and types, who are readily available for consultation. Storage of finds during fieldwork and any site archive preparation will follow professional guidelines (UKIC 1990). Emergency access to conservation facilities is maintained by OA North with the Department of Archaeology, the University of Durham. Any gold and silver artefacts recovered during the evaluation will be removed to a safe place and reported to the local Coroner according to the procedures relating to the Treasure Act, 1996.

3.12 Human remains are not expected to be present, but if they are found they will, if possible, be left *in-situ,* covered and protected. If removal is necessary, then the relevant Department of Cultural Affairs permission will be sought, and the

removal of such remains will be carried out with due care and sensitivity, as required by current legislation.

3.13 ***Watching brief:*** a programme of field observation during excavations associated with proposed development will accurately record the location, extent, and character of any surviving archaeological structures, features and/or deposits exposed. This work will comprise observation during ground works, the systematic examination of any subsoil horizons exposed during the course of the groundworks, and the accurate recording of all archaeological structures and features, and any artefacts, identified during observation.

3.14 Archaeological structures, features and/or deposits exposed during the removal of modern surfacing, together with the immediate vicinity of any such features, will be cleaned by hand, using either hoes, shovel scraping, and/or trowels depending on the ground conditions, and where appropriate sections will be studied and drawn.

3.15 During this phase of work, recording will comprise a full description and preliminary classification of features or materials revealed, and their accurate location (either on plan and/or section, and as grid co-ordinates where appropriate). Features will be planned accurately at appropriate scales and annotated on to a large-scale plan. A photographic record will be undertaken simultaneously.

3.16 A plan will be produced of the areas of groundworks showing the location and extent of the ground disturbance and one or more dimensioned sections will be produced.

3.17 It is assumed that OA North will have the authority to stop the works for a sufficient time period to enable the recording of important deposits. It may also be necessary to call in additional archaeological support if a find of particular importance is identified or a high density of archaeology is discovered. In normal circumstances, field recording will also include a continual process of analysis, evaluation, and interpretation of the data, in order to establish the necessity for any further more detailed recording that may prove essential.

3.18 ***Contingency plan:*** in the event of significant archaeological features being encountered during the watching brief, discussions will take place with the Client, in consultation with GMAU, as to the extent of further works to be carried out. All further works would be subject to a variation to this project design.

3.19 ***Report:*** copies of a written synthetic report will be submitted to the Client, GMAU, and relevant amenity bodies. The final report will include a copy of this project design, and indications of any agreed departure from that design. It will include an historical and archaeological background to the mill complex, an outline methodology of the investigation, and present, summarise, assess, and interpret the results of the programme of archaeological works detailed above. It will provide an account of the buildings' past and present use, with supporting archaeological and historical

evidence, provide an assessment of the relative significance of the various rooms and appurtenances within the complex, and place the mill in its local and regional context. The identification of any inaccessible areas (due to modern render, health and safety, or access problems) where there is a requirement to undertake a second phase survey once those areas become accessible will be identified. The report will also include a complete bibliography of sources from which data has been derived.

3.20 ***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. 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. This archive will be provided in the English Heritage Centre for Archaeology format and will be deposited with Stockport Museum. A further copy of the archive can be made available for deposition in the National Archaeological Record. In addition, a summary of the project will be forwarded for inclusion in the Online Access to Index of Archaeological Investigations (OASIS).

3.21 A summary of the results obtained from the archaeological investigation will be published in relevant period journals. It should be noted that if the results are significant then a more detailed publication article will be required.

3.22 ***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.

3.23 ***Other Matters:*** monitoring of the project will be undertaken by the Greater Manchester County Archaeologist, or his representative, who will be afforded access to the site at all times.

3.24 OA North will ensure that any significant results are brought to the attention of the Client and GMAU as soon as is practically possible.

3.25 Full regard will, of course, be given to all constraints during the survey, as well as to all Health and Safety considerations. The OA North Health and Safety Statement conforms to all the provisions of the SCAUM (Standing Conference of Unit Managers) Health and Safety manual. Risk assessments are undertaken as a matter of course for all projects. The Unit Safety Policy Statement will be provided to the Client, if required.

3.26 The insurance in respect of claims for personal injury to or the death of any person under a contract of service with OA North and arising out of an in the course of such person's employment shall comply with the employers' liability (Compulsory Insurance) Act 1969 and any statutory orders made

there under. For all other claims to cover the liability of OA North, in respect of personal injury or damage to property by negligence of OA North or any of its employees, there applies the insurance cover of £5m for any one occurrence or series of occurrences arising out of one event.

4. WORK TIMETABLE AND RESOURCES

4.1 TIMETABLE

4.1.1 OA North could commence the archaeological programme of works within one week of receipt of written notification from the Client. The phases of work would comprise:

i ***Project set-up, desk-based research and analysis – 5 days***

Historical research will form the first stage of the project, as the results will inform the subsequent stages of fieldwork.

ii ***Building survey – 10 days***

It is likely that the building survey will be completed in two stages. The initial stage will generate a ground floor plan of each building within the mill complex, and written and photographic records will be compiled. A second stage of survey will be carried out when individual buildings have been cleared of rubbish and collapsed material, or during demolition.

iii ***Evaluation trenching***

A detailed programme for the archaeological evaluation will be determined upon completion of the desk-based research. Close liaison with the demolition contractors and the Client will be necessary to identify the best time to undertake the evaluation trenching within the remediation and demolition programmes.

iv ***Watching brief***

The extent of the watching brief required during the removal of modern surfaces will similarly be determined upon completion of the desk-based research and building survey, when areas of high archaeological potential have been identified.

v ***Production of Report and Archive Preparation***

The draft report will be submitted to GMAU within four weeks from the completion of the fieldwork.

4.2 RESOURCES

4.2.1 The project team will be led by a Senior Project Manager (SPM), **Ian Miller BA FSA**, who is based in Lancaster. Ian will provide strategic project management, financial and resource management, and will co-ordinate the provision of specialist input. Ian will manage the project from design and delivery of the fieldwork component, through analysis to archive deposition. It is likely that Ian would also carry out the desk-based research.

4.2.2 It is proposed that the survey be undertaken by **Chris Wild BSc** (OA North Project Officer). Chris is a very experienced building surveyor who has undertaken most of the OA North building surveys over the last five years. with extensive experience of Total Station survey, Reflectorless Total Station survey using the TheoLT AutoCAD interface, and GPS survey, and the manipulation of this data to produce report quality drawings via three-dimensional CAD packages. Chris will be assisted by one technician, who will have several years professional expertise in archaeological building survey.

4.2.3 The evaluation is likely to be undertaken by **Sean McPhillips BA** (OA North Project Supervisor). Sean is an highly experienced field archaeologist, who has a particular interest in Industrial Archaeology, and especially that of Greater Manchester. Sean recently directed the archaeological investigation of a 19th-century dye works on Adelphi Street in Salford, and also carried out an evaluation of a bleach works in Radcliffe. He also played a key role in the excavations at the Calprina textile-finishing works in Stalybridge. Sean will be assisted by at least two technicians.

4.2.4 Assessment of any finds from the archaeological work will be undertaken by OA North's in-house finds specialist **Christine Howard-Davis BA** (OA North Finds Manager). Christine has extensive knowledge of all finds of all periods from archaeological sites in northern England, and is a recognised expert in the study of post-medieval artefacts.

