

An Archaeological Evaluation of Samuel Oldknow's Mellor Mill, The Roman Lakes, Marple Bridge, Stockport



The University of Manchester

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Summary

The University of Manchester Archaeological Unit (UMAU) and Mellor Archaeological Trust (MAT) carried out an archaeological evaluation in April/May 2009 at the site of Mellor Mill, Marple Bridge, Stockport (centred on the National Grid Reference of SJ 9670 8845). The evaluation was carried out as part of the Mellor Heritage Project (MHP); a three-year Heritage Lottery funded community archaeology project. A photographic survey and visual inspection of Mellor Mill's wheelpits, drive and access tunnels was also carried out during the works.

Mellor Mill was built between 1790 and 1793 and was part of a large estate centred here, owned and first developed by the important industrialist Samuel Oldknow. The mill itself measured c.400 feet long and 42 feet wide with six stories and was one of the largest water-powered mills in the country when first built. Oldknow was a manufacturer of cotton, and in particular muslins, who later became a partner to the significant figure of Richard Arkwright Jnr. After Oldknow's death, the estate and mill continued working in cotton manufacture until a disastrous fire in 1892 which partly destroyed the main mill building and caused the mill to cease operations. The mill stood as a ruin until the 1930's when demolition of the remaining above ground remains took place.

The present site of the main Mellor Mill building lies mostly under heavy vegetation and tree cover with a small area at the southwest corner of the main mill utilised as a carpark. The evaluation took place within this carpark in the form of an open area excavation designated as Trench 1 with a further small trench (Trench 2) located in the western corner of the study area.

The evaluation proved successful in establishing a substantial level of surviving structural remains associated with the 18th century cotton mill in both trenches, as well as an early 19th century corn-drying kiln within Trench 1. Trench 1 also revealed the ground-floor remains of a late 19th century brick structure to the southeast between the southern elevation of the cotton mill and the mill pond which possibly served as a warehouse. A large assemblage of artefacts predominantly associated with a gassing frame were also recovered.

The western wall footings to the mill were uncovered together with a north-easterly return, which have helped establish the extent and orientation of the mill. An unexpected engine-room was also discovered within a basement of the mill with two engine beds still in-situ. It would also appear that the remains encompass at least four distinct building phases of the cotton mill complex which include the separate constructions of a warehouse to the southeast and a drying kiln connected to a corn mill.

The high level of survival of the building foundations together with a dense assemblage of artefacts associated with the cotton mill machinery provides excellent research potential for further works on the site. Although some scrap recovery and stone-robbing events appear to have taken place, the surviving remains provide an unusual time-capsule of mill artefacts and features due to the rapid abandonment of the mill following the fire of 1892. These well-preserved remains would lend themselves aptly to community archaeological participation.

1. Introduction

The University of Manchester Archaeological Unit (UMAU) and Mellor Archaeological Trust (MAT) carried out an archaeological evaluation at the site of Mellor Mill, Marple Bridge, Stockport (centred on the National Grid Reference of SJ 9670 8845). These works took place for eighteen days during March and April 2009. Permission for the evaluation was given by the landowner Mr Bernard Sewart of Roman Lakes Leisure Park (RLLP) and the evaluation was carried out as part of the Mellor Heritage Project (MHP); a three-year Heritage Lottery funded community archaeology project. A photographic survey and visual inspection of Mellor Mill's water, drive and access tunnels was also carried out during the works. This survey was undertaken by Nigel Dibben and Geoff Standring of the Derbyshire Caving Club in association with Chris Mann of MannMade productions. This report will present the results and interpretations of the evaluation and includes an appendix of the results of the survey.

The project design for the evaluation was approved by the County Archaeologist for Greater Manchester Norman Redhead (GMAU). The evaluation was monitored by Norman Redhead.

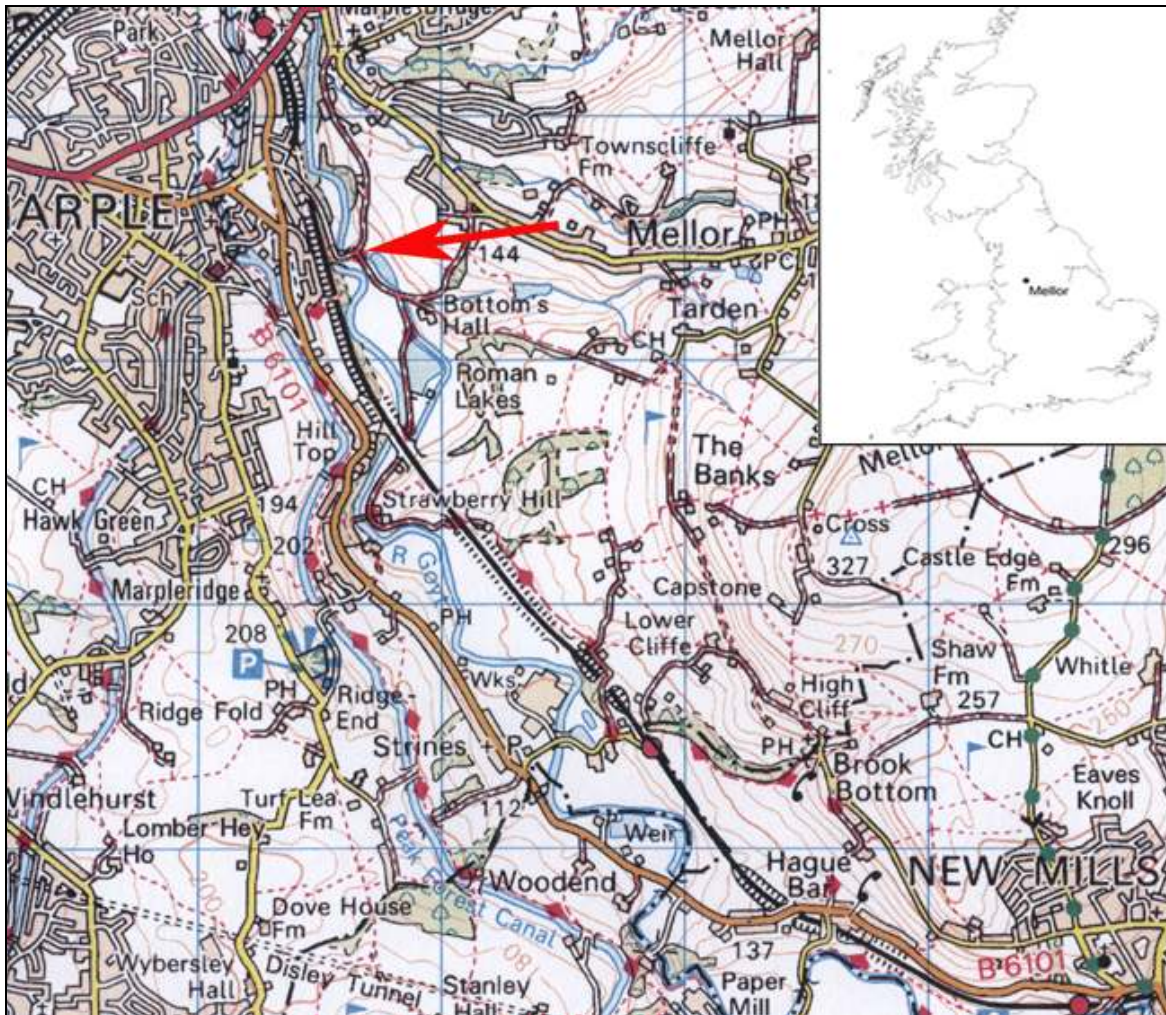


Figure 1: Site location map (arrowed). Reproduced by permission of Ordnance Survey on behalf of the Controller of Her Majesty's Crown Office @ Crown copyright. All rights reserved; Licence number 100019571

2. The Physical Setting

2.1 Setting

The site of Mellor Mill is situated in privately-owned land adjacent to the River Goyt in Marple Bridge. The majority of the mill complex lies within woodland with a small area at the southwest corner of the main mill utilised as a carpark. A small lake now used for boating but originally a feeder reservoir for the mill lies to the east of the carpark. Vehicular access to the site was gained via Lakes Road, Marple.

2.2 Geology

No solid or drift geological deposits were uncovered during the archaeological works, although bedrock was observed within several of the mill's tunnels during the survey conducted by the Derbyshire Caving Club (Appendix 4 below).

2.2.1 Solid

The site is located upon a solid deposit of sandstone known locally as Woodhead Hill Rock, the lowest sandstone development in the Westphalian A succession, laid during the late Carboniferous Period.

2.2.2 Drift

The adjacent fields to the north and east contain boulder clay of glacial origin.

2.3 Archaeological Background

During 1987-1988 the Greater Manchester Archaeological Unit (GMAU) conducted limited archaeological works on the site as part of the Stockport Archaeological Project. As far as it is possible to determine, these works consisted of non-intrusive repairs and maintenance to the mill remains and its associated leats and tunnels. No report on these works has been produced though a summary of the project is included within GMAU's 1987-1988 Annual Report (GMAU 1988).

3. *Historical Background*

3.1 Map Evidence:

1849 Tithe Map

This map shows the main mill running in a north east/south west orientation with the mill pond to south east off the southern end of its south eastern elevation. The main mill was a long narrow structure with a central extension off the north western elevation and two wings at the far ends of the mill. Off the south western gable was a detached square building that was the corn mill.

The River Goyt runs in a north/south direction before turning approximately ninety degrees west a short distance before it reached the mill, after which it turned ninety degrees to return to run in a north/south direction following the line of the mill and some distance away from it. Within the bend of the river was the house built by Samuel Oldknow called Mellor Lodge. Almost on the banks of the river shortly after returning north, which was approximately opposite the southern end of the north western elevation of the mill, were four small rectangular structures that were a mechanic's shop, stable and coach house and two warehouses (Ashmore, 1989). Between the main mill and these four ancillary structures was a water wheel house known as the 'Waterloo' wheel.

Two leats were visible on the map running from the north western and south western corners of the mill pond. The north western leat ran into the central part of the mill where there was an extension off the south western elevation which would have fed the internal water wheel that was known as the 'Wellington' wheel. The leat off the south western corner of the mill pond fed into the dislocated structure off the south eastern gable of the mill that was the corn mill. An arm of the river extended southwards to end a short distance from the most northerly of the four ancillary buildings that was probably the tail race of the water feeding the two water wheels returning the used and overflow water to the river.

1867 plan (from sale of mill and estate)

This plan with its associated description gives an outline of the mill its various components and its contents.

'Mellor Mill, brick built and slated, consisting of main building seven stories high, including the attic, has Four Rooms of 25 bays each, 7ft. 10in. in each bay, Three Rooms of 49 bays each 7ft. 10in. in each bay, including wings, separate Waste and Cotton Rooms, Warehousing, Countinghouse, Storerooms, Engine and boiler Houses, 3 main Stair-cases from bottom to top of Mill; detached are mechanic's smith's, joiner's and other workshops, Gasometer and Retorts, Reservoir, supplied by the river Goyt, and springs on the Estate. The Machinery comprises 23,000 throstle spindles by Wren & Hopkinson, with full compliment of preparation by Parr, Curtis & Madely, of Manchester; Hoist by Hughes & Wren; the power consists of three Water- wheels of 120 (total) H.P.; Two Steam Engines each of 20 (nominal) H.P. by Goodfellow, of Hyde;'

A further plan of the site from the 1867 sale gives a stylised outline of the buildings on the mills site. The attached reference outlines the function of each area and its dimensions (**Figs. 4 and 5**). The itinerary showed that the site was powered by water and steam with an octagonal chimney to the north east some distance away on the hillside. There is no mention of any of the rooms being concerned with weaving and

together with the trade directories it would indicate that the mill from its inception to the 1870's was concerned solely with spinning cotton yarn.

OS 1880's Map (Derbyshire)

The Ordnance Survey map of the 1880's (**Figure 2**) showed a few substantial and important additions to the mill site. Off the north eastern gable of the main mill a detached square structure had been added that was the engine and boiler house that was installed sometime after the 1850's. Alterations had been made to the detached corn mill off the south western gable of the mill in that by this time although of similar shape it was now attached to that gable.

To the north of the most northerly of the ancillary buildings two further associated structures had been built the northern circular structure was designated as a gasometer and the rectangular structure to its south was the retort house.

The mill at this time was shown as '*Mellor Mill – cotton spinning*'.

OS 1898 Map (Derbyshire)

It is known that the mill suffered a dramatic fire in 1892 and the map of 1898 (**Figure 3**) showed this as the main mill was shown as having no cover (roof). All the other buildings were shown as being covered and presumably structurally unaffected by the fire. This map did, however, show a further addition to the mill site in the form of a long narrow structure of the southern end of the south eastern elevation that ran approximately half the length of the mill. It was connected to the central part of the mill via a curving walkway. The mill at this time was shown as '*Mellor Mill disused*'.

OS 1907 Map (Cheshire) – OS 1923 Map (Derbyshire)

These maps showed no changes to the mill site

3.2 Trade Directories:

A suite of directories from 1828/29 to 1891 list further details on the mill site and in 1828/29 records state that Samuel Oldknow was still at Mellor at that time and is shown as a *cotton spinner*.

The next directory that of 1835 shows a John Clayton and Co. at Mellor. By this time Oldknow had died and left the company to Arkwright with John Clayton (a relative) as manager. Again the directory shows that the company was cotton spinning. John Clayton and Co. are also shown as *lime burners* and it was Oldknow who built lime Kilns in the Marple area.

The successive directories (roughly at ten year periods, the final one being from 1891), all show that Mellor Mill (sometimes referred to as Bottoms Mill) was run by John Clayton and Co. who were shown as cotton spinners. Worralls directory of 1887 nine years before the mill was destroyed shows that John Clayton and Co. cotton spinners at Mellor Mill was managed by R. Furniss and the mill contained 26,656 spindles,

16"/32". At this late stage of the mill's life there is no mention of weaving even though the eastern range was shown on the maps. In 1892 there was the disastrous fire and the mill ceased production.

3.3 The Oldknow Estate:

The details of the early life of Samuel Oldknow are unclear although he originated from Nottingham. His father moved to Anderton in Lancashire where he married and had three children during their brief five years of marriage when Samuel snr. died young. Samuel jnr. was born in 1756 and was the eldest of the three children. His mother later re-married John Clayton and had three more children one called John who later became involved in the mill at Mellor.

The young Samuel was apprenticed to his uncle and in 1781 aged 25 he entered into partnership with him. The next year he returned to Anderton where he became one of the leading manufacturers of fine calico and muslin cotton products. In 1784 he obtained a loan from Richard Arkwright and purchased a warehouse and house (which still stands today) on Upper Hillgate in Stockport and began to produce cotton material becoming, over the next four years, probably the foremost muslin manufacturer in Britain.

Having made his money as a manufacturer of muslin in Stockport in the years before the construction of Mellor Mill he was attracted by the prospects of owning a landed estate with all that entailed and in 1787 he acquired the Bottoms Hall estate (Unwin 1924, p.135). He was a local entrepreneur and constructed several buildings on his estate including Lime Kilns and a house for himself. He also was instrumental in the construction of the Peak Forest Canal.

With the Bottoms Hall Estate came water rights to the River Goyt and in 1790 construction began on the Mellor Mill. It would have been a massive undertaking with the main mill being brick built, four hundred feet long, forty-two feet wide, with six storeys high and a loft in parts. It had three wings on the north western elevation, one at either end thirty feet wide and a central wing that was also the entrance façade. Between the central and both end wings were stair towers. According to the 1867 plan of the site the four storey high southern wing contained warehousing and the northern wing also of four storeys had cotton rooms on the ground floor and upper rooms for carding, warping and a lumber attic. The central wing, seven storeys high, contained the offices on the ground floor with store rooms on the upper floors. The main body of the mill was divided into three areas with the central area being the largest. At the northern end, which was five storeys, were blowers on the ground floor and second floor with throstle spinning machines on the third. The larger central area contained throstles on the first three floors with carding rooms above. The southern area, four storeys high contained throstles on the first three floor with warehousing above.

The mill was water powered and contained within the basement level of the central wing a large wheel-pit containing the 'Wellington' wheel estimated at twenty-two feet in diameter, seventeen feet wide and of breast shot design (Ashmore, 1989, p.32). It was probable that power was taken from the rim of the wheel via gearing to vertical shafts transmitting power to all floors of the mill. The water from this wheel left the wheel-pit via a tunnel to another later built wheelhouse to the north west of the mill. The wheel here was known as the 'Waterloo' wheel suggesting a date of c.1815 for its construction. The wheel was slightly smaller at twenty feet in diameter and also breast shot and supplied supplementary power to the mill suggesting an increase in machinery and production at the mill. Power from this wheel to the mill was apparently via an underground tunnel where evidence of anchor bolts and bearing supports were seen in the mill basement area. A similar shaft running in the opposite direction towards the complex of outbuilding to the north west of this second wheel would have supplied power for these buildings. Being lower than the

River Goyt at this point the water went via a tunnel some six hundred metres further downstream by which time the river had dropped sufficiently in height so that the water could be returned to it. A further water wheel is known to have supplied power to the stone-built corn mill off the south western gable of the mill.

Water was supplied to these wheels via two headraces from the mill pond situated a short distance from the south eastern elevation of the mill. The most northerly headrace supplied the 'Wellington' wheel (and ultimately the 'Waterloo' wheel) and the one at the southern end of the mill pond supplied the corn mill. To supply sufficient water to power these wheels Oldknow had the course of the River Goyt diverted and built several mill ponds and constructed a whole series of underground tunnels which together altered the whole landscape of the valley at this point. A visual and photographic survey of these tunnels was undertaken by the Derbyshire Caving Club who supplied a written report (see Appendix 4).

A gas holder and retort house can also be seen on the mapping to the north of the 'Waterloo' wheel house. This would probably have supplied lighting to the mill in the later parts of the 19th century and numerous artefacts connected with gas supply were recovered from Trench 1.

Steam power came late to Mellor Mill but eventually in 1860 two steam engines and boilers were installed by the Hyde engineer Benjamin Goodfellow (Ashmore, 1989, p.37). Two new buildings off the north eastern gable of the mill were erected to contain the engines and boilers and a long flue contained within a tunnel was constructed to take the exhaust up the hill behind the mill to a brick chimney.

The building uncovered in Area A of Trench 1 (see Section 4.2.1 below) was probably constructed a few years after steam power was introduced. It is not recorded on OS mapping of 1880, but is shown on the OS map of 1898. The evidence from the excavations suggested that this was a low single storey structure unsuited to heavy machinery and may have been for extra storage. It is improbable that the mill expanded to take on a weaving capacity and evidence from trade directories would suggest that the mill was concerned only with spinning.

Although the mill was producing large amounts of cotton thread from more than 10,000 spindles in production in 1804, and Oldknow's vision for his Marple estates was considerable, he was none the less accruing crippling debts. He was heavily in debt to Richard Arkwright jnr. and on his death in 1828 his estate value was probably equal to his debt and subsequently went to Arkwright in settlement. In 1824 John Clayton his half brother was appointed manager of the mill and took over the manufacturing business on Oldknow's death and the business became known as John Clayton and Company and remained so until the demise of the mill.

In November 1892 a disastrous fire took hold in the mill and by early morning nothing remained but the external wall of the building. Several of the outbuildings and portions of the mill remained standing after the fire and the corn mill which survived the fire intact was not demolished until the 1930's.

4. *Results of the Evaluation*

4.1 Excavation Methodology

The site of the main Mellor Mill building covers an area of approximately 400m x 40m orientated northeast to southwest with the vast majority of it lying under heavy vegetation and tree cover. At the southern end of the site an area of approximately 30 square metres serves as a car parking area and was covered in a thin layer of limestone chippings, with two large spoilheaps of recently deposited soil to the northeast of this. Within the wooded area to the north lies a deep hollow which contains the remains of the mill's integrated water power system.

Due to Health and Safety issues the evaluation was confined to the car park area at the southwest end of the mill and was originally designed (Noble 2009) to evaluate the remains of the southern wing of the mill, the wheelpit of the wheelrace and drying kiln associated with the corn mill and a later structure off the eastern elevation of the mill which had above-ground red brick walls visible prior to the evaluation. Excavation within the suspected area of the wheelpit (Area B) was limited due to the depth of the overlying infill deposits and to a lack of sufficient space for required Health and Safety precautions. Excavation within Area C was also limited by these concerns and the north, west and southern edges of Trench 1 were stepped and battered to overcome this. These Health and Safety requirements impacted upon the overall area evaluated, with Area B in particular being limited in its scope.

The southern entrance area of the car park remained unexcavated to allow for site access and the eastern quarter was used to accommodate the hand excavated spoil, with some of the machine excavated spoil being removed off-site. The perimeter of the evaluation area was fenced with Heras fencing and orange safety fencing was used to denote trench edges and spoilheaps. Two on-site welfare cabins and toilets were sited to the southeast of the carpark.

Much of the remainder of the site was subject to an open area excavation designated as Trench 1 (measuring 22.5m north-south by 16.5m east-west) with a further small trench (Trench 2, measuring 4.2m by 3.6m) located in the western corner of the study area (**Figure 7**). Trench 1 was divided into four areas (A – D) to facilitate recording and along with Trench 2 was excavated and backfilled with its originally excavated material at the conclusion of the evaluation.

Both trenches were machine excavated to the top of any perceived archaeological deposits using a mechanical excavator fitted with a 1.5m toothless ditching bucket. The existing two large spoilheaps were also removed during the machining phase.

Excavation and cleaning of the archaeological deposits was carried out by hand. Features and deposits were then photographed in digital format with all sections drawn at 1:10 scale and plans at 1:20 scale. All drawings were annotated with context information and AOD levels. All finds were bagged and labelled with context information.

4.1.1 Result Typology

In this report all fills and layers are represented in rounded brackets (***) and features/cuts are in square brackets [***]. Features will be named and denoted by their principal cut number. All recorded measurements given for contexts/features are the maximum dimensions unless otherwise specified. All contexts lay directly either underneath the carpark hardcore surface (075) or a mixed deposit of modern spoil and topsoil (001) unless otherwise specified. Following standard conventions when describing the colour or matrix of a fill the greater element is listed last, thus a mid grey/brown silt clay would be principally brown in hue and have a higher percentage of clay than silt.

4.2 The Mill Remains

The evaluation proved very rewarding and exposed a substantial amount of surviving structural remains associated with the 18th/19th century cotton mill in both trenches and the c. early 19th century drying kiln within Trench 1. Area A of Trench 1 also revealed the floor remains of a late 19th century brick structure to the southeast between the southern elevation of the cotton mill and the mill pond.

The high level of survival of the building foundations together with a dense assemblage of artefacts associated with the cotton mill machinery provide an informative interpretation of the site during the period of the cotton mill's existence. The western wall footings to the mill were uncovered together with a north-easterly return, which have helped establish the extent and orientation of the mill. An unexpected engine-room was also discovered within a basement of the mill with two engine beds still in-situ. It would also appear that the remains encompass at least four distinct building phases of the cotton mill complex which include the separate constructions of a warehouse to the southeast and a drying kiln connected to the corn mill.

4.2.1 Phase 1 – The 18th Century Cotton Mill (1790-1793) (Figures 2, 3, 4, 5, 6 and 7)

The earliest remains of the cotton mill were observed in Areas C and D of Trench 1 and in Trench 2 and represent the stone-built foundation walls of the south, west and north facing gables for the main Mellor Mill [077]. An internal basement [079] for the mill was also uncovered. Two ground build-up/levelling layers (026 and 032) are grouped within this phase.

Trench 1 (Plates 3, 8, 10, 13, and 14, Figures 10 and 14)

Wall (045) was a 1.65m long by 1m wide by 0.86m high section of faced and squared sandstone orientated northeast-southwest. This wall had been substantially modified during the Phase 3 works (below) and only seven surviving evenly-laid courses of the wall remained in-situ. The wall was built of sub-rectangular and sub-square sandstone (largest 45cm x 12cm) bonded together by a light grey/brown mortar. Due to probable stone-robbing and later re-building the internal face and the core of (045) was not clearly observed during the works.

Associated with wall (045) but separated by the Phase 3 rebuild was stone (048). This was a large ashlar block of faced sandstone measuring 1m square which lay 3m to the southwest of wall (045) and formed a quoin at the southeast corner of the Mellor Mill.

A parallel wall (069) lay 3m to the northwest of (045) and was of a similar build. Fourteen courses of this wall survived to a height of 1.48m above floor surface (039) which abutted it. (069) had a width of 0.5m and extended 3.25m southwest (and continuing to the northeast) from the trench edge. At this point wall (069) had been cut (or less possibly damaged/robbed-out) to a depth greater than the limit of excavation.

Wall (069) is associated with mill wall (045) and together forms an internal basement [079] to the mill. This basement had a (damaged and later rebuilt, Phase 3 below) sandstone flagged floor (039). This floor was composed of tightly abutting square and rectangular flags (largest 1.06m by 0.5m).

Trench 2 (Plates 19 and 20, Figure 12)

Wall (028) was 'L' shaped in plan, with the western-most extent orientated northwest-southeast (measuring 2.9m long by 0.62m wide) and the northernmost line orientated northeast-southwest (measuring 2.75m long by 0.62m wide) and continuing to the northeast. The wall was composed of faced rectangular and square sandstone (largest 0.75m by 0.24m by 0.24m high) with a sub-angular sandstone core heavily mortared with a light grey/brown mortar. The western line was broken at a point 2.9m south of the northeastern return and appears to have been cut or robbed-away. (028) was abutted by wall (029).

The interior of the wall as well as the southwestern exterior was filled with a compact deposit of tan brown clay (026). It is unclear whether or not this clay served as a basal levelling layer immediately prior to the mills' construction, though its occurrence both within and outside of the mill building may suggest this. Due to the damage and stone-robbing of the upper surface of (028) relationships between the two were indistinct, but (026) may have served a similar function to layer (032) (below) and have been deposited to create a firm levelling layer for later construction, or less-possibly may have been used post-construction to raise the ground-surface to a level.

A shallow (<5cm deep) and irregular deposit (025) of light grey mortar and very small sub-angular sandstone (average size <5cm by 5cm by 5cm) lay over (026) and abutted (028) which had possibly originally served as a basal levelling layer for a now missing floor surface.

4.2.1.1 Probable Phase 1

Trench 1 (Plate 9, Figure 10)

Layer (032) was a widespread deposit of compact light-mid orange/brown sand gravel with very frequent river-rolled cobbles (average size 12cm by 10cm by 10cm) which extended south and east from mill wall (045) for 16.5m and north from drying kiln wall (050) (below) for 6.6m. (032) appeared to abut mill wall (045) and kiln wall (050) and lay under the Phase 4 building [071] (below). However, no excavation of (032) took place and its depth and precise relationship with both (045) and (050) is unclear due to later rebuilding. It is entirely possible that this later rebuilding and disturbance has masked/removed potential stratigraphic relationships. If, as seems likely, (032) served as a levelling/basal layer then the differing use of clay (026) in this function to the west may suggest separate phasing. It is possible however, that both (026) and (032) represent locally derived geological/alluvial deposits (potentially from the excavation of the feeder reservoir to the east or other works) and as such their differences may denote separate areas or depths of excavation in the course of these works.

4.2.2 Phase 2 – Probable Early 19th Century. Drying Kiln [076]

The northern end of a (probable) early 19th century wheelrace and drying kiln building [076] associated with the corn mill [078] was uncovered within Trench 1 Area B, to the south of Area D. The wheel race lay under the drying kiln and was not uncovered during the evaluation. It was however, recorded as part of the survey of the Mill's watercourses undertaken by the Derbyshire Caving Club and is listed within Appendix 4 below). The evidence for this structure consisted of a northern external wall (050), a (later rebuilt, Phase 3 below) pair of stone steps (055), and two floor layers (030) and (054). All of these contexts had to a lesser or greater extent been affected by both later rebuilding and/or stone-robbing/damage events and the in-situ remains from the original phase were consequently limited in scope.

In Trench 2 the western external wall (029) of the drying kiln was uncovered as it abutted the main Mellor Mill.

Trench 1 (Plates 3, 4, 5, 7 and 8, Figures 10 and 15)

The external wall (050) was constructed of 5 courses of sub-square and sub-rectangular sandstone (average size 0.34m by 0.2m) which were heavily mortared and partly obscured by a light brown/grey mortar.

Abutting this wall was a (damaged and incomplete) layer of square and rectangular sandstone flags (054) (largest 0.54m by 0.58m by 0.12m deep) which had once formed the internal ground floor within [076]. (054) was set within an indurated mortar and stone basal layer (030) which had been heavily truncated to the south.

Two closely-set rectangular sandstone blocks (measuring 0.7m by 0.34m each) were set within the western end of wall (050) and abutted the Phase 1 stone (048). Both stones had evidence of use as steps in the form of shallow foot-worn depressions on their upper face.

Trench 2 (Plates 19 and 20, Figure 12)

A partly truncated north northeast-south southwest orientated sandstone wall (029) abutted mill wall (028) from the south (measuring >0.48m long by 0.55m wide). (029) was composed of sub-square and sub-rectangular sandstone (average size 0.28m by 0.2m) which were mortared by a light brown/grey mortar.

4.2.3 Phase 3 – Mid-Late 19th Century. Steam Power

Evidence for the updating and expansion of the power sources required by the mill was unexpectedly revealed within Trench 1 Area C. This evidence consisted of two stone engine-beds (037 and 041) which originally housed a (now missing) steam engine. These beds were placed within basement [079] (Phase 1 above), a phase of work which necessitated large-scale rebuilding of the basement and mill walls (072), the basement's flooring (040), and the provision of access in the form of steps (047) and cobbled entrance (033).

Trench 1 (Plates 2, 7, 8, 9, 10, 11, 12, 13 and 14, Figures 10 and 16)

Two east-west orientated rectangular sandstone machine beds measuring c.1.54m long x 0.92m wide and 0.78m deep were discovered within basement [079] Area C. The beds were spaced 2.8m apart and the northern machine bed (037) had a shallow central rectangular inset in its surface within which were the remains of two iron fixing bolts and two rectangular sunken insets (measuring 0.1m by 0.12m each). The southern one (041) did not have a shallow central rectangular inset in its surface but instead had the remains of four fixing bolts and an arrangement of seven rectangular sunken insets (largest measuring 0.18m by 0.08m). On the northern side of (041) (facing bed (037)) was a shallow (0.08m) semi-circular inset (measuring 0.9m east-west by 0.3m deep) which presumably allowed an internal fly-wheel to spin freely. Both beds were set-upon a raised (0.24m deep) rectangular flooring, with (037) set on two courses of end-on red brick and (041) lying on a block of sandstone.

The installation of these beds had necessitated the rebuilding of the mill wall (045) and its replacement with a red brick rebuild (072), as well as the partial demolition of internal basement wall (069). The flooring (040) was also damaged during these works and new flagging was laid which included a small rectangular sandstone plinth (measuring 0.46m by 0.36m) lying centrally between the two machine beds. In the centre of this small plinth (040) were the remains of a small diameter (0.12m) cast iron column.

An east-west orientated flight of stone steps (047) measuring 2.52m long by 0.8m wide provided external access to the engine room development. These steps (largest measuring 0.8m by 0.7m) descended 1.54m from east-west. An associated compact and sub-square (measuring 1.8m by 1.6m) deposit of tan brown clay and river-rolled cobbles (033) lay immediately to the east of (047).

4.2.4 Phase 4 – Late 19th Century. External Warehouse [071]

The final recorded phase of works involved the construction of a (probable) warehouse [071] to the east of the main mill building within Area A Trench 1. This building is not shown on maps pre-1898 and dates from between 1880 and 1892. Further rebuilding associated with this phase was also observed within Area B Trench 1 where a new step-access point was created (034, 035, 058-060, 063) within the drying kiln [076] with consequential works on the internal flooring of this building also (052, 057 and 073).