APPENDIX 2: DETAILS FROM 1910 INVENTORY

Room No On Plan	**Summary Description**	**Summary of Contents**
1	Brick-built, two-storey building: mechanics shop on ground floor, with joinery shop above. Building measures 43'4" x 23'.	Slide screw cutting lathe, built by Butterworth (Manchester). Bowl turning lathe, built by Oldham & Richards (Manchester). Oblique steam engine, 5" cylinder and 9" stroke, on stone bed. Built by Butterworth (Manchester). Brick smiths hearth.
2	Single-storey brick dining room. Building measures 22'6" x 19'	
3	Brick-built single-storey structure, containing the hanging stove and plaiting down and batch room at the eastern end. The hanging stove room measures 117' x 16', with a brick floor.	
4	Single-storey cylinder drying room, measuring 45'8" x 8'6". Contains flagged and planked floor.	CHECK Vertical steam engine, 8" cylinder and 16" stroke, on ashlar bed. Wrought iron multi-tubular heater for Progressive Stove, measuring 15' by 3'6" diameter. Equipped with steam trap and piping to boiler feed tank. Horizontal drying machine, over the multi-tubular heater. Oblique steam engine, 5" cylinder, powering drying machine. 11 single gas pendants and piping.
4A	Tubular heater and fan shed, measuring 31'6" x 8'6". Contains brick and flagged floor, with a lean-to roof.	Wrought iron multi-tubular heater. Gunther blow fan. Vertical steam engine, 9" cylinder and 14" stroke, on ashlar bed. Built by J Chadwick (Manchester).
5 6	Brick-built stentering, stretching and batch room, measuring 53' x 31'6". Contains a flagged floor under cased with wooden boards, and an redundant, octagonal brick chimney on a square base. Brick-built damping shed, measuring 22' x 13'. Contains a flagged floor and a glazed, lean-to roof.	Damping machine. Double diagonal steam engine, 6" cylinders and 8" stoke, to power damping machine. Bolted to ashlar bed. Belt cloth stretching machine. Double diagonal steam engine, 4" cylinders and 6" stoke, to power belt cloth stretching machine. Bolted to ashlar bed. Self clip stenter stretching machine, built by Bentley & Jackson, 1897. Four single and two double gas pendants and piping.

7	Brick-built, single-storey making-up and calendar room, measuring 114' x 45'6". Contains a flagged floor and five glazed side windows.	Two ashlar pits for wet whites, each measuring 10' x 6', and 7' deep. One pair of washing or blueing squeezers, with two sycamore bowls.
10	Brick-built, single storey stiffening and mangle house, measuring 85'6" x 44', with brick-built shed for wet cloth pits at northern end, measuring 26'4" x 10' 6". Contains a flagged floor.	Double diagonal steam engine, 9" cylinders and 12" stoke, to power washing or blueing squeezers. Bolted to ashlar bed. Damping machine, built by Jackson & Bro, 1903. Double diagonal steam engine, 6" cylinders and 9" stoke, to power damping machine. Concrete bed. Built by J Strang Ltd (Ramsbottom), 1902. Back filling machine, built by Jackson & Bro, 1889. Double diagonal steam engine, 6" cylinders and 9" stoke, to power back filling machine. Ashlar bed. Friction stiffening machine. Double diagonal steam engine, 9" cylinders and 12" stoke, to friction stiffening machine. Ashlar bed. Three-bowl water mangle, built by Bentley & Jackson. Two brass expanding breadtheners, built by Entwisle & Gass Ltd. Double diagonal steam engine, 8" cylinders and 10" stoke, built by J Chadwick & Son. Friction stiffening mangle. Double diagonal steam engine, 9" cylinders and 12" stoke, to power friction stiffening mangle. Six-bowl first time mangle. Double diagonal steam engine, 12" cylinders and 14" stoke, to power first time mangle. Ashlar bed. Built by Ommaney & Tatham. Six-bowl second time mangle. Double diagonal steam engine, 12" cylinders and 14" stoke, to power second time mangle. Set on cast iron bridge bearers over waterwheel. Built by Ommaney & Tatham. Six-bowl calender. Double diagonal steam engine, 12" cylinders and 14" stoke, to power six-bowl calender. Set on two cast iron beams. Built by J Strang Ltd (Ramsbottom), 1902. Ten-bowl calender, built by Jackson, Mitchell & Co, 1872. Double diagonal steam engine, 12" cylinders and 14" stoke, to power ten-bowl calender. Set on two iron cross beams. Built by Ommaney & Tatham.

		Two waterwheels, 14' diameter, with 8' breast wooden buckets. Centre shaft extends to counter shafts for calenders. Spur driving wheel, 14' diameter. Four plaiting machines, built by Hacking & Co. Oblique steam engine, 5½" cylinder and 10" stroke, set on ashlar block. Cloth doubling arrangement with jacketed wooden drum and roller, built by JH Riley & Co. Cloth stamping machine, built by Bentley & Jackson, 1901. Hydraulic packing press. Six-throw press pumps. Double diagonal steam engine, 5" cylinders and 6" stoke, to power press pumps. Ashlar bed. Friction-driven jib crane.
8	Pattern office and paper store, measuring 45'6" x 11'. Contains a boarded floor and a lean-to roof.	
9	Loading shed, measuring 26'4" x 32'4".	
11 12 13	Starch mixing shed, measuring 25'6" x 13'. Contains a flagged floor and a lean-to slated and glazed roof. Single-storey starch store, measuring 22' x 9'. Contains a flagged and brick floor. Single-storey building, measuring 22' x 12', for stone water cistern. Contains a flagged floor.	Six wooden starch boiling tubs, each measuring *c* 36" diameter and 36" deep. Clay boiling tub, 42" diameter and 36" deep. Galvanized iron water cistern, measuring 30" x 24". Stone water cistern, measuring 10' x 6' and 4'6" deep on brick walls. Seven single gas pendants and piping.
14/15	Brick-built, single storey boiler and pump room. Contains paved floor to cartway, and flagged floor to firing place.	Two Lancashire steam boilers, each measuring 30' long and 7' diameter, built by Jackson & Bro, 1874. Galloway steam boiler, measuring 30' long and 7' diameter. Built by Galloways Ltd, 1899. Cameron double-acting vertical steam pump, for boiler feeding and fire purposes. Seven single gas pendants and piping.
16	Single-storey chemic mixing and starch places, measuring 58'9" x 22'3". Contains a flagged floor and three sliding wooden doors.	Ashlar chemic cistern, measuring 8'6" x 3'9", and 5' deep, with plank cover. Centrifugal pump on concrete bed. Horizontal steam engine, 9" cylinders and 12" stoke. Iron bed bolted to concrete foundation. Two single gas pendants and piping.
17	Single-storey bleach croft, measuring 78'6" x 60'. Contains flagged and planked floor, three sliding doors, and three fireproof doors to singe house.	Mild steel high pressure kier, 8' diameter. Seven cast iron open kiers, 8'6" diameter, on brick foundations.

		Double diagonal steam engine, 6" cylinders and 10" stoke, built by JC Kay & Co (Bury). One 80 gallon lime tub. One two-bowl pit liming and washing machine. Double diagonal steam engine, 9" cylinders and 12" stoke, to power pit liming and washing machine. One two-bowl washing machine. Double diagonal steam engine, 9" cylinders and 12" stoke, to power washing machine. One two-bowl liming machine. Two stone double chemicing cisterns, each measuring 10' x 6', and 6'6" deep with cobbled base overlying 8"-thick ashlar. Two cast iron chemic spraying troughs, each 15' x 13" and 12" deep. Two gutta percha bucket chemic pumps. Two ashlar chemic wells below floor, each *c* 6' x 6', and 3' deep. Two pot guide eyes in wood frame. 18 single and two double gas pendants.
18	Single-storey singe house, measuring 60' x 13'9". Contains flagged floor, one iron and one wooden door, and an octagonal brick chimney for singe furnace.	Single plate singeing machine, with 54"-wide copper plate, and brick furace. Oblique steam engine, 5" cylinder and 8" stoke. Ashlar foundations. Wood cloth roller and rails. Two brass cloth eyes in wood wall frame. Two single gas pendants and piping. 40 gallon water tub.
19	Grey unloading shed, measuring 44'4" x 14'. Contains two flights of 16 steps to grey cloth store.	Three single gas pendants and piping.
20	Single-storey grey stitching room. Contains brick partitions, flagged floor, and four wooden doors.	Two Singer's twin-needle sewing machines. One Rayer & Lincoln rotary sewing machine. Wrought iron cross shafts with three strap pulleys, two pedestals and two wall boxes. Cast iron steam warming pipes. Three single gas pendants and piping.
21	Beetle engine house.	Vertical steam engine, 12" cylinder and 20" stoke, built by J Chadwick & Son (Manchester). Ashlar foundations. Single gas pendant and piping.
22	Passage	
23	Brick-built, two-storey building: beetling room, with flagged floor, on ground floor, with faller and grey cloth store over. Building measures 61'6" x 33'6".	Double beam faller beetle, 10'9" wide between flanges of beams. Double beam faller beetle, 13'6" wide between flanges of beams. Two double beam faller beetles, 14'1" wide