Trench 1 (Plates 1, 2, 4, 5, 6, 15, 16, 17 and 18, Figures 4, 8, 11, 13 and 17)

A detached sub-rectilinear structure [071] approximately similar in width to the main mill (internal width of 6.52m) but only half the length (of which 11.9m were exposed during the works), with the southern quarter narrowing to 6m was uncovered within Area A. The bricks making up the remains of the walls (contexts 002, 010, 011, 013, and 015) were laid in English Garden Wall Bond (with a width of 0.48m) and though the majority lay below the carpark ground level those along its eastern elevation survived to a height of approximately 0.50m above ground level. These bricks were ‘frogged’, with a raised moulded name of ‘TYMMS’ (the ‘S’ being in reverse).

The interior floor of the structure was composed of two layers. The uppermost layer (003) was an indurated dark grey asphalt which originally would have served as the floor surface within [071]. (003) had a depth of 0.08m and was incomplete in many areas with only discrete areas surviving. This asphalt lay over an

indurated layer of concrete and river-rolled cobbles (004) which formed the basal layer for (003). (004) had a depth of 0.1m and lay over layer (032).

Running lengthways and central to structure [071] were a series of five square sandstone plinths (006, 007, 008, 009 and 012) measuring 0.54m and 0.17m high. All five had shallow internal square indentations in the upper surface measuring 0.4m square and <2cm deep and all were set within layer (032). These plinths were regularly spaced with a distance of 2.12m separating each stone and a gap of 2.65m between stones (006) and (007) probably denotes a missing stone.

In building [071]'s southern gable wall (013) was a foot-worn rectangular sandstone block (014) (1.14m long by 0.48m wide) which served as an entrance step. To the east of (014) were two rectangular indentations in the floor surface (022 and 023) measuring 0.32m by 0.08m with a depth of 0.09m. In the south western corner to the west of the possible entrance were the remains of drain consisting of a square stone block (019) measuring 0.54m by 0.5m with a central hole (020) housing the remains of a cast iron pipe (018).

Presumably as a consequence of [071]'s construction a new eastern entrance was created into the drying kiln building [076]. This consisted of a short (3 step) east-west orientated flight of rectangular (largest measuring 1.1m by 0.56m) sandstone steps (035), with red brick side-walls (059 and 060) which had been built upon a compact deposit of tan brown clay (058). The original northern wall of [076] was partially rebuilt (034) and a square recess for a hinged-door (063) set within the new wall. The flooring of [076] was also partially remodelled with two levelling layers (057 and 073) added to the east to facilitate the new entrance. Further stone flagging was also added (052) which had partially built-over the original flagging (054).

4.2.5 Post-1892 to Modern

Trench 1

Infill (036) lay in Area C Trench 1 and consisted of a deep (0.86m) deposit of very mixed light grey sand silt mortar with frequent red brick and grey roofing slate with a high proportion of mixed machinery parts probably connected with the cotton processes that would have taken place in or above the area.

Topsoil (001) was a mixed 0.1-0.4m deep dark grey loam with regular red brick. This layer extended into Trench 2.

Carpark surface (075) was a 0.14m deep layer of compact limestone chippings.

Trench 2

Infill (032) in Trench 2 was similar in form to (036) but did not contain any artefacts.

Fill (031) in Trench 2 was unlike other infills seen on the site and contained tarmac within its mid grey silt clay matrix and consequently is assumed to be recent in date.

5. Conclusions

The works proved successful in establishing several key aims of the evaluation. The external walls of the 18th century mill were uncovered and a precise ground-plan and alignment of the southern gable has allowed an accurate extrapolation for the remaining parts to be made. Evaluation of the red brick structure [071] to the east of the mill also helped reveal its function as a probable warehouse.

The evaluation has also helped establish the depth and extent of any surviving archaeology within the area and in particular that the majority of the site (other than the drying kiln building [076]) remains largely in-situ below ground level. Furthermore, the evaluation discovered a surprising level of artifactual survival within the demolition rubble infills and the probability that this situation extends throughout the remaining mill area.

The works included within this archaeological evaluation covered only a small percentage of the Mellor Mill site and it is hoped that the results of this evaluation will stimulate further investigations into this extremely important industrial site.

5.1 Phase 1 – The 18th Century Cotton Mill (1790-1793) [077]

Evidence for the earliest construction of Mellor Mill probably derives from the large-scale excavations of geological/alluvial deposits, potentially from the excavation of the feeder reservoir to the east or other such works. Some of these layers at least (i.e. clay (026)) were used as ground-levelling/foundation layers upon which the mill was built and river gravel (032) would appear to have been used to form the basal layer for a surfaced ‘yard’ area to the southeast of the main mill (see **Figure 9**).

The use of stone for the foundations (walls 028, 045 and 048) and ground-floor build (as shown on **Figure 9**) was a practical matter and would have greatly increased the mills’ load-bearing properties. The depth of these foundations was sufficiently deep to include cellarage [079] which would have further increased these properties with the installation of cellarage cross-walls (069). No documentary evidence exists for the intended use of this cellarage, although its use for storage is a strong possibility (and see Phase 4 below).

5.2 Phase 2 – Probable Early 19th Century. The Drying Kiln [076]

Only partial and incomplete remains of the Phase 2 works were uncovered during the works. As is common with all things connected to Samuel Oldknow attempts had been made to maximise the efficiency and profitability of the mill site. The 1790-1793 corn mill is one such example and it would appear that this operation was extended during the early part of the 19th century to include a drying kiln which was built over the wheelrace for the corn mill. No corn drying kiln tiles were recovered during the works, however the area as a whole was only partially covered by the excavation area and had also suffered from extensive stone-robbing/damage events.

The exterior access to the drying kiln was gained via steps (055), and the entrance was aligned parallel to the main mill building. These steps had been rebuilt during the Phase 3 works (below) but seemingly replaced in their original position so that access to the drying kiln could still be gained at this point.

5.3 Phase 3 – Mid-Late 19th Century. Steam Power

Perhaps the most unexpected of the discoveries made during the works was the finding of two steam engine beds within basement [079]. Although Ordnance Survey mapping and sale plans from 1867 onwards record the operation of steam power within the mill, it had been assumed that these had been housed within the specifically built engine house to the north of the mill.

The installation of these engines was a sizeable operation and involved the demolition and rebuild of the mill walls, basement flooring and a host of unseen internal designs in order for the drive shafts to transmit their power through the mill. The finding of these engine beds within the mill itself is further evidence of the almost insatiable appetite of cotton mills for a regular and increased source of power at this time, a similar appetite to that which had initially determined Samuel Oldknow's choosing and development of the Mellor Mill site.

Due to the limits of excavation it is unknown whether the installation of the engines here served to supply a particular local power demand, or whether other basement areas of the mill building were similarly utilised to house steam engines and their concomitant machinery. It would appear certain however, that from the mid- 19th century onwards the previous water-power supply of the mill was deemed insufficient and/or irregular and steam power was invested in to supplement the demand. The fact that the first steam power references are not made until the rather late date of 1867 is a testament to the plans and designs of Oldknow's grandiose water-power system.

5.4 Phase 4 - Late 19th Century. External Warehouse [071]

Building [071] is a post-1880/pre-1898 construction which appears on several photographs of the age (including the front cover of this report) and is of single storey build with no cellarage. Evidence for the date-range comes from both cartographic and archaeological sources. The type of brick used to construct the external walls of the structure denote a date of manufacture in the latter part of the 19th century and Ordnance Survey mapping of the site does not depict the building until the map of 1898 (after the mill was destroyed by fire). As the previous Ordnance Survey map was undertaken in 1880 a secure date between this and the date of the fire in 1892 seems assured. The bricks for this build were produced by the Tymm family brickworks of Rose Hill Marple, whose works lay on the site of the present council tip (Ashmore, p.64).

Evidence for its function is somewhat less assured, and its interpretation as a warehouse is partly based on negative evidence for other usages. No evidence in the form of fittings or wear-marks was found which would suggest that the building housed either cotton processing machines or steam engines. Furthermore, the insubstantial flooring of the building would not be suitable for either of these purposes.

It is possible that the Phase 3 mid-late 19th century developments within the main mill building had begun to limit the space needed for storage. This possibility is suggested by the findings within Trench 1 Area C and the installation of steam engines within the main mill building. This development would suggest that both power and space were limited and that areas previously used for one purpose were becoming utilised in other ways. If this demand for space in order to house new forms of power had begun to impact upon previous storage areas (and it is interesting to note that one such storage area lay immediately to the west of Area C, building 12 (a), **Figures 5 and 6**) then it would be a quick and relatively inexpensive solution to build a single-storey external warehouse in order to resolve the problem.

The associated phase of access-works within the drying kiln building [076] to the south of building [071] may denote that at least some of the new storage facility was utilised for cereals.

5.5 Post-1892 to Modern

The destructive fire of 1892 and the subsequent ruin and demolition of the Mellor Mill have left both positive and negative archaeological evidence. As to be expected large-scale stone-robbing has taken place over many years and evidence for this was found in both Trench 1 and 2, as well as in the visible remains of the mill outside of the excavation areas. Trench 1 Area B in particular has suffered major stone loss (**Plate 7**).

On a more positive side, the rapid fire and partial collapse of the mill has abetted in the survival of many fittings and artefacts associated with the mills' works which would normally be assumed to have been removed if a more long-termed and thorough clearance of the mill had taken place. Although sifting of the demolition has taken place (see Appendix 3) and the larger and more valuable scrap artefacts removed, a large amount of smaller fixtures and fittings remain within the demolition deposits.

5.6 Summary of Potential

The high level of survival of the building foundations together with a dense assemblage of artefacts associated with the cotton mill machinery provides excellent research potential for further works on the site. Although some scrap recovery and stone-robbing events have taken place, the surviving remains provide an unusual time-capsule of mill artefacts and features due to the rapid abandonment of the mill following the fire of 1892. These well-preserved remains would lend themselves aptly to community archaeological participation.

6. *Archive*

The records are archived by Stockport MBC at the Stockport Story Museum, Stockport under the site code MM 09. It is the aim of MAT to have digitised copies of all archaeological reports available for viewing and download on the Mellor Archaeology home website at mellorheritage.org.uk.

The finds from the evaluation will be held by Bernard Sewart of the RLLP and Stockport Story Museum.

Copies of this report will be sent to all concerned parties. Further copies are available upon request at the GMAU offices.

7. *Bibliography/Sources*

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Unwin G, 1924, *Samuel Oldknow and the Arkwrights: the Industrial Revolution at Stockport and Marple*, The University Press, Manchester

Maps:

1849 Tithe Map

Ordnance Survey 1880 1:25,000 Map (Derbyshire)

Ordnance Survey 1898 1:25,000 Map (Derbyshire)

Ordnance Survey 1907 1:25,000 Map (Cheshire)

Ordnance Survey 1923 1:25,000 Map (Derbyshire)

1867 plan (from sale of mill and estate)

Trade Directories:

Pigot and Co. Cheshire and Derbyshire 1828-1829

Pigot and Co. Derbyshire 1835

Pigot and Co. Derbyshire 1842

Directory of Manchester and Salford 1853

Post Office Directory 1855

Harrod and Co. Derbyshire 1870

Directory of Stockport District 1887

Kelly's Directory Derbyshire 1891

8. *Acknowledgements*

The excavations were directed by Peter Noble and supervised by Brian Grimsditch and Phil Cooke (all UMAU). The report was written by Peter Noble and Brian Grimsditch. The project was monitored by the County Archaeologist for Greater Manchester Norman Redhead (GMAU).

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Appendix 1: Plates



Plates 1 and 2: Aerial view showing Trench 1 (top) with areas highlighted (below). Viewed from the west.
Photo Adam Stanford



Plate 3 (top): Showing Area B viewed from the northwest, with stone (048) in the foreground. Photo Adam Stanford

Plate 4 (below): Showing steps (035), flagging (052) and bricks (060) within Area B. Photo Adam Stanford



Plate 5 (top): Area B viewed from the west

Plate 6 (below): Detail of steps (035) with flag floor levelling layer (057). Viewed from the northwest.
Photo Adam Stanford



Plate 7: Overhead showing steps (047), steps (055) and cobbled area (033). Note robbed-out/damaged area (30) to the left. Photo Adam Stanford



Plate 8: Detail of steps (047) and wall (048), with Phase 2 steps (055), cobbled area (033), and levelling layer (032) in the background. Viewed from the northwest. Photo Adam Stanford



Plate 9: Overhead of Area C with levelling layer (032) to the south. Viewed from the northwest. Photo Adam Stanford



Plate 10: Area C detail of engine room north facing wall (045) and red brick rebuild (072) with (040) in the foreground. Photo Adam Stanford



Plate 11: Area C detail of engine room floor (039) showing (040). Photo Adam Stanford



Plate 12: Detail of engine bolts in engine bed (037) Area C. Photo Adam Stanford



Plate 13: Overhead of Area C showing engine beds (037) and (041), floor (039) and walls (042) and (069).
Photo Adam Stanford



Plate 14: Area C viewed from the southeast. Showing engine beds (037) and (041), floor (039), infill (036) and wall (069). Note break in wall (069) to right of figure



Plates 15 and 16: Area A showing (top) probable warehouse [071] and internal flooring (003) and (004) (below). Photo Adam Stanford



Plates 17 and 18: Area A showing (top) detail of pillar base (009) and (below) detail of brick build in warehouse wall (002) [071]. Photo Adam Stanford



Plate 19: Trench 2 overhead showing western corner of Mellor Mill wall (028), abutting wall (29) (bottom left) and clay layer (026). Photo Adam Stanford



Plate 20: Showing alignment of mill walls in Trenches 1 (background) and 2 (foreground). Viewed from the northwest. Photo Adam Stanford

Appendix 2: Figures

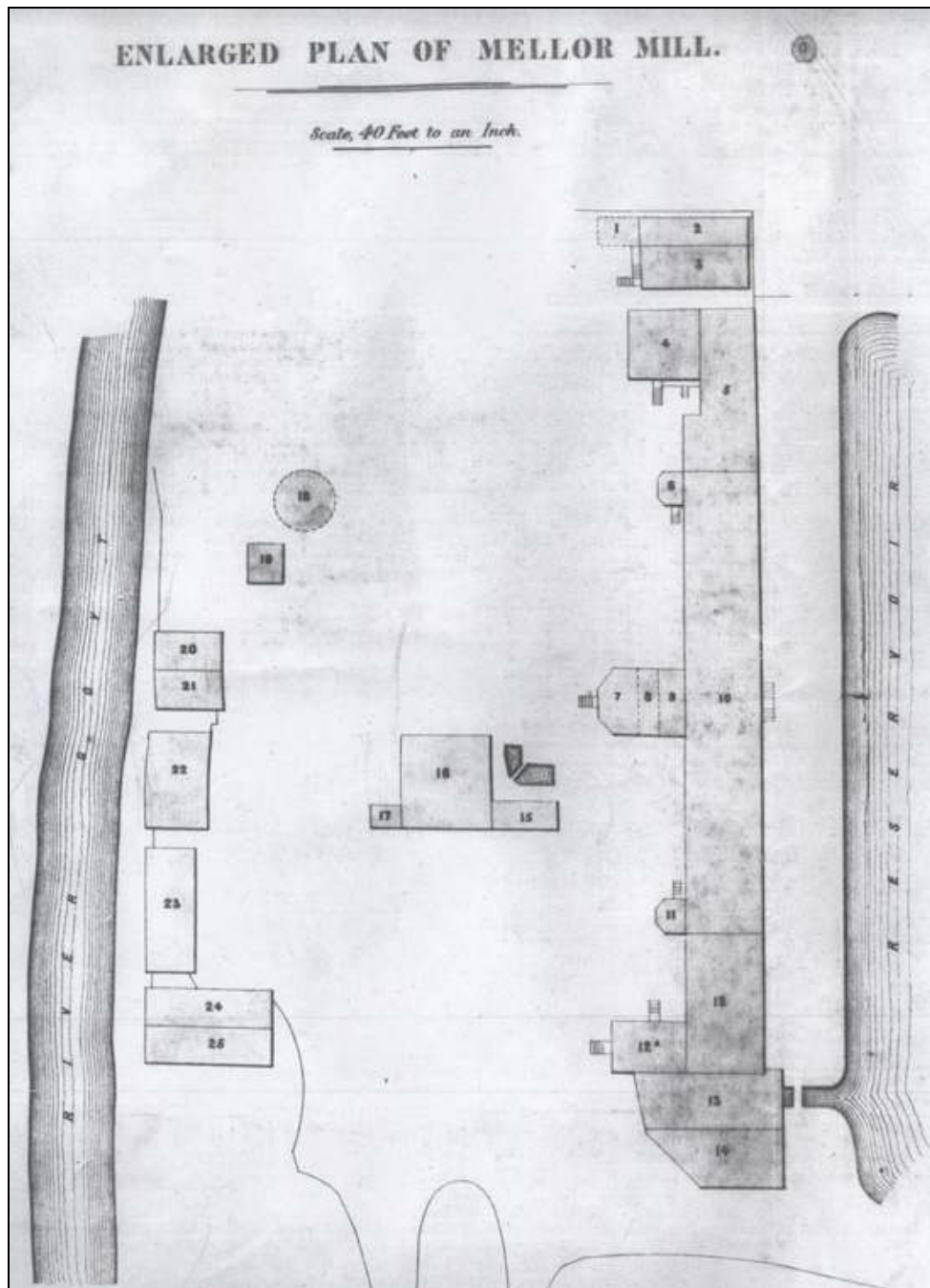


Figure 2: Detail from 1867 plan of Mellor Mill site. Note wall alignment of wheelrace and drying kiln building 13 with buildings 12 and 12 (A) (bottom right). The corn mill is building 14 (extreme bottom right)

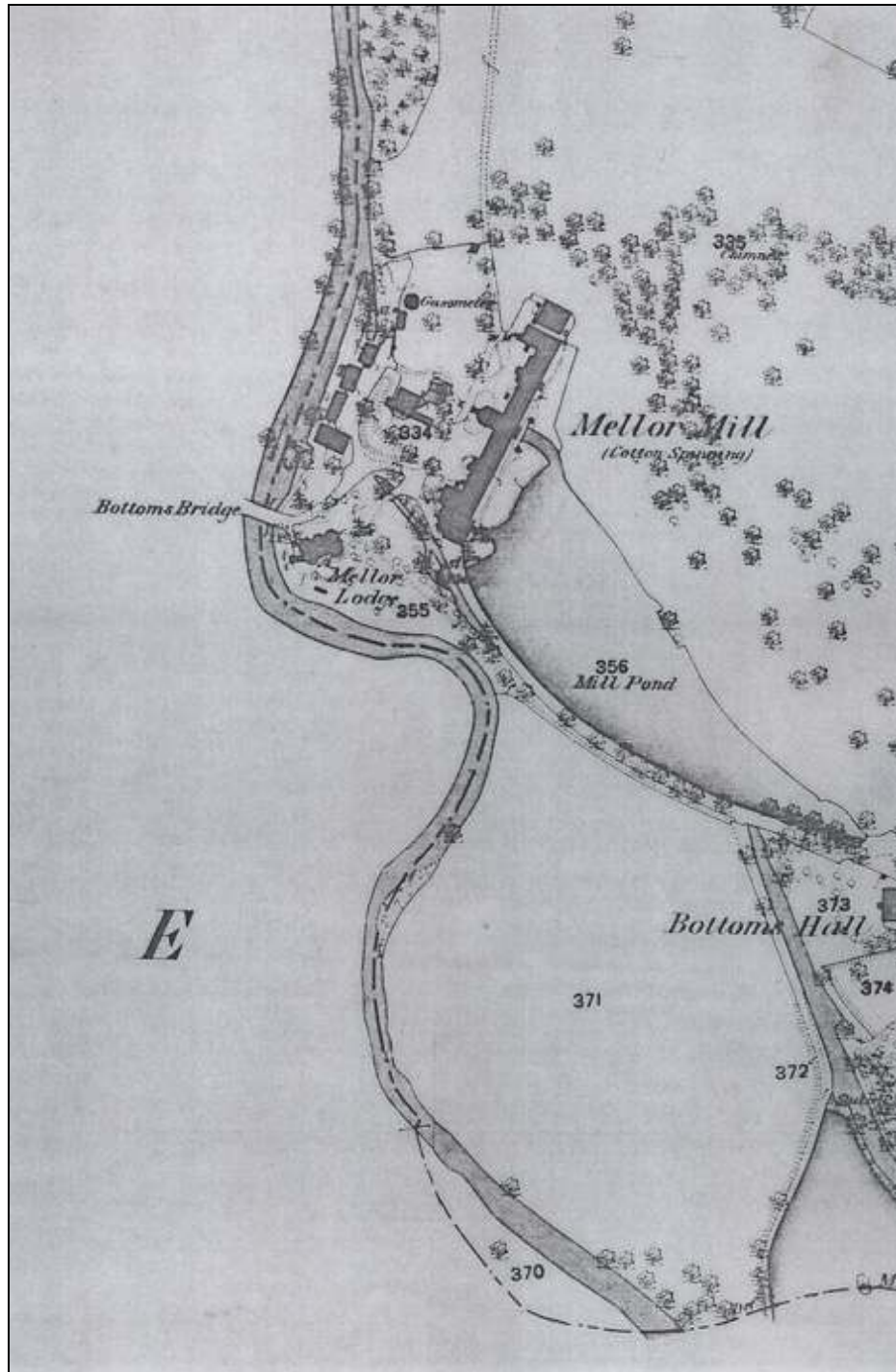


Figure 3: Detail from OS 1880 map of Mellor Mill

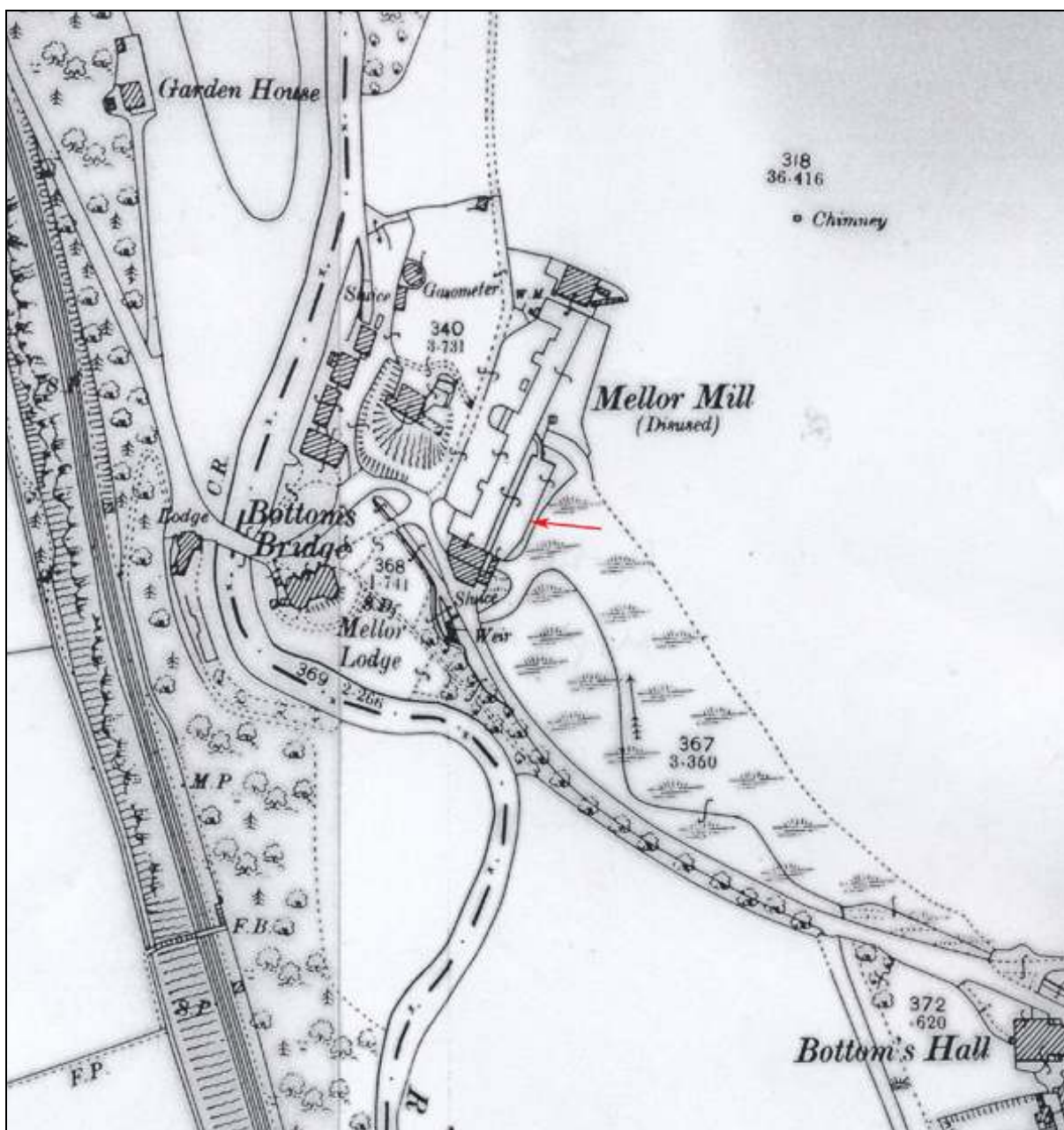
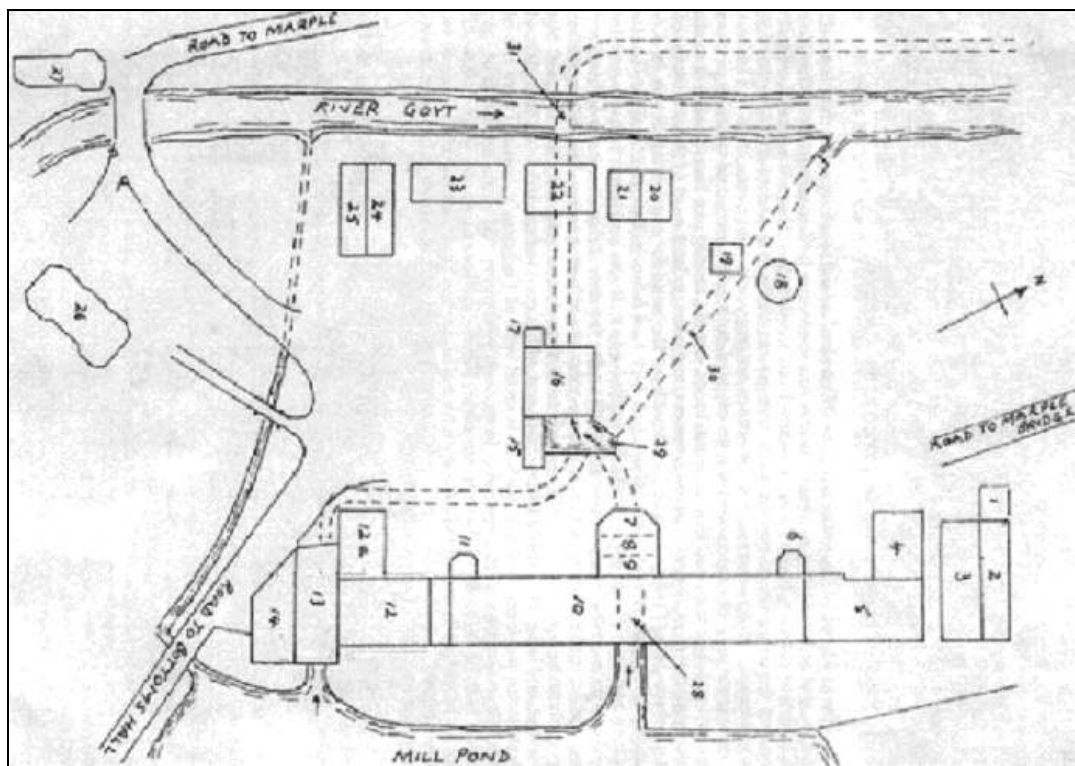
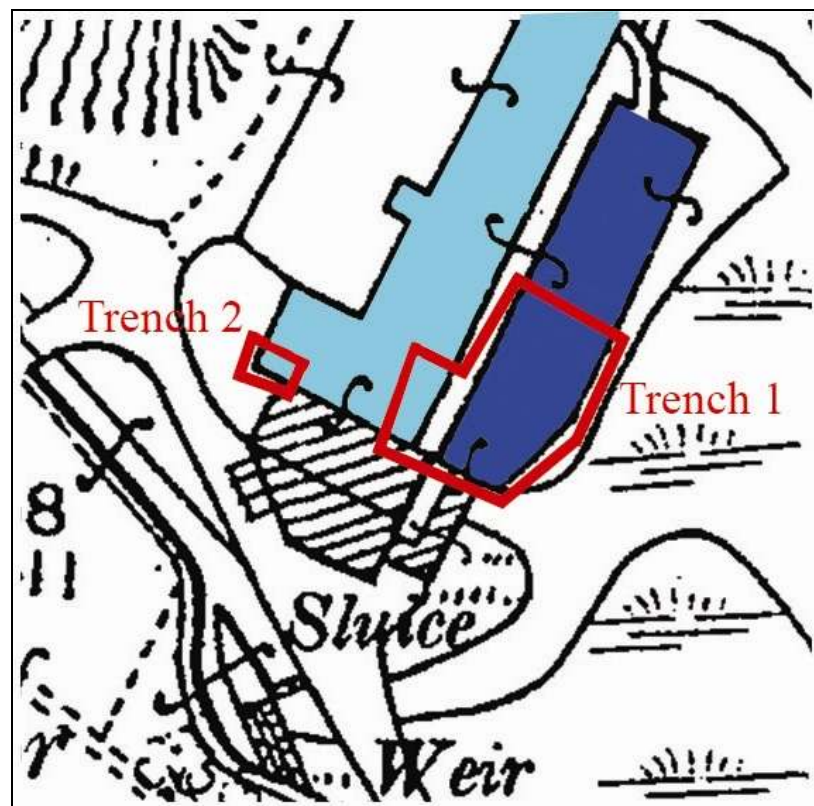
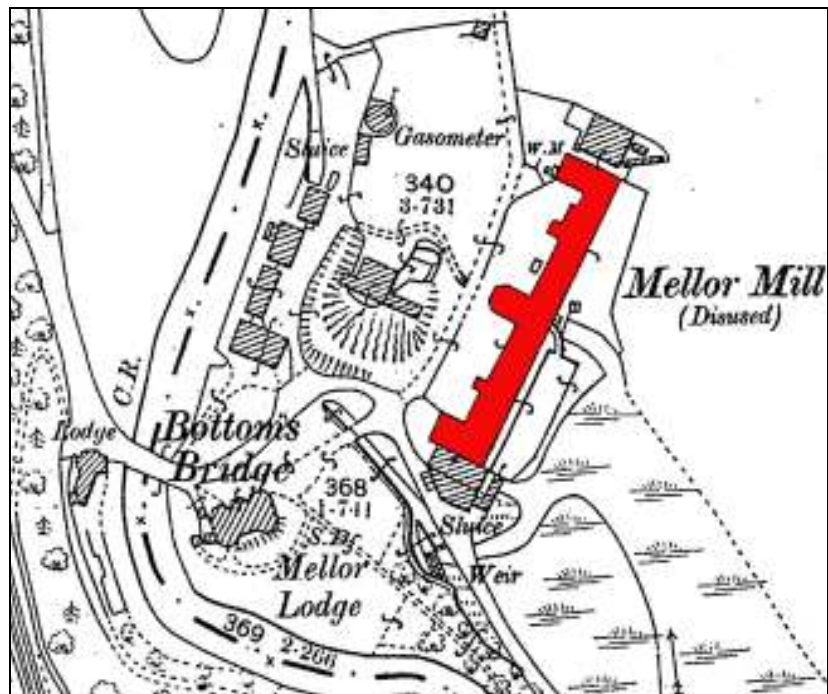


Figure 4: Detail from 1898 OS map of the Mellor Mill. Note arrival of probable warehouse [071] (arrowed)



No.	1st STOREY	2nd STOREY	3rd STOREY	4th STOREY	5th STOREY	6th STOREY	7th STOREY
1	Coal Place						
2	Boiler House						
3	Engine House						
4	Cotton Rooms						
5	Blowers						
6	Stairs						
7	Offices						
8	Passage						
9	Store & Making up Rooms						
10	Throstles						
11	Stairs						
12	Throstles						
12a	Warehouse						
13	Wheelrace & Drying Kln						
14	Corn Mill						
15	Shaft Shed						
16	Wheelrace						
17	Ditto						
18	Gasmeter						
19	Retort House						
20	Warehouse						
21	Cottage						
22	Mechanics' Shop						
23	Workshop						
24	Warehouse						
25	Stables & Coach House						
ADDITIONAL DETAILS							
26	Mellor Lodge, Oldknow's House.						
27	Marple Lodge.						
28	Position of Waterwheel in Mill Basement.						
29	Water Junction.						
30	Tunnel to take water to river from upper wheelpits.						
31	Tunnel under river discharging into the river at a lower level some distance downstream						

Figures 5 and 6: Schematic plan of mill complex (top) with key (below). Both taken from Ashmore O, 'Historic Industries of Marple and Mellor', 1989 (Revised Edition) p.34-35, original from 1867 sale plan.