		between flanges of beams. Range of 4½" mild steel shafting.
24	Single-storey offices, entrance passage, lavatory, and laboratory.	
25	Single-storey general store room, measuring 31' x 22'. Contains flagged floor and sliding wooden door.	
26	Brick-built stable with loft.	
27/28/29	Brick-built store sheds, measuring 45' x 14'6". Contain paved floors.	Four tubs. Three drying trays.
30/31	Four brick-built closets, with cesspool, and rag drying shed. Also includes two disused pig cotes.	
32	Brick-built greenhouse, measuring 18'9" x 9'6".	
CHY	Brick-built circular chimney.	40 yards high and measuring 7' diameter at base, reducing to 4'9" at top. Incorporates a metal cap and lightning conductor.

APPENDIX 3: CONTEXT LIST

Context	Area	Phase	Description
01	2	3	Flag stone floor
02	2	2/3	North-east/southwest-aligned wall
03	1	3	East/west-aligned wall to north of Rooms **1** and **2**
04	1	3	East/west-aligned wall to south in Rooms **1**, **2** and **3**
05	1	3	East/west-aligned flue in Room **1**
06	1	3	East/west-aligned wall in Room **1**
07	1	3	North/south-aligned return of wall ***06***
08	1	3	South-east/north-west-aligned flue in Room **1**
09	1	4	North/south-aligned drain in Room **1**
10	1	4	Concrete surface to south of Rooms **1**, **2** and **3**
11	1	4	Concrete square inserted into wall ***03***
12	1	3	North/south-aligned wall dividing Rooms **1** and **2**
13	1	3	North/south-aligned wall dividing Rooms **2** & **3**
14	1	3	Brick blocking of flues ***16*** and ***18***
15	1	3	North/south-aligned wall to west of Room **3**
16	1	3	South-east/north-west-aligned vaulted flue in Room **3**
17	1	3	Square flue in Room **3**
18	1	3	Possible flue in Room **3**
19	1	4	Modern brick feature
20	1	3/4	Column base
21	1	3/4	Cleaning layer for Room **3**
22	1	-	River gravel above bedrock in Room **1**
23	2	2	North wall of west waterwheel pit
24	2	2	South wall of west waterwheel pit
25	2	2	East wall of west waterwheel pit

26	2	2	West wall of west waterwheel pit
27	2	2	West waterwheel
28	2	2	Stone lintels above west waterwheel pit
29	2	2	Axle and gearing above and to west of waterwheel ***27***
30	2	2	West pit wheel
31	2	3	Eastern machine bed between waterwheels
32	2	3	Central eastern machine bed between waterwheels
33	2	3	Central western machine bed between waterwheels
34	2	3	Western machine bed between waterwheels
35	2	2	East/west-aligned wall to north of waterwheels
36	2	2	East/west-aligned wall to south of waterwheels
37	2	3	East/west-aligned supporting wall beneath north of machine beds
38	2	3	East/west-aligned supporting wall beneath south of machine beds
39	2	3	North/south-aligned supporting wall for ***31***
40	2	3	North/south-aligned supporting wall for ***32***
41	2	3	North/south-aligned supporting wall for ***33***
42	2	3	North/south-aligned supporting wall for ***34***
43	2	2/3	Brick surface to south of ***31***
44	2	2/3	Brick surface to south of ***32***
45	2	3	Head race for east waterwheel
46	2	3	Head race for waterwheel ***27***
47	2	3	North/south and east/west-aligned return of wall
48	2	2/3	Drain cut
49	2	2/3	Stone capped drain
50	2	2/3	Culvert
51	2	2/3	Machine bed to the west of west waterwheel ***27***
52	2	3	Machine bed to the northwest of west waterwheel ***27***
53	2	3	Machine bed to the north of west water wheel ***27***
54	2	3	Brick surface to north of west water wheel stone lintels ***28***

55	2	4	North/south-aligned brick wall
56	2	2	East waterwheel
57	2	2	East pit wheel
58	2	2	North wall of waterwheel pit ***56***
59	2	2	East wall of waterwheel pit ***56***
60	2	2	South wall of waterwheel pit ***56***
61	2	2	West wall of waterwheel pit ***56***
62	2	3	Gearing box to west of waterwheel pit ***56***
63	2	2	Stone lintels above waterwheel pit ***56***
64	-	3	Chemicing tanks