Figures 7 and 8: Showing highlighted site of the main building of the Mellor Mill (top) and trench location (below). Taken from Ordnance Survey 25in Maps of Derbyshire 1896 to 1900



Figure 9: Artist impression (Francis Jukes) of the southeast facing façade of Mellor Mill c.1803, showing stone built ground floor and red brick superstructure

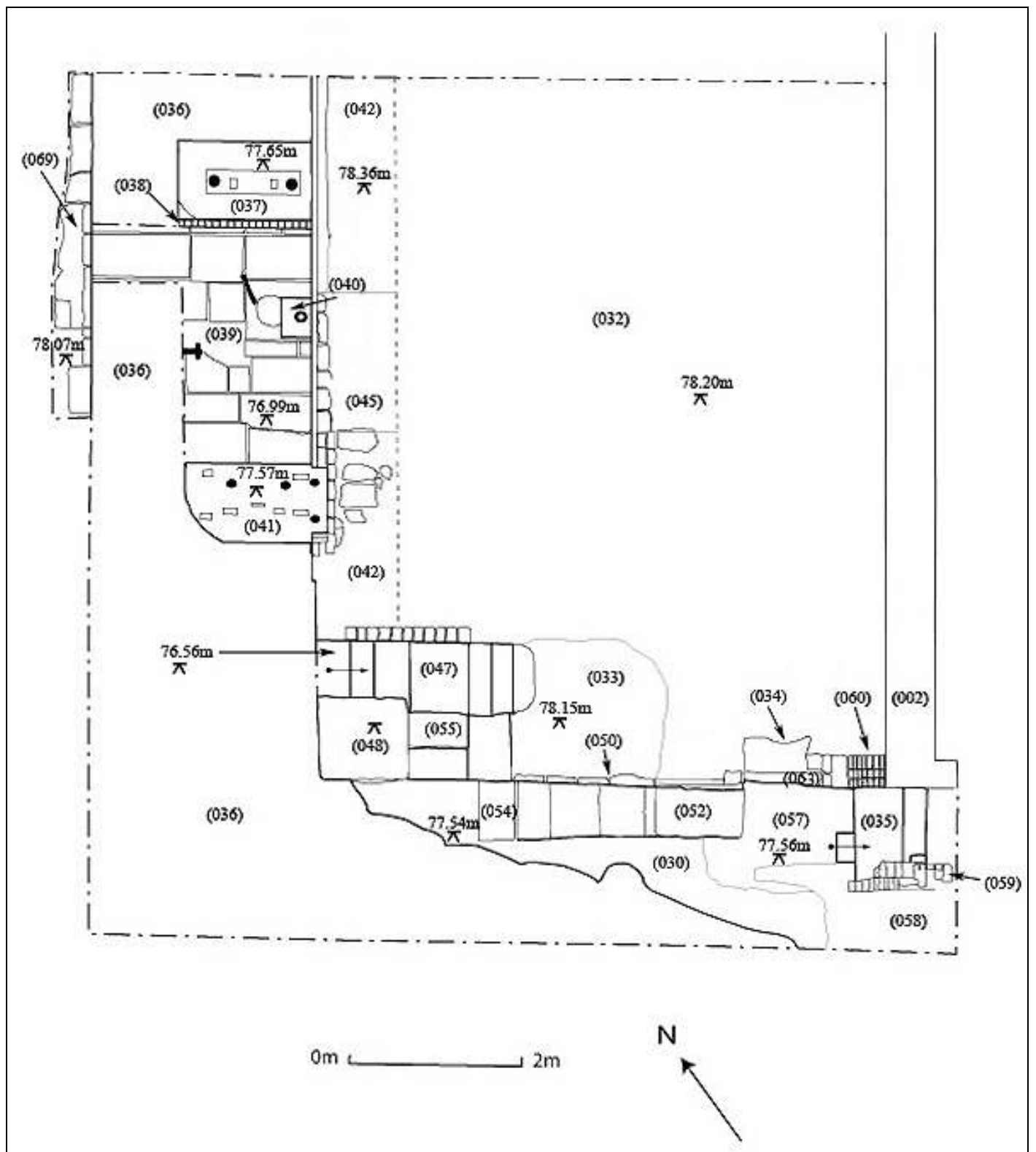


Figure 10: Part plan of Trench 1 showing Areas B, C and D

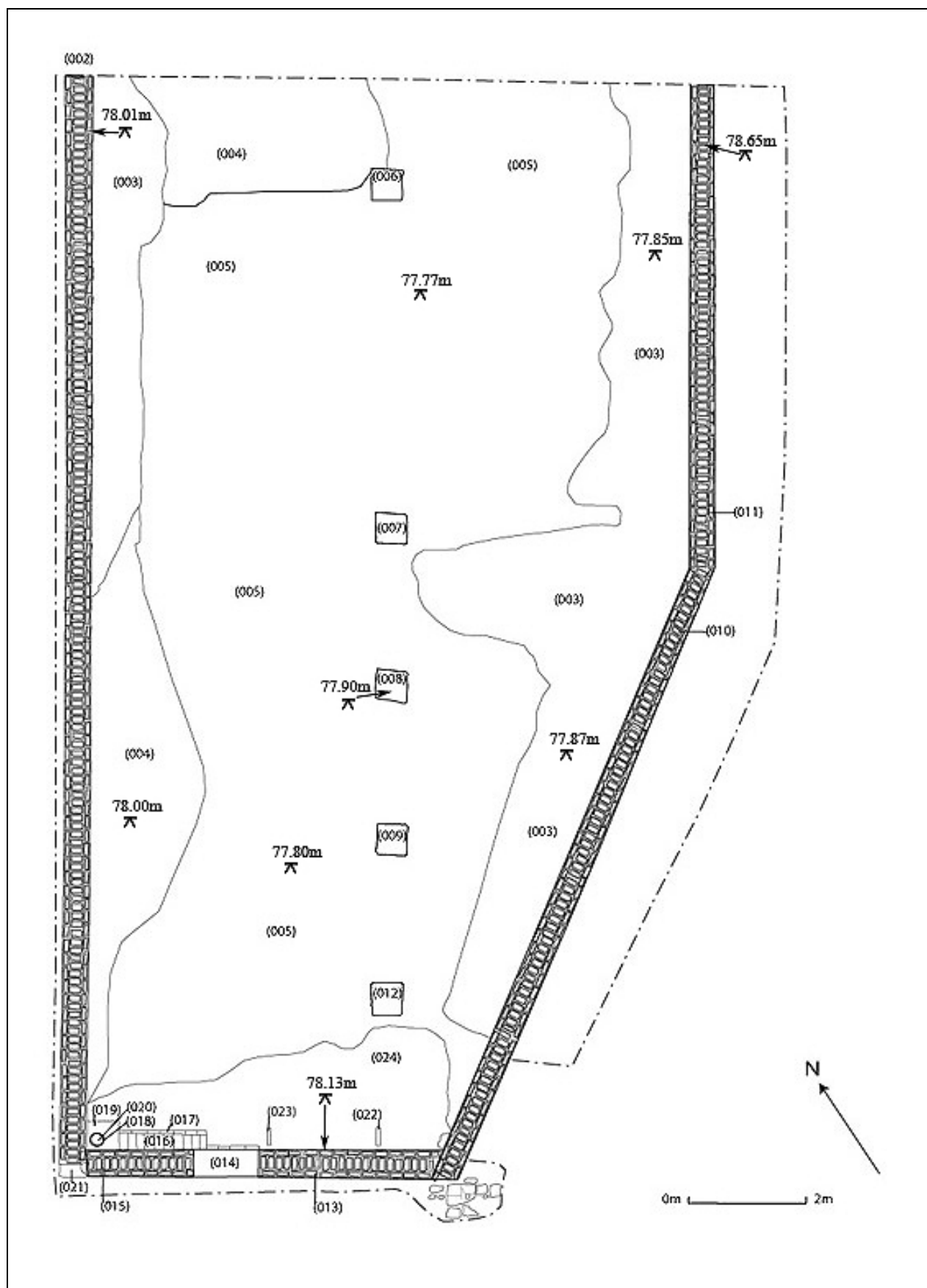


Figure 11: Part plan of Trench 1 showing Area A

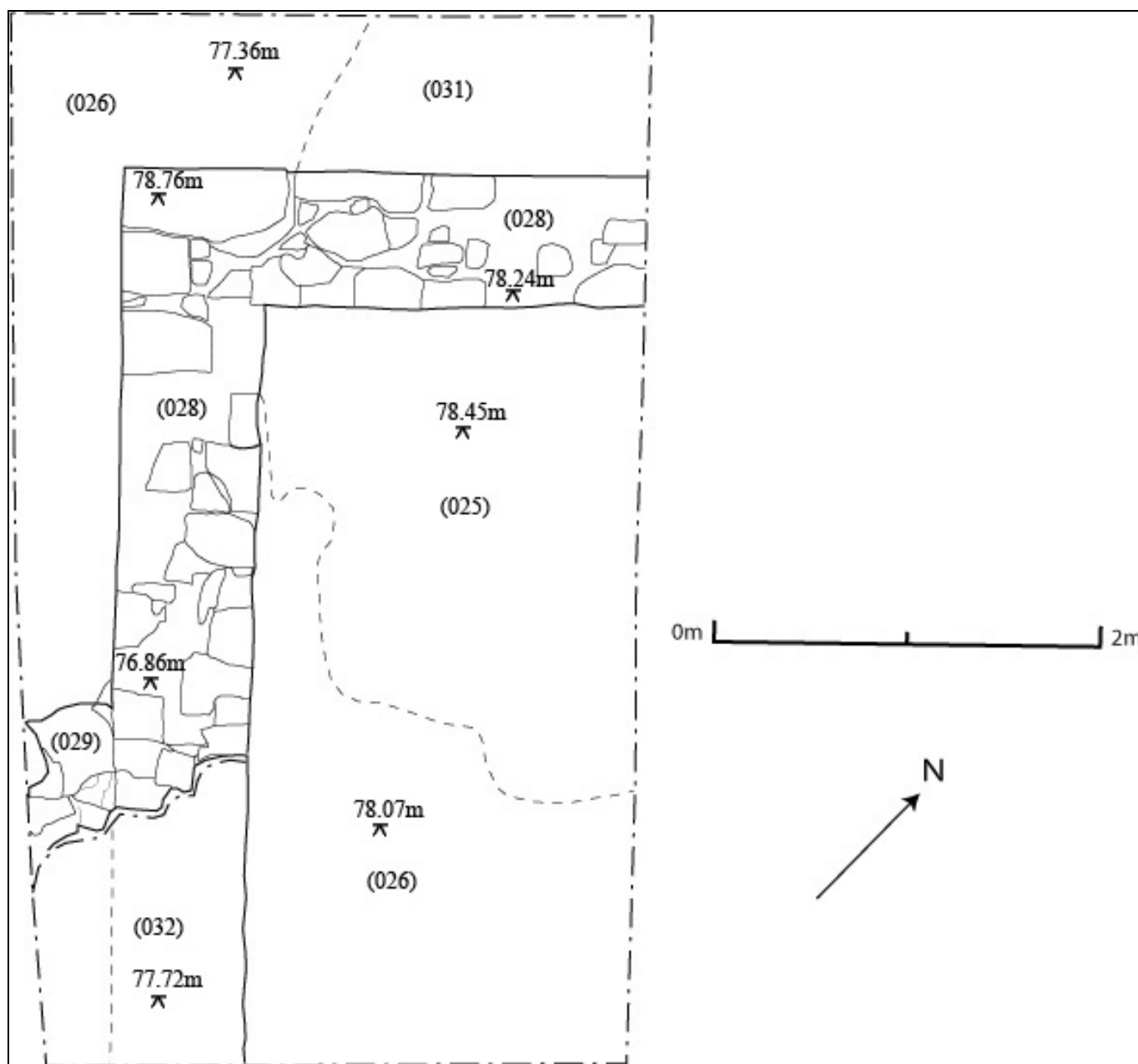


Figure 12: Plan of Trench 2

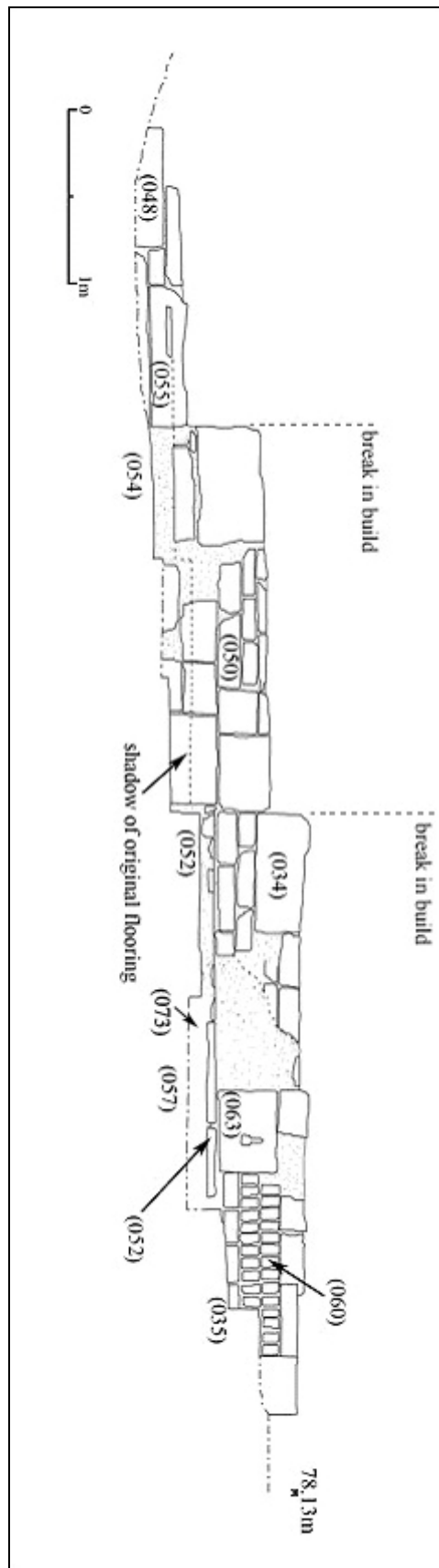


Figure 13: West facing section Area B

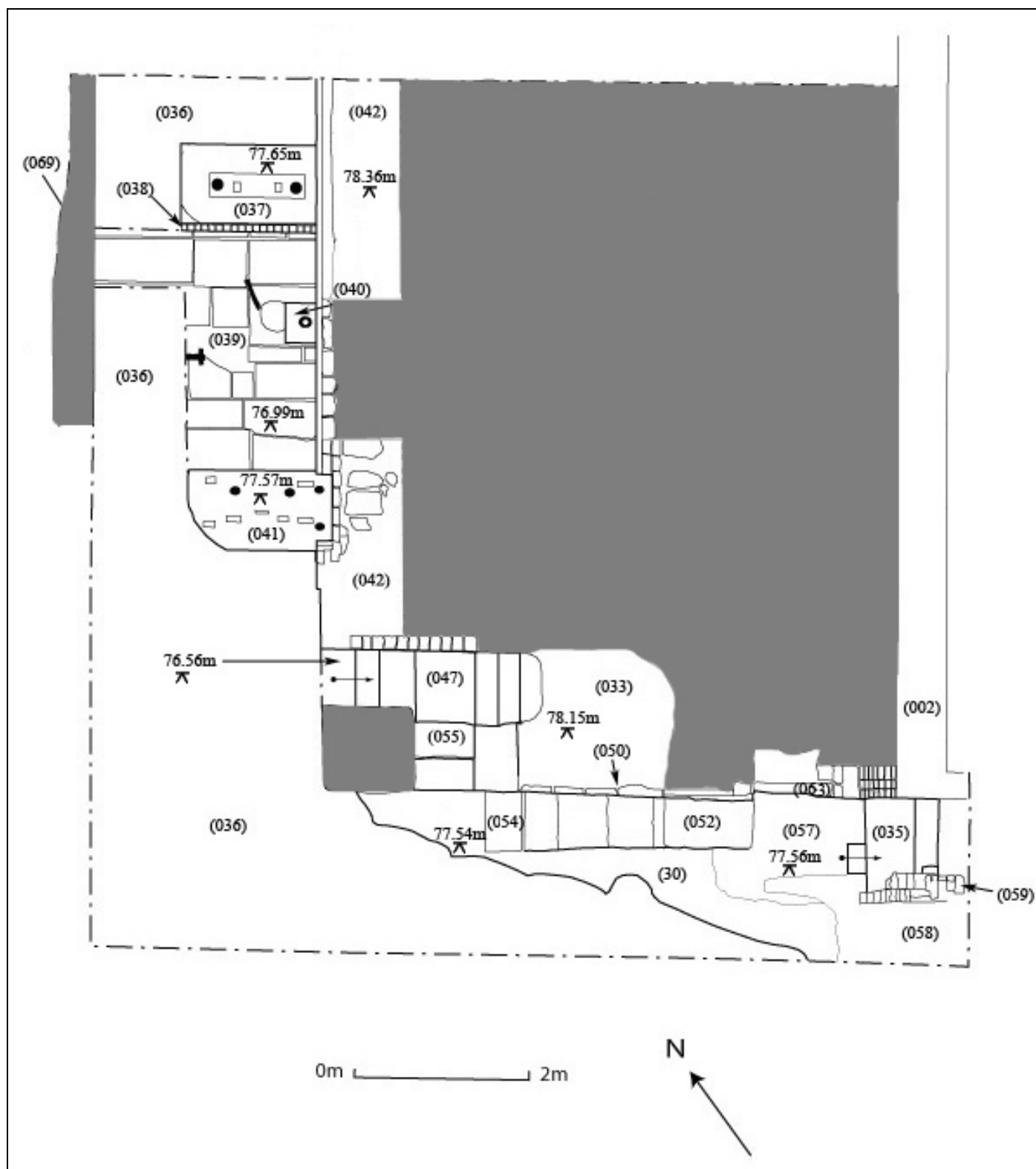


Figure 14: Plan of Areas B, C and D showing (highlighted in grey) Phase One Mellor Mill

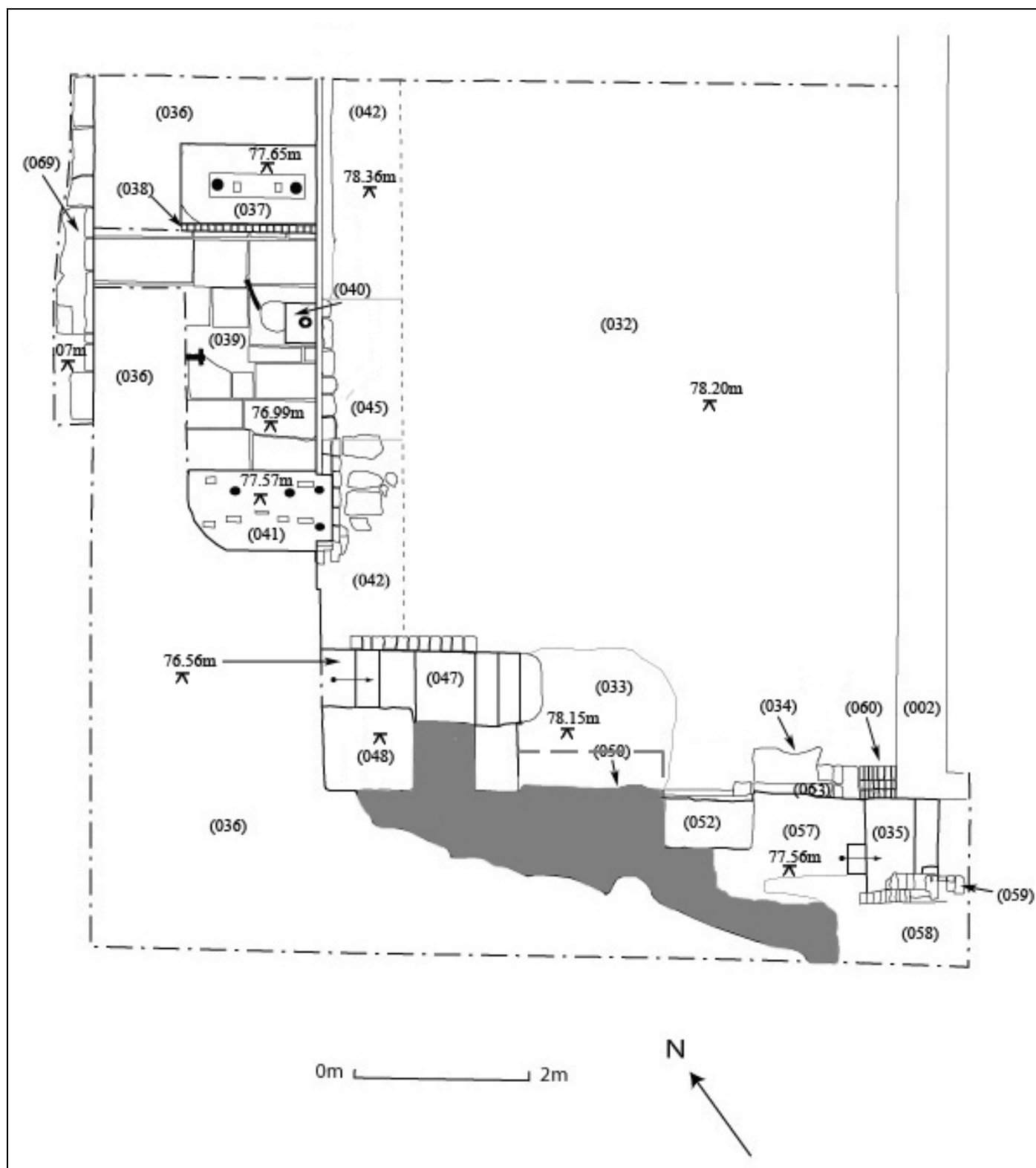


Figure 15: Plan of Areas B, C and D showing (highlighted in grey) Phase Two Mellor Mill. Dashed line denotes probable width of wall (050)

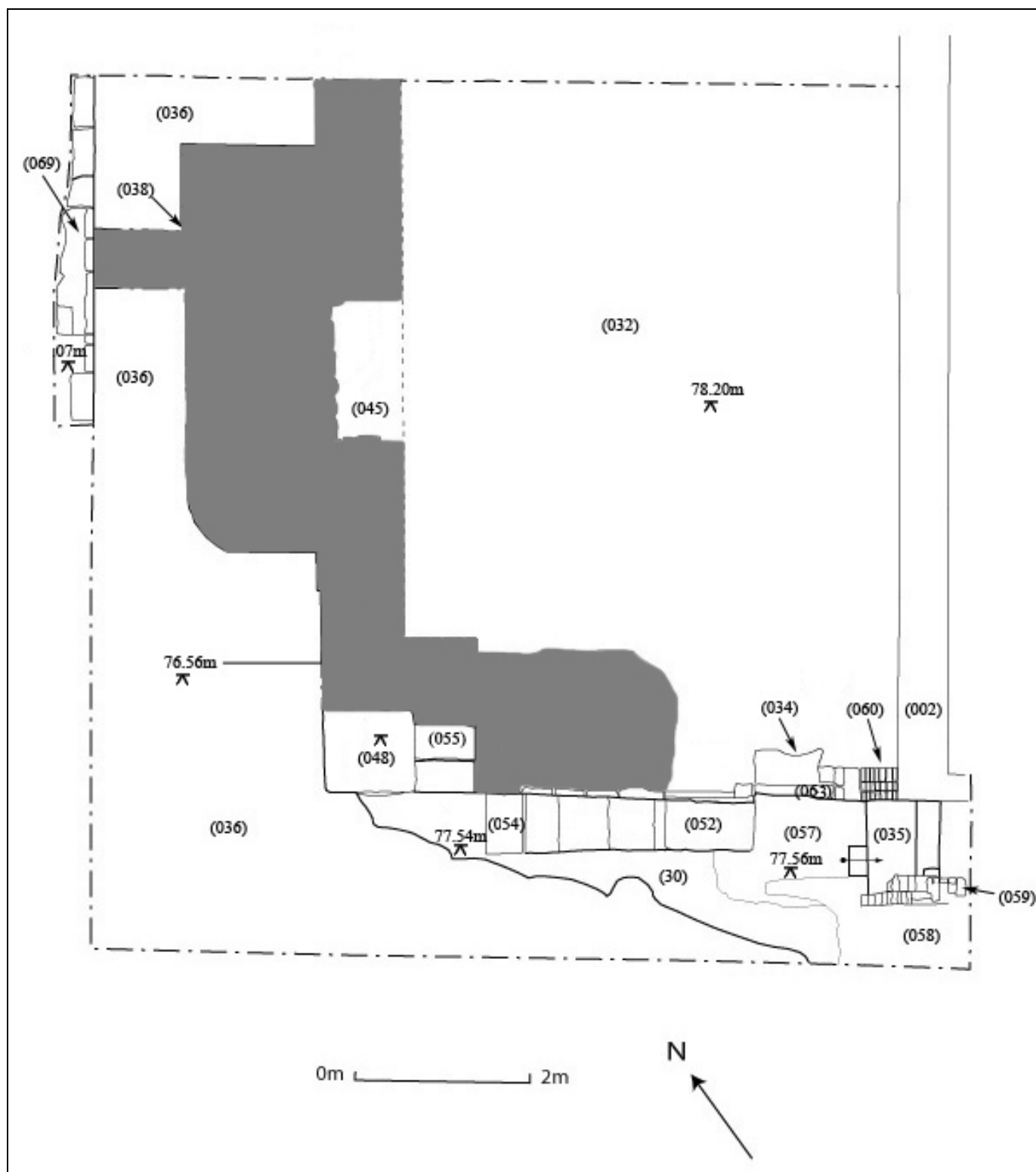


Figure 16: Plan of Areas B, C and D showing (highlighted in grey) Phase Three Mellor Mill

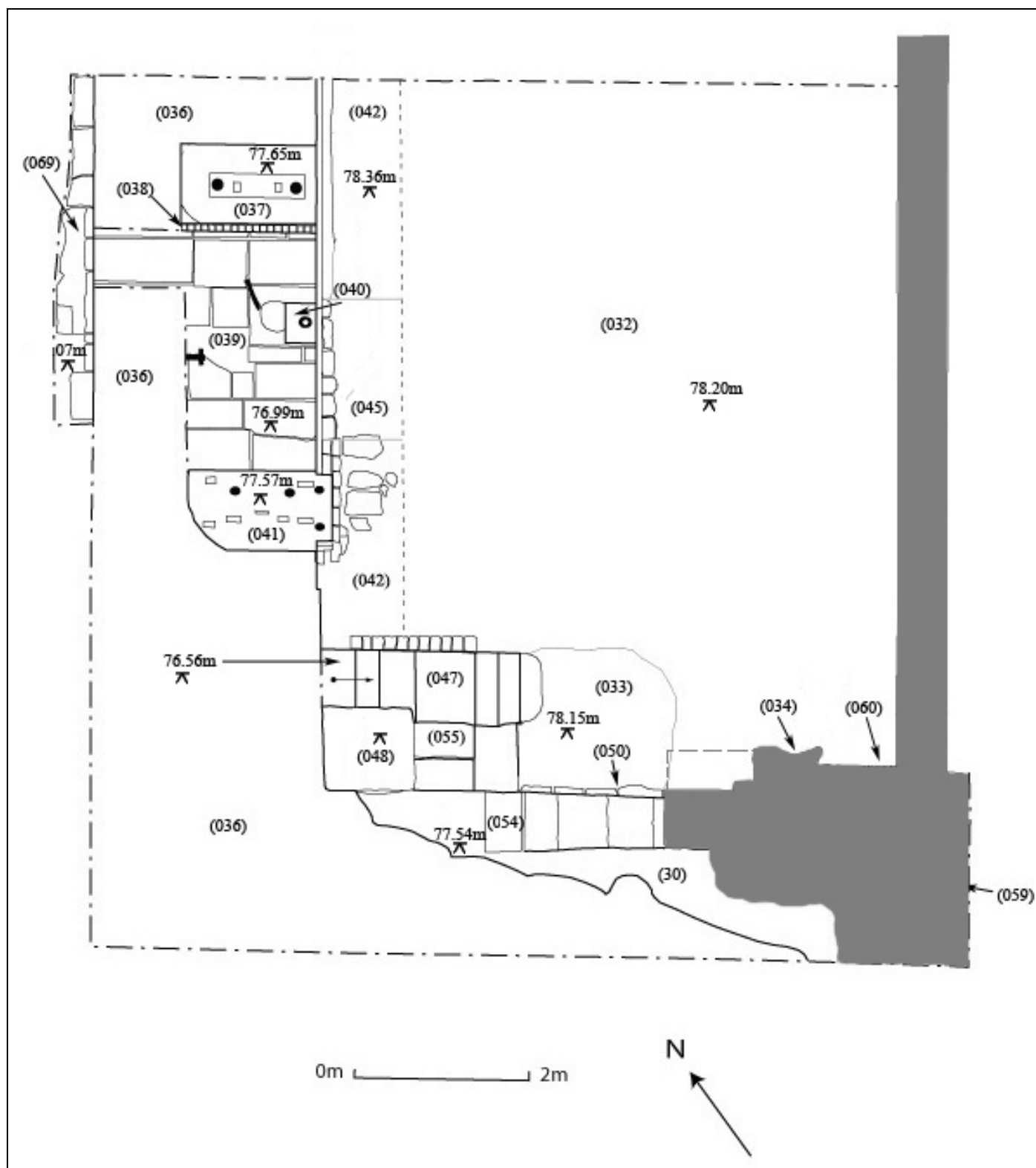


Figure 17: Plan of Areas B, C and D showing (highlighted in grey) Phase Four Mellor Mill. Dashed line denotes probable width of wall (034)

Appendix 3: Finds Report

A Report by Ian Gibson

Initial considerations

It is well-recorded that the Mill was destroyed by fire in November 1892 having relatively recently been re-equipped with a great deal of new textile machinery.