ILLUSTRATIONS

FIGURES

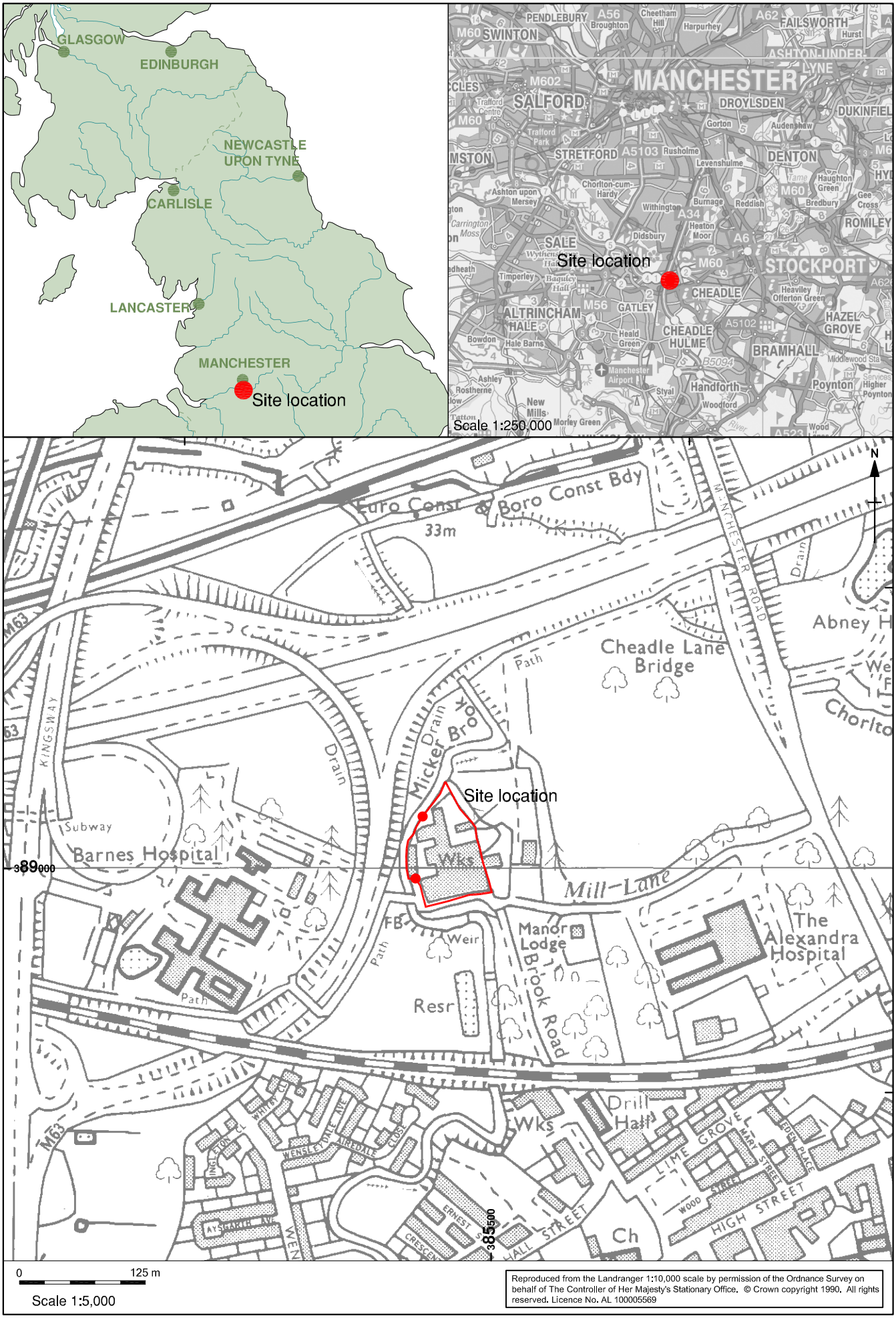


Figure 1: Site location

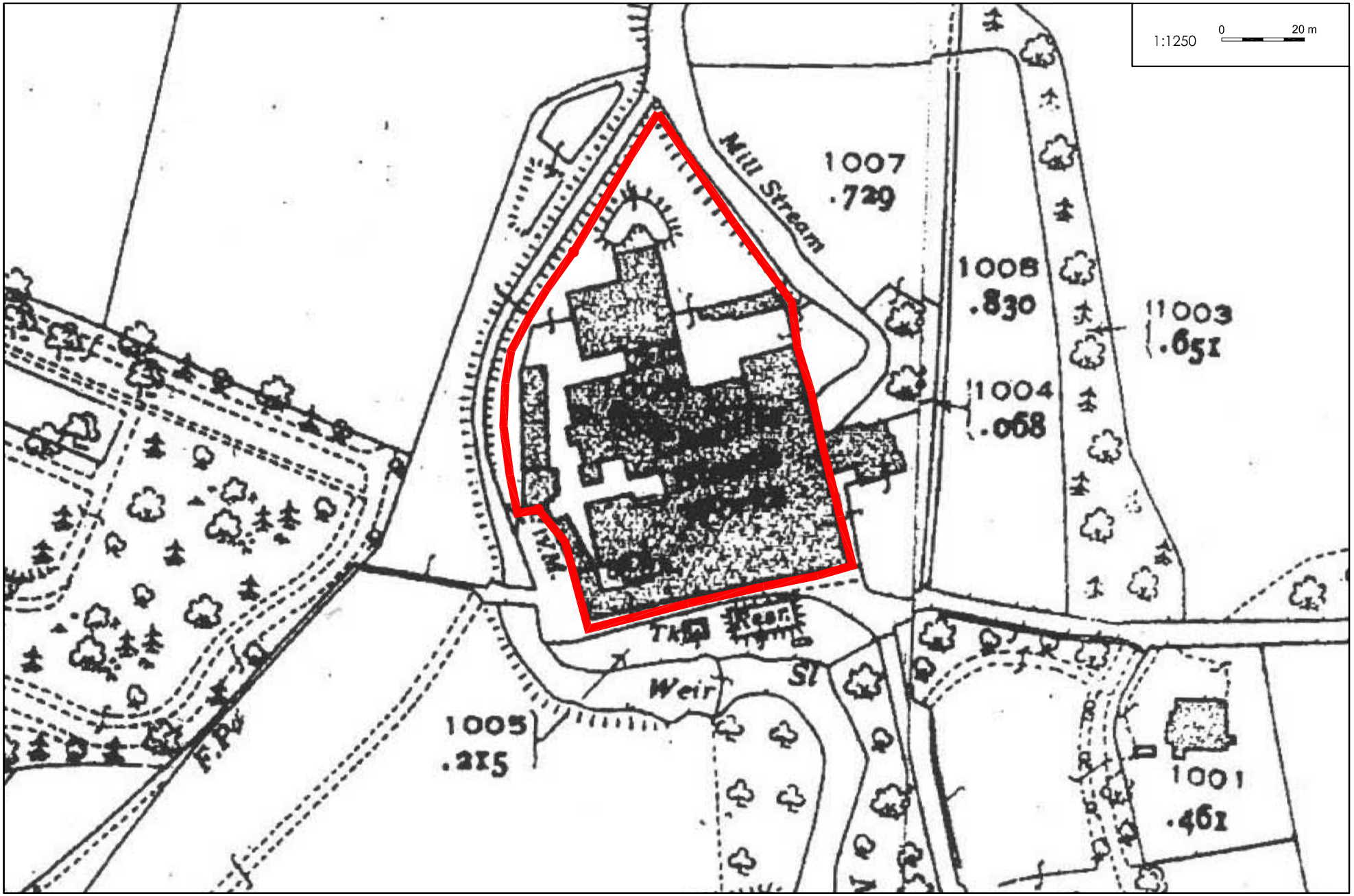


Figure 2: Extract from the Ordnance Survey map of 1872, showing study area boundary