In 1887 Worrall's directory shows the Mill as having 26,656 spindles 16"/32". This suggests that the range of cotton yarn being produced was between English Cotton Count 16 and ECC 32. An ECC 1 means that 1 hank (840 yards) of yarn weighs 1lb --- ECC 2 means that 2 hanks (1680yards) of yarn weigh 1 lb – and so on. The range 16/32 would be regarded as in what was called the "medium count" range.

It is not clear whether the Mill was entirely mule spinning in 1887, but if it was the number of spindles cited would imply somewhere in the region of 28 mules (not all with the same number of spindles). Mules were normally operated in pairs, although space limitations in an older mill could force an odd number (resulting in what was called a "single wheel").

The Mill was not of the construction known as "fire-proof" (a term best interpreted as meaning "somewhat fire-resistant") and it would appear that the timber floors collapsed taking all machinery down to the lowest level.

There appear to have been either two or three floors above the basement level in the area excavated. Unfortunately detailed floor layout arrangements for the period immediately preceding the fire have not survived so it is uncertain precisely what machinery was located in different areas of the Mill. However, in the excavated basement were substantial entablatures indicating that it was likely that a steam engine had been in place here. It is worth, therefore, considering what the immediate aftermath of the fire would have been likely to reveal.

Contemporary reports indicate that the main central section of the Mill was entirely burnt out by a fire that was beyond control and therefore all timber structures, floors, and roof, would have been consumed leaving the line shafting and machinery to fall as far as they could with much of the slate roof on top of them. However, the level of fire damage to the south west section of the Mill from which the machinery finds were extracted is less certain. If the two or three timber floors originally above the excavation did indeed collapse and if each of the floors contained line shafting and textile machines then this would have resulted in a very large pile of debris – far too much to be contained within the height of the basement.

In a mill of this age much of the lineshafting would have been malleable iron which tends to bend rather than fracture, so if internal walls survived some line shafting could have been hanging down from higher levels. Similarly many preparatory, spinning, & winding, doubling, and gassing machines are of considerable length and their own internal shafts would hold large sections of such machines together.

In what follows it will be seen that the finds indicate the remains of gassing frame(s) and possibly winding frame(s). These tend to be long machines and 10m (or 33ft) long would not be a particularly large machine.

These would be driven from one end from the overhead lineshafting using a fast & loose pulley arrangement to allow starting and stopping each machine while the lineshafting continued to rotate at constant speed. Machines of this type themselves contain long malleable shafts (but of smaller diameter than the lineshafting). As a result the bulk of such machines tend to stay together in a long twisted mass with many smaller components broken off when they fall through the burning floors of a mill. Thus it can be imagined that if there was a steam engine in the lowest level it would have been buried beneath the twisted debris of these quite lengthy gassing and winding frames. There would have been a huge quantity of smaller components, both loose rollers, weights, and broken parts. Lying across these, and also probably hanging down from any remaining internal structural walls would be lineshafting with lots of flat belt pulleys and the whole covered in building debris, fractured cast iron columns etc.

Finds which were not recorded, but which would be expected if the remains had been buried without further intervention include:- line shafting (long lengths generally ranging from 38mm (1.5 inches) to 75mm (3 inches) in diameter; driving, and driven pulleys in the range circa 150mm (6 inches) to 500mm (18 inches) in diameter; line shafting hangers, parts of cast iron columns, and brass bearings; broken cast iron machine frames; machine shafts (generally smaller diameter than line shafting and in the range 12mm (0.5 inches) to 30mm (1.25 inches); both broken and intact gear wheels of various sizes and types; and at least one maker's nameplate per machine.

The Finds

Gassing Frame(s)

These were machines which transferred cotton yarn from one package to another during which process the yarn was passed through a gas burner. Quite an early and small version of such a machine is shown in the 1866 Cyclopaedia of Useful Arts & Manufactures (Plate 1).

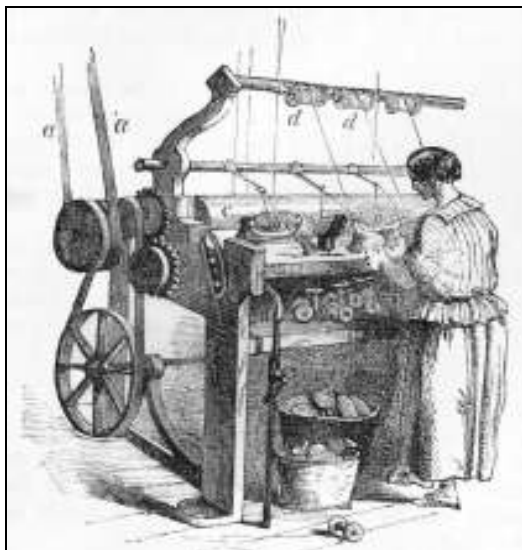


Plate 1 Small Gassing Frame dated 1866 but probably reprinted from 1852

The purpose was to singe off all loose fibres from the surface of the yarn leaving a very smooth yarn with a “polished” appearance. This also had the effect of increasing the count of the yarn because the loss of fibre

reduced its weight per unit length. Thus the English Cotton Count 32 which seems to be indicated as the finest yarn produced at Mellor in 1887 could easily become ECC 35 or more after gassing.

One gas burner was provided per strand of yarn and the machines of this period were invariably double-sided. Thus a 110-head machine would have 55 heads on each side. Such a machine would be about 10m (33ft) long, but rather less than 2m (around 5ft) wide and it would weigh around 2.5 tonnes. With 110 burners it was essential that such a machine had an overhead duct (usually made of sheet metal) which took the heat, the combustion gases, and ash from the burnt cellulose (cotton) away and out of the building to a quenching tank (for the avoidance of fire). Notwithstanding this precaution gassing frames carried a very high fire risk and to that end they were often segregated from other machines by brick or stone walls within the Mill. However, if all the gassing frames were indeed housed on upper floors above the area excavated it seems most unlikely that the fire was caused by one of them, or their immediately adjacent gas supply equipment, since this area of the Mill seems to have suffered less fire damage than the main central section.

One of the most important elements of a gassing frame was the need for each strand of yarn to run through the gas flame at the same speed, and for that speed to remain constant. Up until recent times constant yarn speed on such as a Gassing Frame was invariably achieved by using the surface drum driving principle. Thus if the yarn was to be wound onto a wooden bobbin the bobbin would be weighted against an iron pulley running at constant speed from the Mill shafting. Thus the bobbin is driven gradually more slowly as the diameter of the package of yarn on it increases but the linear speed of the yarn as it is wound onto the bobbin stays the same all the time. Unfortunately no pulleys of any description have been found in the excavation. Other components required on Gassing Frames include one gas tap for every burner, and a method of swinging the burner away from the yarn when piecing up a broken end. At least one Gassing Frame of some size must have been in Oldknow's Mill, because one of the most obvious, numerous, and easily identifiable finds is a large number of gas burners, gas taps, and brass/copper pipes. These appear to be the "atmospheric pattern" of burner used on gassing frames (Plate 2).



Plate 2 Gas Burners, taps and piping from the excavation

These burners are fed with coal gas and take in air for combustion local to the burner (much like a modern gas cooker). They are very similar to burners shown by Dobson & Barlow in Plate 3.

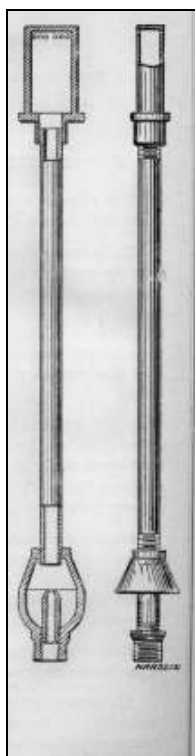


Plate 3 Atmospheric Burners by Dobson & Barlow

The alternative form of burner involves the gassing frame being equipped with a gas/air mixer which feeds a stoichiometric mixture of coal gas and air to the burners, thus dispensing with the need for any take up of air local to the burners, but their appearance is usually quite different from the ones found. However, such other castings as were found do not seem to be of the pattern used by Dobson & Barlow. Three adjustable feet came out of the excavation (plate 4) and they are very similar to ones used by Asa Lees on their Gassing Frames (Plates 5 & 6) although the machine shown dates from around 1920.



Plate 4 One of three adjustable machine feet found in the excavation

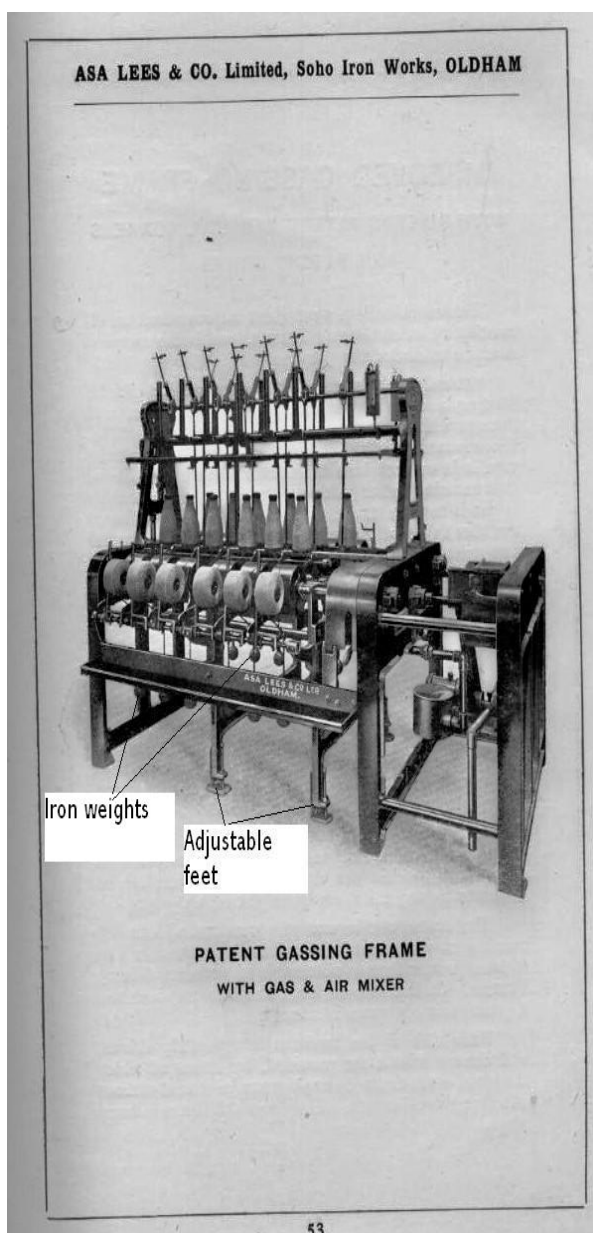


Plate 5 Gassing Frame by Asa Lees

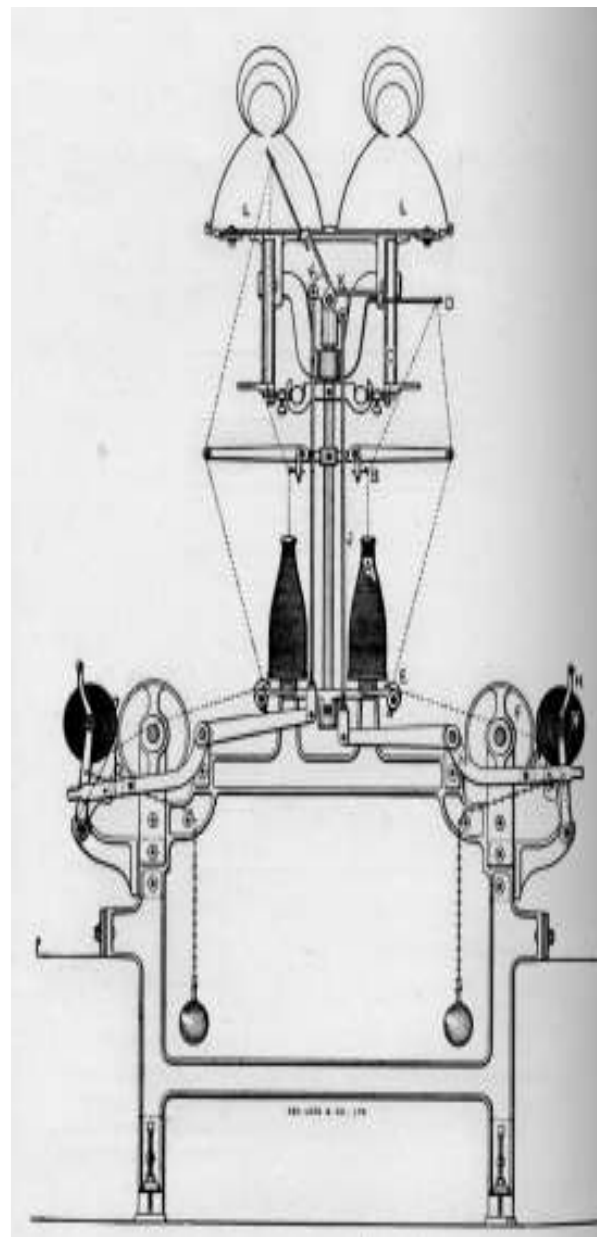


Plate 6 Diagram of Gassing Frame by Asa Lees

Quite a number of small iron weights (Plate 7) were excavated and compare well with the weights shown in Plates 5 & 6 on the Asa Lees Gassing Frame.



Plate 7 Weights and chains from excavation

The most local supplier of Gassing Frames to Oldknow Mill was Arundel, Coulthard & Co of Stockport, but so far a catalogue of their products from the 1880's or 1890's has not been found. However, an illustration of their circa 1920 Gassing Frame (Plate 8) reveals an altogether different style of casting to anything found in the excavation.

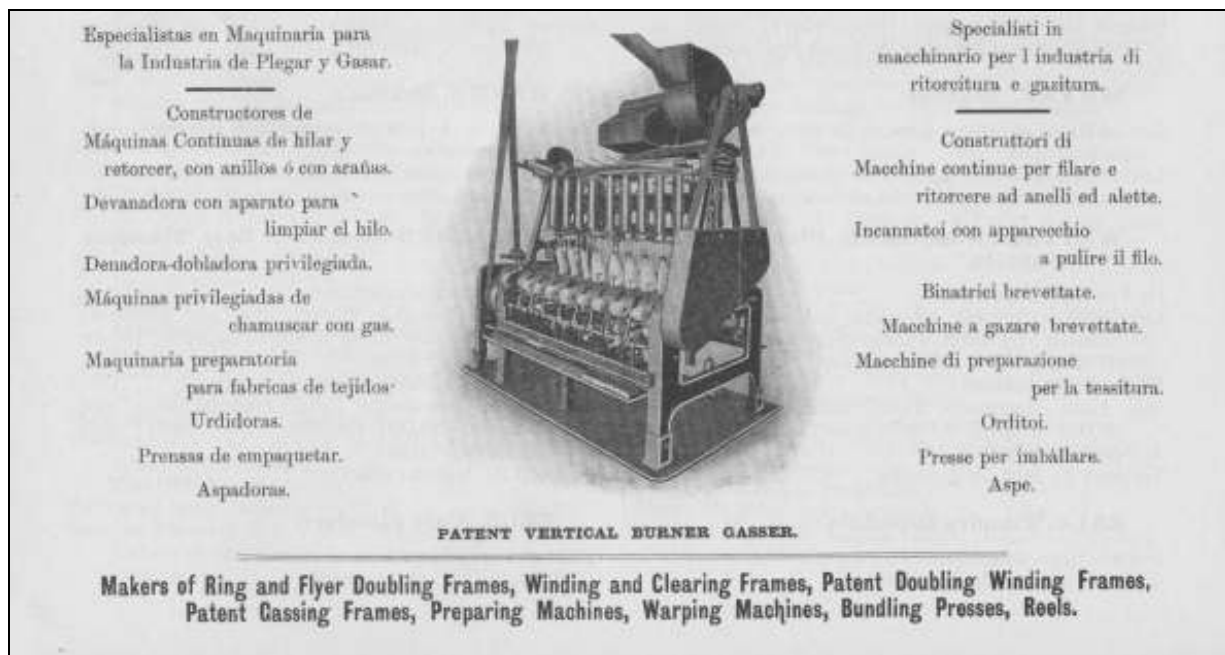


Plate 8 Arundel, Coulthard & Co (Stockport) Gassing Frame circa 1920

The other big manufacturer of gassing and winding frames in the area was Joseph Stubbs of Ancoats. However, an 1892 illustration of one of their winding frames (Plate 9) reveals frame castings of a different

style to anything found in the excavation (winding, doubling & gassing frames from the same manufacturer and same date would have frame castings of similar style).