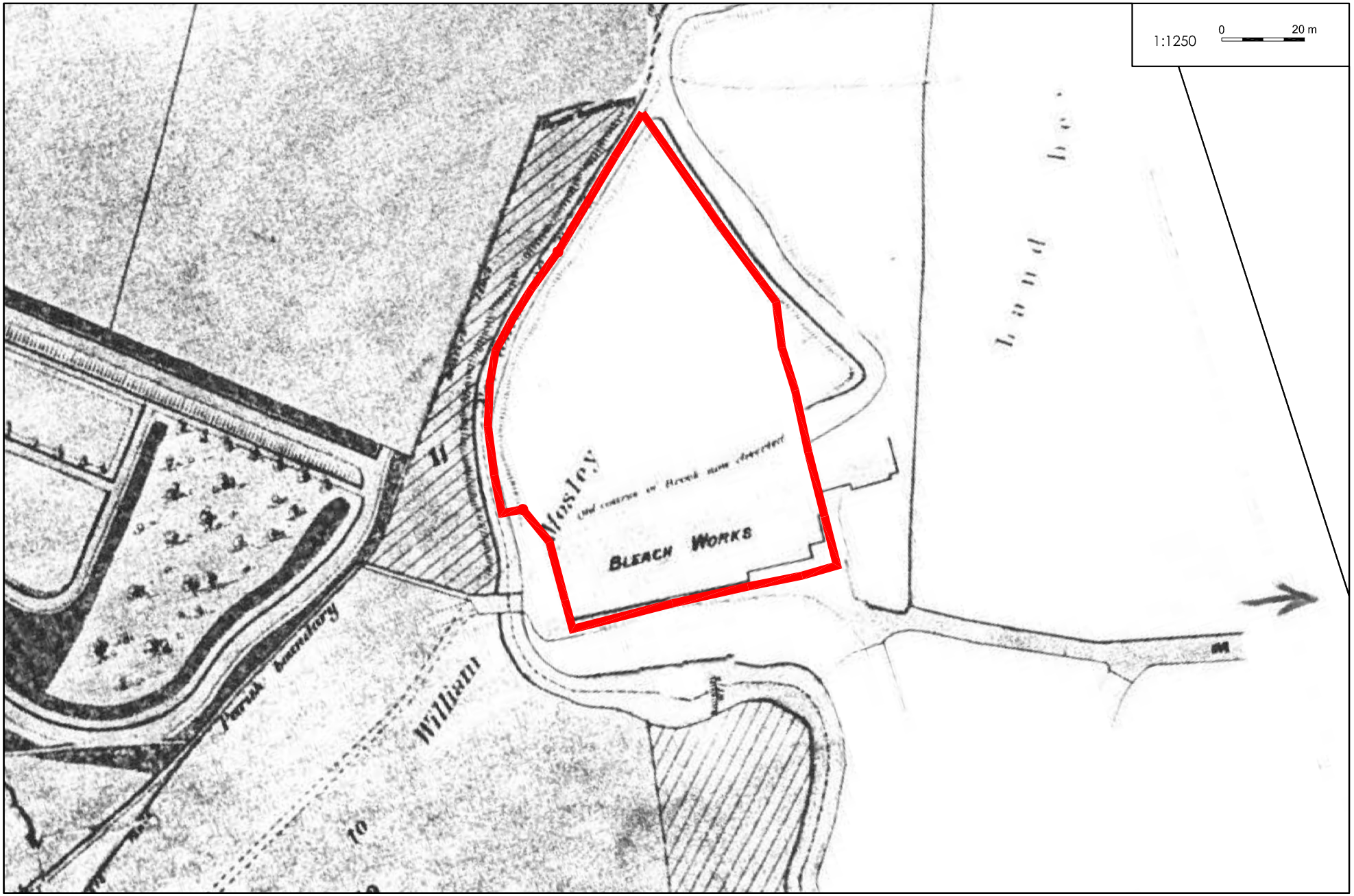


Figure 3: Extract from a plan of the Barnes Convalescent Home, 1886

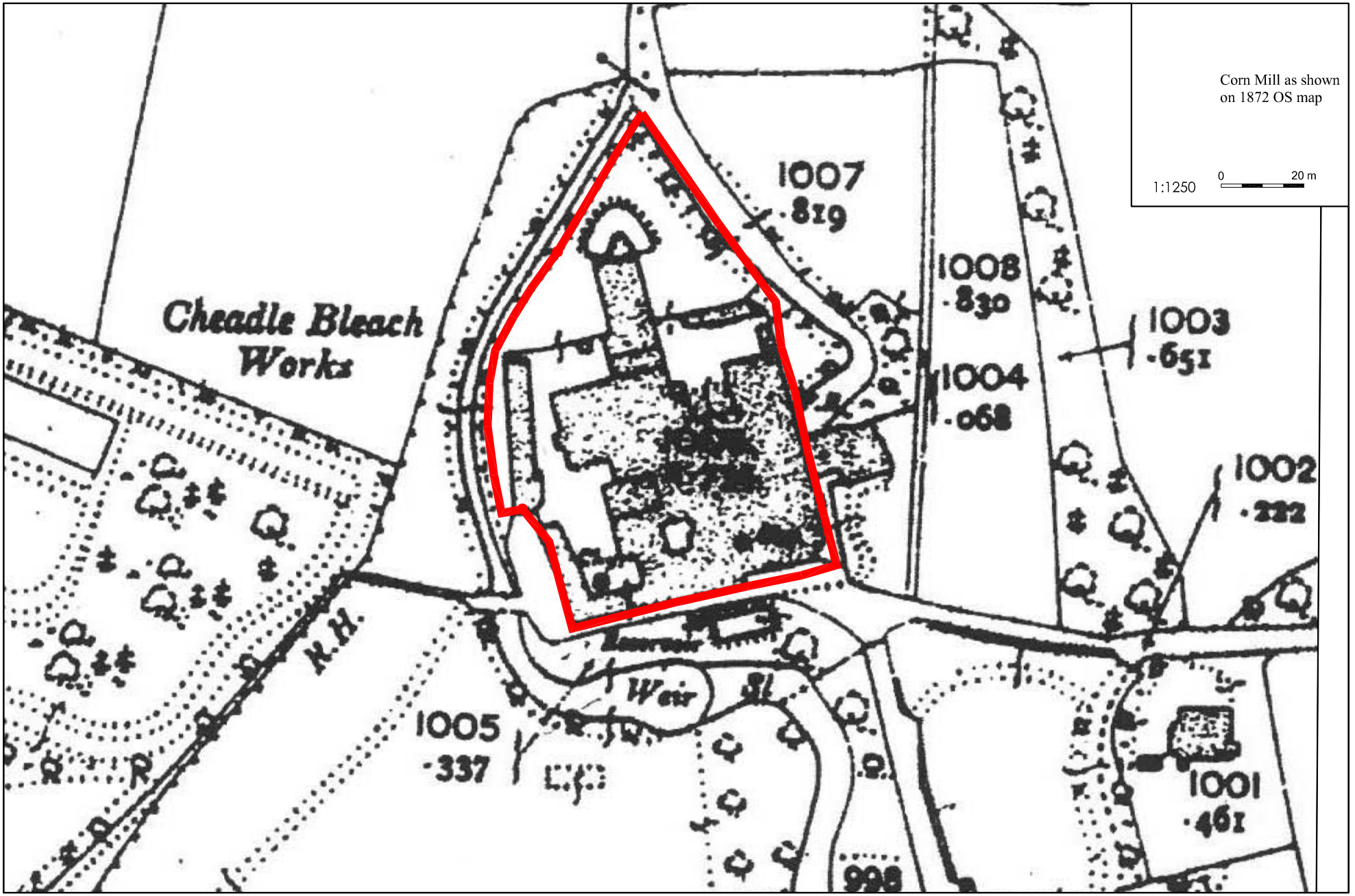
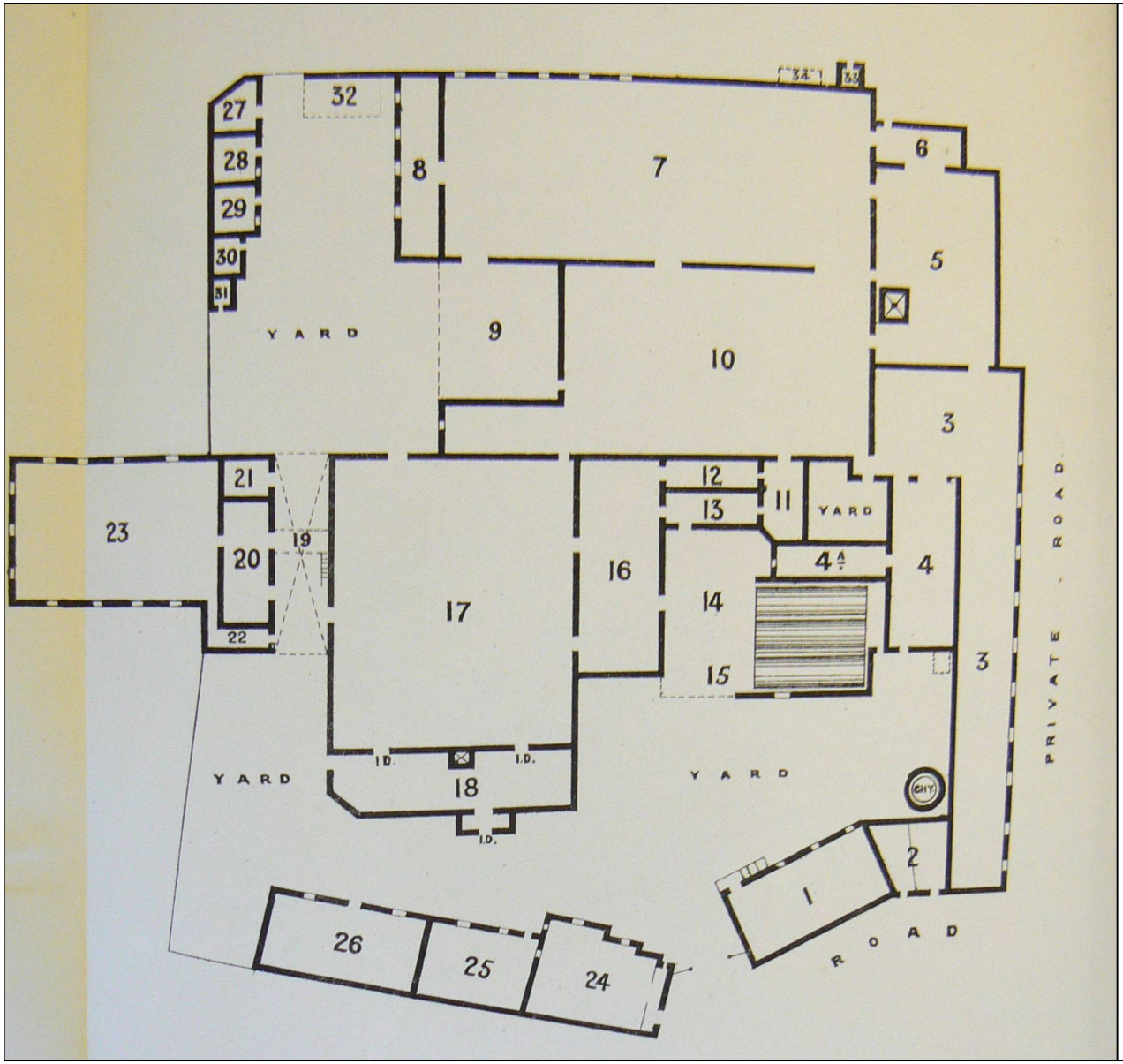


Figure 5: Extract from the Ordnance Survey 25": 1 mile map of 1910, showing study area boundary



Key

1. Mechanics/Joiners Shop
2. Dining Rooms
3. Hanging Stove
4. Cylinder Drying Room
5. Stentering, Stretching and Batch Room
6 Damping Shed
7. Making-Up and Calender Room
8. Pattern Office and paper Store
9. Loading Shed
10. Stiffening and Mangle House
11. Starch Mixing Shed
12. Starch Store
13. Stone Water Clstern
14/15. Boiler and Pump Room
16. Chemic Mixing and Starch Room
17. Bleach Croft
18. Singe House
19. Grey Unloading Shed
20/21/22 Grey Stitching Room, Beetle House
23. Beetling Room with Grey Cloth Store over
24. Offices, Lavatory, Laboratory
25. General Store Room
26. Stable
27/28/29 Store sheds
30/31 Closets
32. Greenhouse

Figure 6: Plan of Cheadle Bleach Works from 1910 (BAA 393)

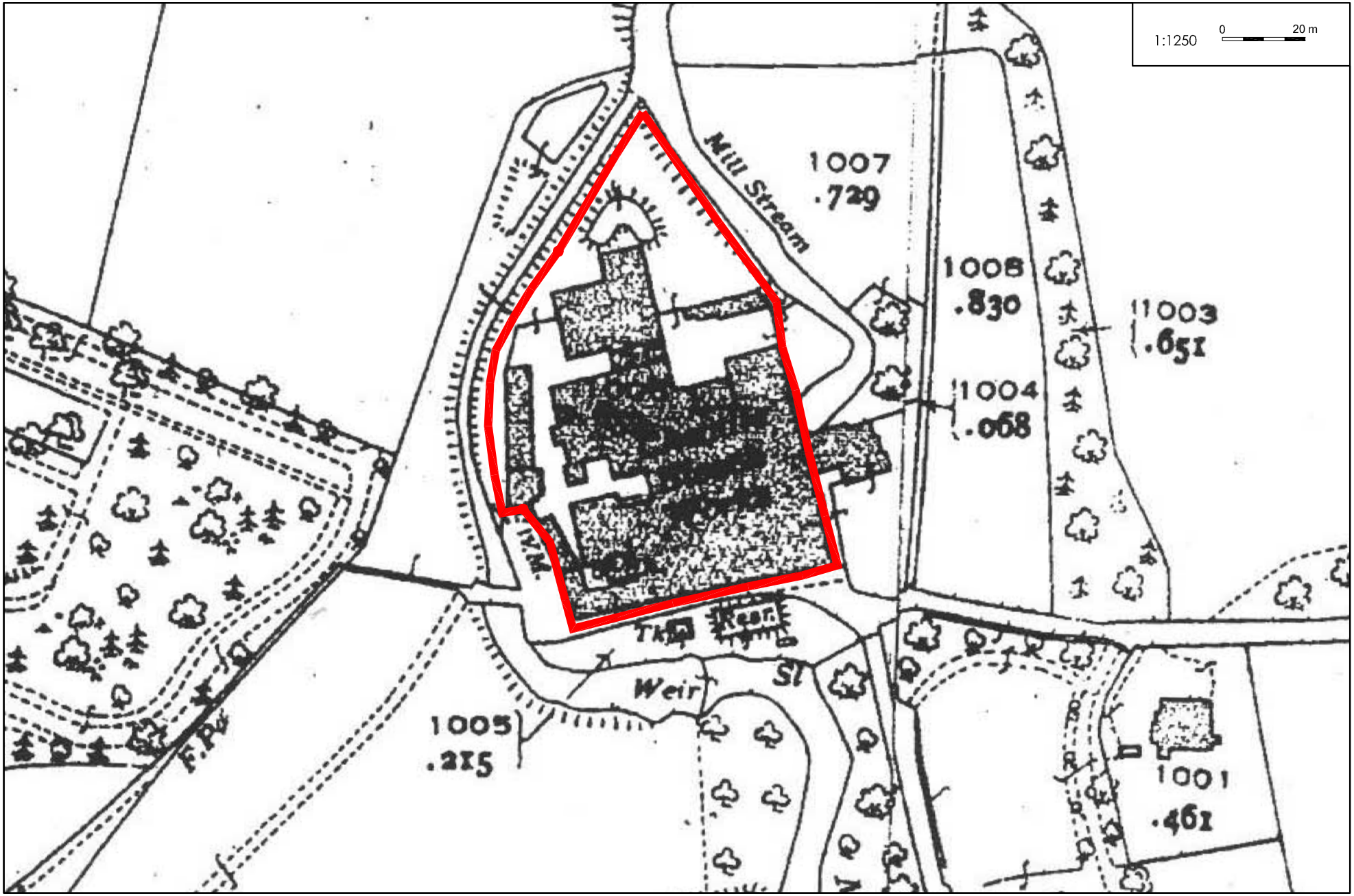


Figure 7: Extract from the Ordnance Survey 25": 1 mile map of 1934, showing study area boundary

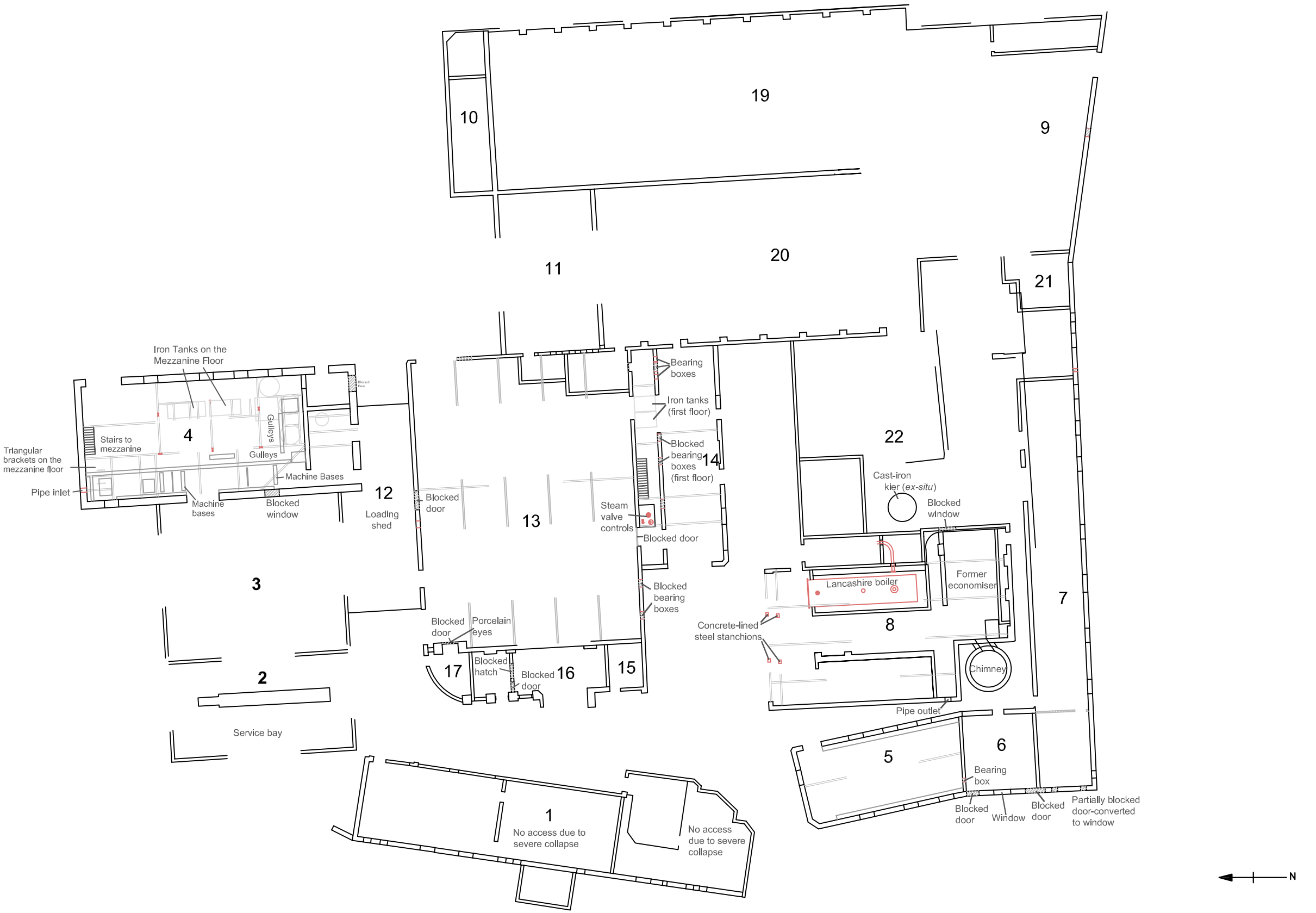
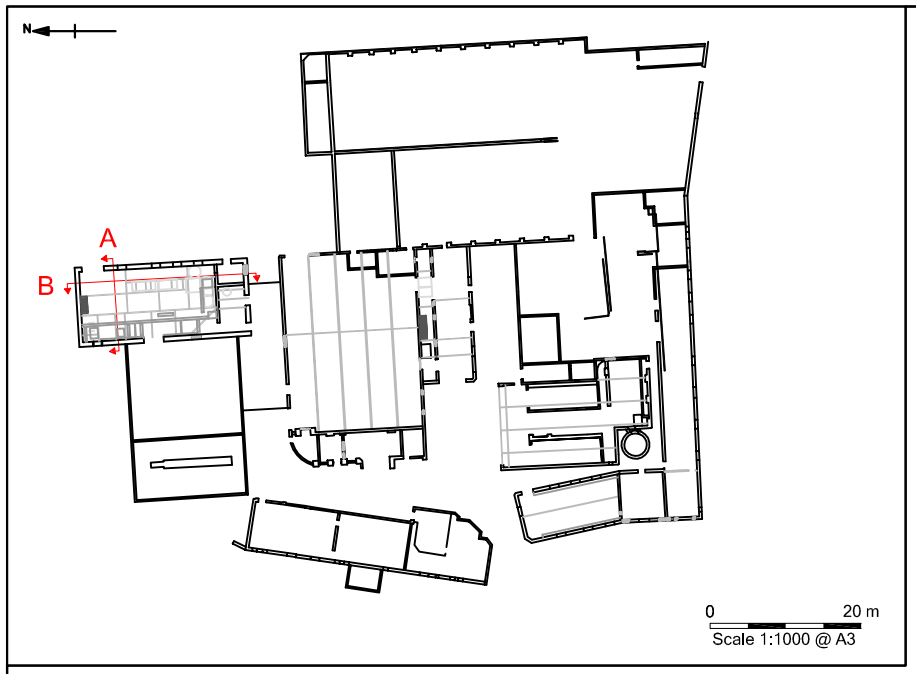
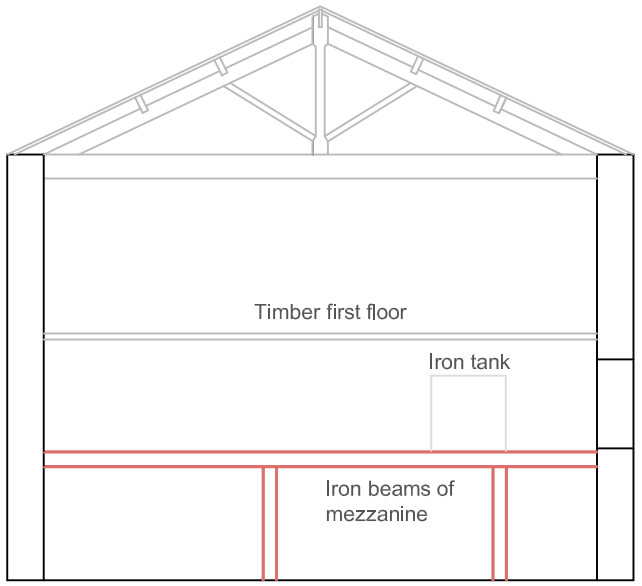


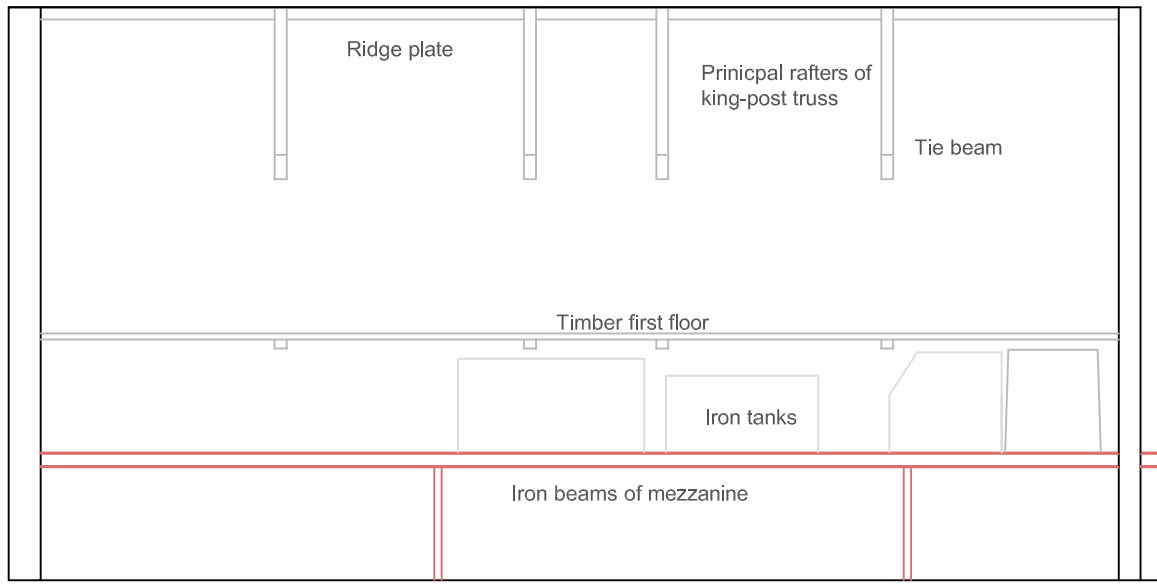
Figure 8: Measured survey plan of the buildings



Brick wall
Timber
Iron beams
Iron tanks (first floor)



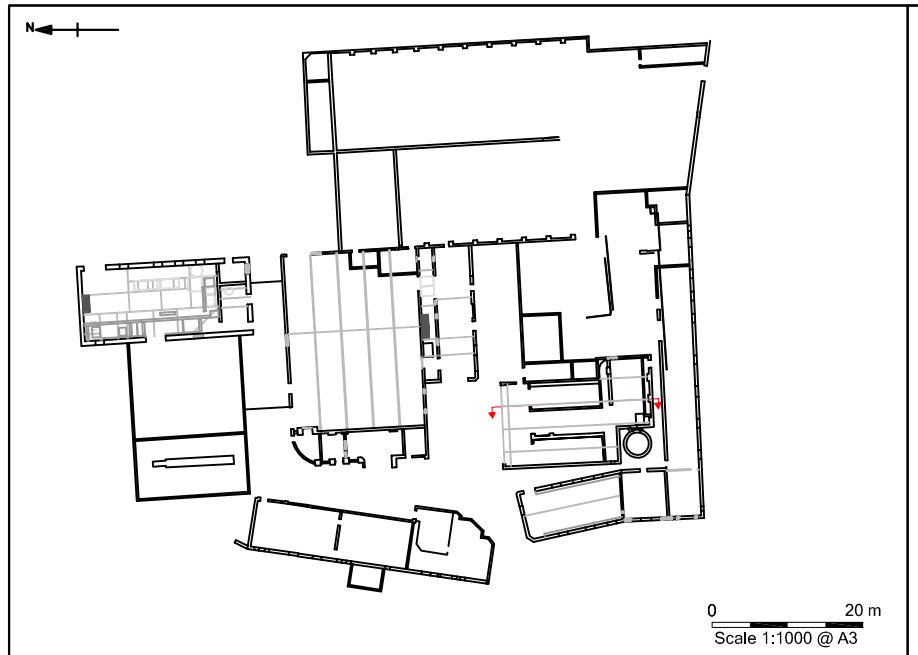
A. West-facing cross-section through Building 4



B. South-facing cross-section through Building 4

0 2 m
Scale 1:125 @ A3

Figure 9: Cross-sections through Building **4**



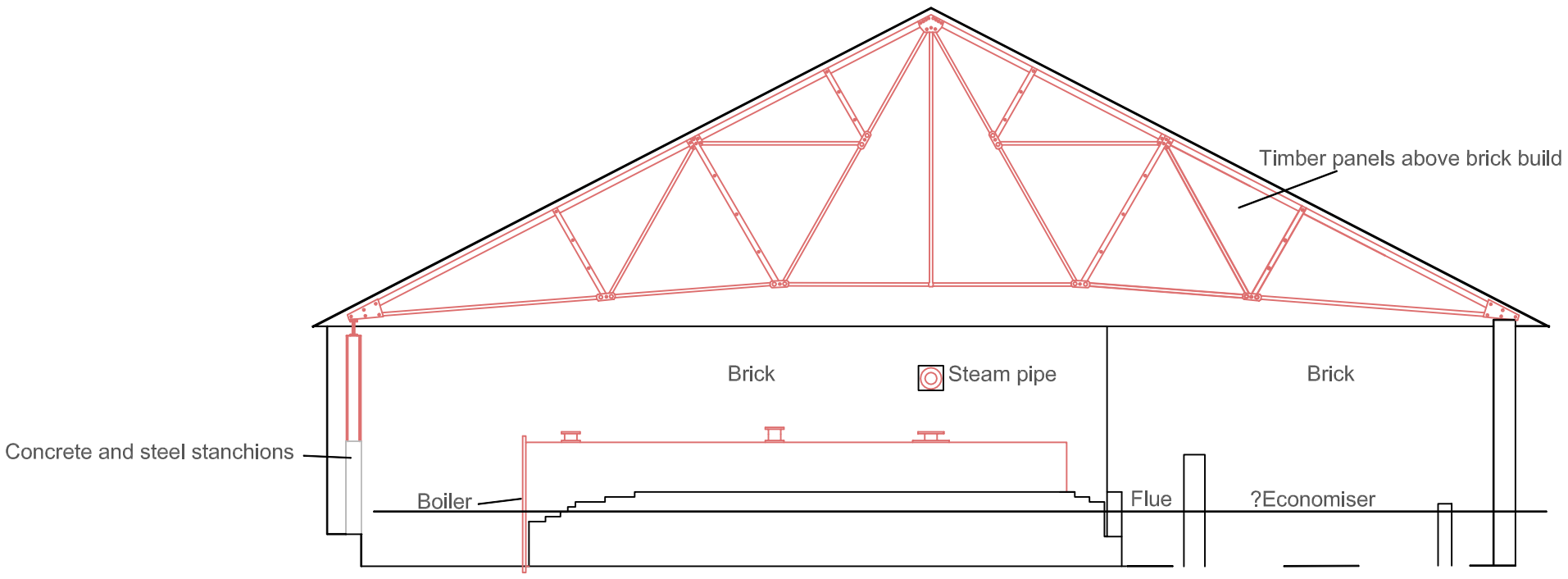


Figure 10: South-facing section of Building 8

Figure 11: Location of evaluation trenches and excavated areas, showing the position of the former corn mill and original river course

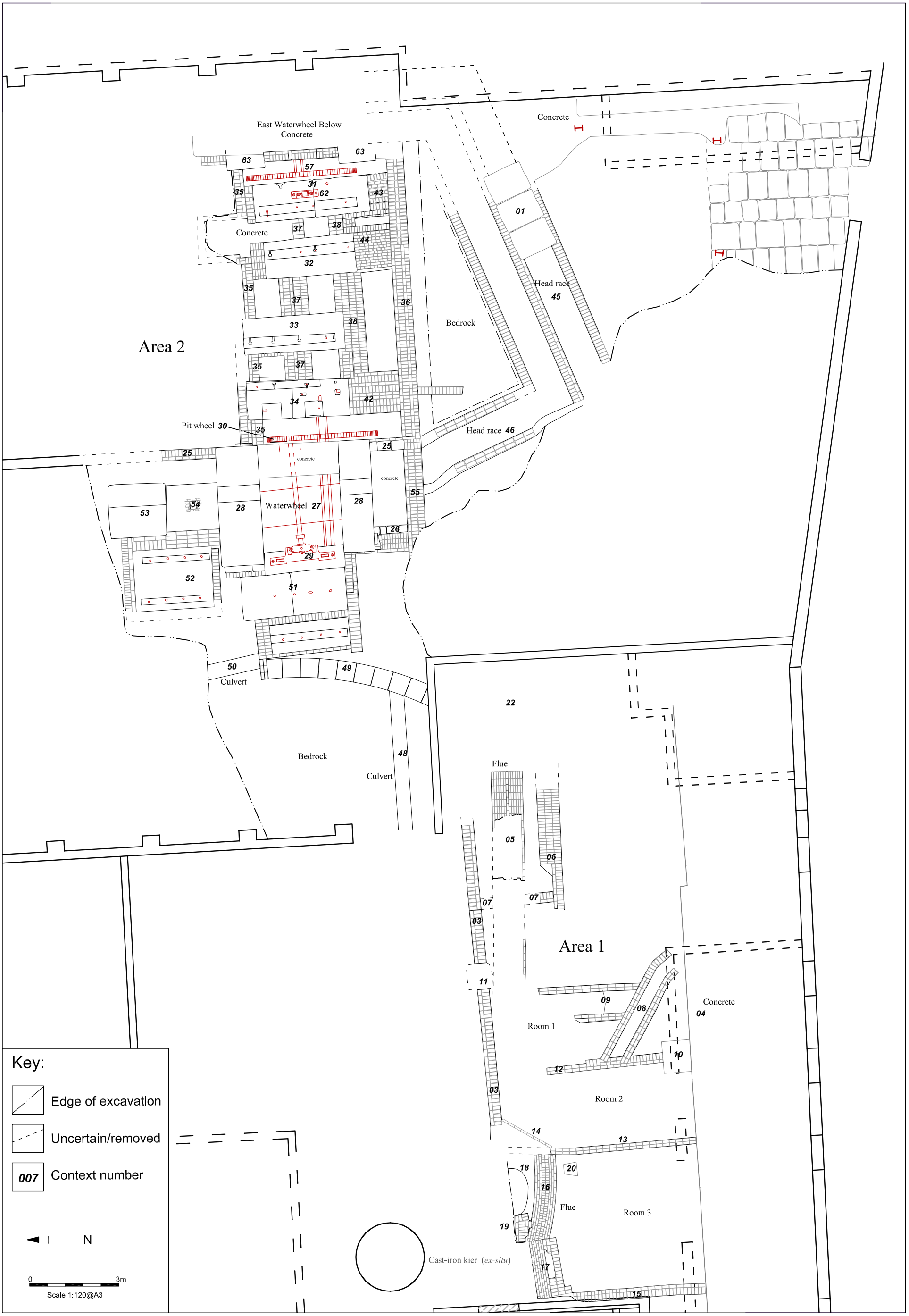


Figure 12: Detailed plan of the excavated areas

Figure 13: Measured survey of machinery bolt housings within the flagstone floor of Building **19**

Figure 14: Areas awaiting archaeological investigation