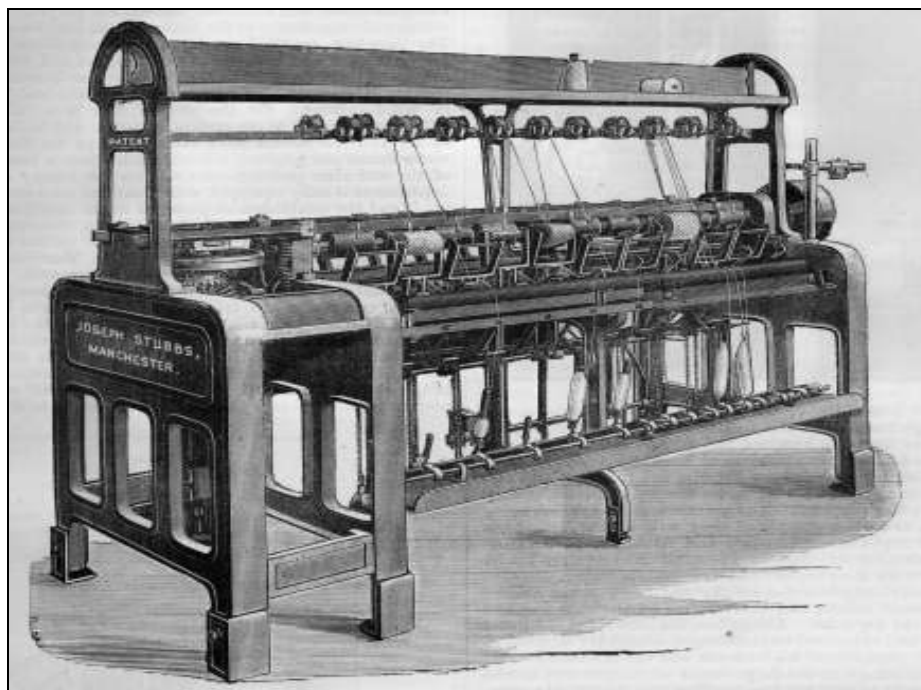


Plate 9 1892 Winding Frame by Joseph Stubbs (Ancoats)

It is not wise to assume that a Mill would necessarily source its machinery locally. Many instances are recorded of purchases of machinery from far away, for reasons that are often lost to us today. Queen Street Mill in Burnley sourced its two Lancashire boilers from Hyde in Cheshire in 1895 & 1901 when there were several renowned quality boiler makers in nearby towns. As moving these 9.5m (30ft) a 2.4m (8ft) cylinders was a considerable feat in those days it is now difficult to imagine why they brought them from so far away.

From the excavation there was a total absence of substantial pieces of cast iron machine frame, and very few smaller pieces of such frames. The single largest piece of recovered iron measured about 750mm x 300mm (Plate 10).



Plate 10 The largest single piece of iron found in excavation

A considerable quantity of identical tapered spikes came out of the excavation. These were for holding mule cops. The spikes would have been set into a timber rail (now burnt or rotted away) with one spike lining up

with each gassing head. Mule cops pushed onto these spikes would have had the yarn drawn axially off them, then through the burner flame, and finally wound onto wooden bobbins (non of which have survived). These bobbins would then have been transferred to either another process at Mellor (such as doubling, or rewinding onto some other package) or to an end-user of the yarn.

Other identifiable components found in the excavation include pieces of broken blue glass rod about 12mm (0.5 inches) diameter. This rod was commonly used to carry yarn through a direction change when it was not necessary to provide precise positional guidance (for which grooved wheels or ceramic eyes were favoured). The blue colour of the glass gave a good contrast with the natural off-white colour of cotton. Blue glass rod was quite widely used on machines where yarn was being transferred from one package to another so it is not specifically indicative of any one machine type. What is significant is that some of the glass rod was twisted and distorted by the heat of the fire indicating exposure to a temperature of at least 800 degrees Centigrade.

The fact that in the same relatively small area of excavation were found pieces of lead piping (almost certainly associated with providing coal gas to the Gassing Frame(s)), and lead flashing, indicates that these lead items cannot have been in the same part of the fire as the distorted blue glass rods.

Other surviving components are numbers of grooved brass wheels approximately 30mm (1.25 inches) in diameter, some still attached to broken cast-iron arms (Plate 11).



Plate 11 Brass yarn guides still attached to brackets

Also shown in plate 11 are the only two pieces of shafting found in the excavation. These are not very illuminating as they are quite short and appear to have had wooden arms bolted to the cast iron flanges still attached to the shafts.

Finally, there were a very few spindles with whorls still attached (Plate 12).



Plate 12 Spindles with whorls to drive them.

These are somewhat reminiscent of mule spindles but they are shorter and thicker than would be expected. Also there were very few of them found, whereas a single medium count cotton mule of this period might have anywhere between 700 and 1000 spindles. In addition this south west section of the Mill would not be likely to contain mule spinning, for which the much larger areas of the centre part of the Mill would be appropriate.

Conclusions

The nature and range of finds material compared to what would be expected from a previously un-scavenged textile mill fire site suggests that what has been found are deliberate or accidental discards from scrap scavenging over the years following the fire. Generally speaking the pieces found are all quite small and may just not have been thought worth retrieving from the bowels of the Mill by scrap scavengers.

There is no doubt whatever that at least one Gassing Frame of some size was in the Mill above the excavated area. The manufacturer may have been Asa Lees of Oldham since some parts have similarities with their machines. However, no substantial components of machines have come out of the excavated area to make positive identification possible. Some other finds point to the possibility of other winding or doubling machines being present in the same area.

Apart from a very few spindles with whorls attached there is nothing among the finds which could have come from cotton mules, and even these few spindles seem out of proportion to be mule spindles. Mules have a number of very distinctive components that are easy to recognise. Their apparent absence is not surprising bearing in mind the known dimensions of the Mill. Mules would simply not have been installed at this south west end.

Absolutely nothing among the excavation finds is indicative of looms or weaving processes. Finds of this kind would have been a considerable surprise in view of what is known of the history of the Mill.

Although entirely speculation it could well be imagined that as the south west section of Mill above the excavation was less seriously damaged by the fire, and may indeed have contained a steam engine in the basement, it was a relatively very accessible and lucrative area for early scrap scavenging. The engine would have been a considerable source of both ferrous and non-ferrous material and any textile machines above it would themselves have been worth clearing out of the way and carting off, but small components (such as most of the finds consist of) breaking off and falling into all the muck & oil around the steam engine entablatures would simply not be worth retrieving.

Excavation in the centre section of the Mill where the fire seems to have been fiercest might reveal a different story since the volume of machinery from these large upper floors may mean that scrap scavenging never penetrated down to the basement floor level and more substantial and coherent sets of machine components may be found there.

Appendix 4: Survey of Mellor Mill Tailraces and Tunnels



Author and copyright: Nigel Dibben, Derbyshire Caving Club
Prepared for: Mellor Archaeological Trust
Version: Revised version 1
Date: August 2009

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1 INTRODUCTION

On 25th March, 2009, Nigel Dibben and Geoff Standing of the Derbyshire Caving Club visited the Mellor Mill site at the request of Peter Noble on behalf of the Mellor Archaeological Trust. The visit was aimed partly at exploration but mainly to assist a cameraman to make a recording for a DVD about the project.

During the day, visits were made to a number of tunnels including the main waterwheel tunnels (mostly tailraces), service tunnels for the drive shaft, drains and underground rooms.

The main features of interest on the site are the two accessible waterwheel pits with the associated tailraces for all three, two of which from the wheels located under the mill joined to form the feed to the third wheel.

The features are described below with reference to the map (Figure 1) and appropriate photographs, all taken on the day of the visit.

A second visit was made on 22nd August, 2009 to complete the photographic record.

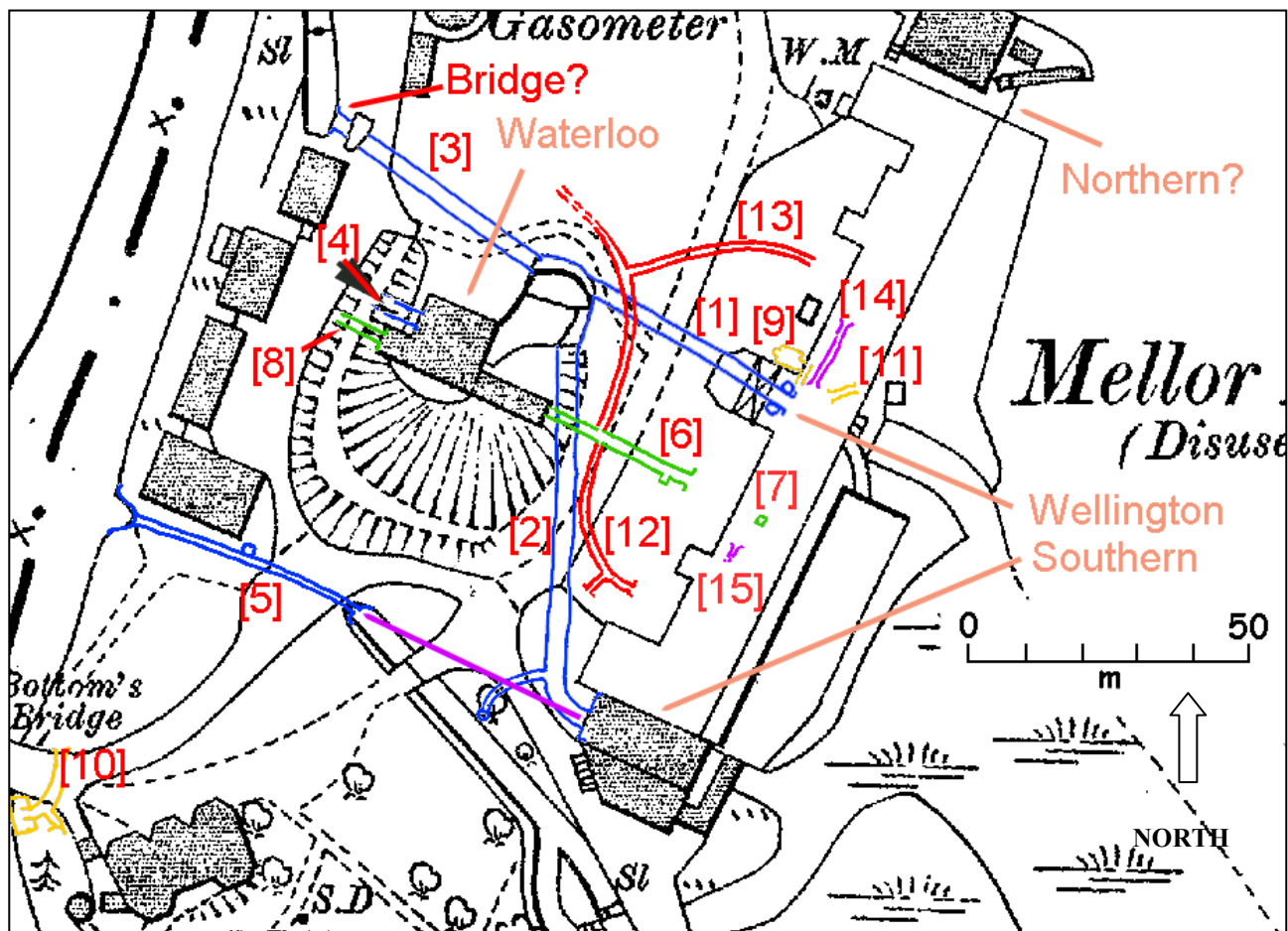
2 BACKGROUND HISTORY

The Mellor Mill was built between about 1790 and 1792 by Samuel Oldknow. The mill was six storeys high and was fed by water from the river Goyt through a series of millponds now known as the Roman Lakes (Ashmore, 1982), a name they were given in Victorian times when they became a huge tourist attraction (Whittaker, 2009). There were three waterwheels in total although one (the Waterloo) was not constructed until 1815. The main wheel in the centre of the building was known as Wellington and was 22 ft (6.7 m) in diameter. The shaft of the great wheel placed in Mellor Mill in 1790 was made from an oak felled on the property, which is believed to have sprung from the stool¹ of an oak (Newton, 1859). The dimensions of the southerly wheel are not known as the wheelpit is filled to surface but the tailrace is comparable in size to the tailrace from Wellington. The third wheel, Waterloo, was built in 1815 and fed by the combined flows of Wellington and the southerly wheel. Waterloo was 20 ft (6.1 m) in diameter (Ashmore, 1982).

The mill was in use until 1892 when it was destroyed by a disastrous fire and subsequently demolished. The corn mill to the south and some of the buildings near the river Goyt remained for many years. In the late 1980s, efforts were made by the Greater Manchester Archaeological Unit to stabilise some of the remains (Ashmore, 1989).

More detail about the mill can be found in Unwin, et al (1924). A superb model of the mill constructed by Tom Oldham for the Oldknow Bi-Centenary celebrations in 1990 is said to be displayed in the Heritage section of the Marple Library (Whittaker, 2009).

¹ Stool: a stump from which new growth develops.



Features:

- 1 Wellington wheelpit tailrace
- 2 Southern wheel tailrace
- 3 Wellington wheelpit tailrace extension
- 4 Waterloo wheelpit tailrace
- 5 Spillway culvert = original line of southern wheel tailrace
- 6 Drive shaft tunnel – east
- 7 Drive shaft bearing block
- 8 Drive shaft tunnel – west
- 9 Coal cellar
- 10 Bridge abutment cellars
- 11 Wellington wheelpit access tunnel
- 12 Southern drain
- 13 Northern drain
- 14 Culvert - unknown purpose
- 15 Culvert - unknown purpose

Note: the line connecting the southern wheelpit and the spillway culvert [5] is the suggested line of the original southern tailrace.

Figure 1: Plan extracted from Ordnance Survey (1909) annotated with sketched locations of tunnels. Original plan at 1:2500.

3 WATERWHEELS

Water was a key source of energy until coal became cheap and even then waterwheels survived in areas where water flow was plentiful all year round. According to SERG (Sustainable Energy Research Group at Southampton University, 2008), an estimated 25-30,000 waterwheels were operated in England alone in the 1850s. There are two basic types of wheel: overshot, breast shot and undershot with buckets which convert potential energy of the water into rotational energy, usually in the drive shaft; and stream wheels which convert kinetic energy. The potential energy-based wheels are more efficient with the breast shot wheel featuring highly, reaching 87% efficiency in SERG's investigation. The illustration in Figure 2 shows the different types of wheels commonly found in the second half of the 19th century at sites such as Mellor Mill. The illustration clearly shows the sluice in position before the breast shot wheel and the curved bed below it which recovers energy from water spilt by the shallow buckets.

There are many other sources of information about waterwheels which can readily found on the internet or in libraries with sections on industrial archaeology.

A good example of a working wheel can be seen at Quarry Bank Mill, Styal near Wilmslow where a similar wheel has been reinstalled in the mill. This wheel is 24 feet in diameter and is said to be able to generate 100 h.p. The original Styal waterwheel was 32 feet in diameter (Guy, 1995). Another example at Portland Basin in Ashton-under-Lyne clearly shows the power take-off mechanism which was used at Mellor (see Figure 2).

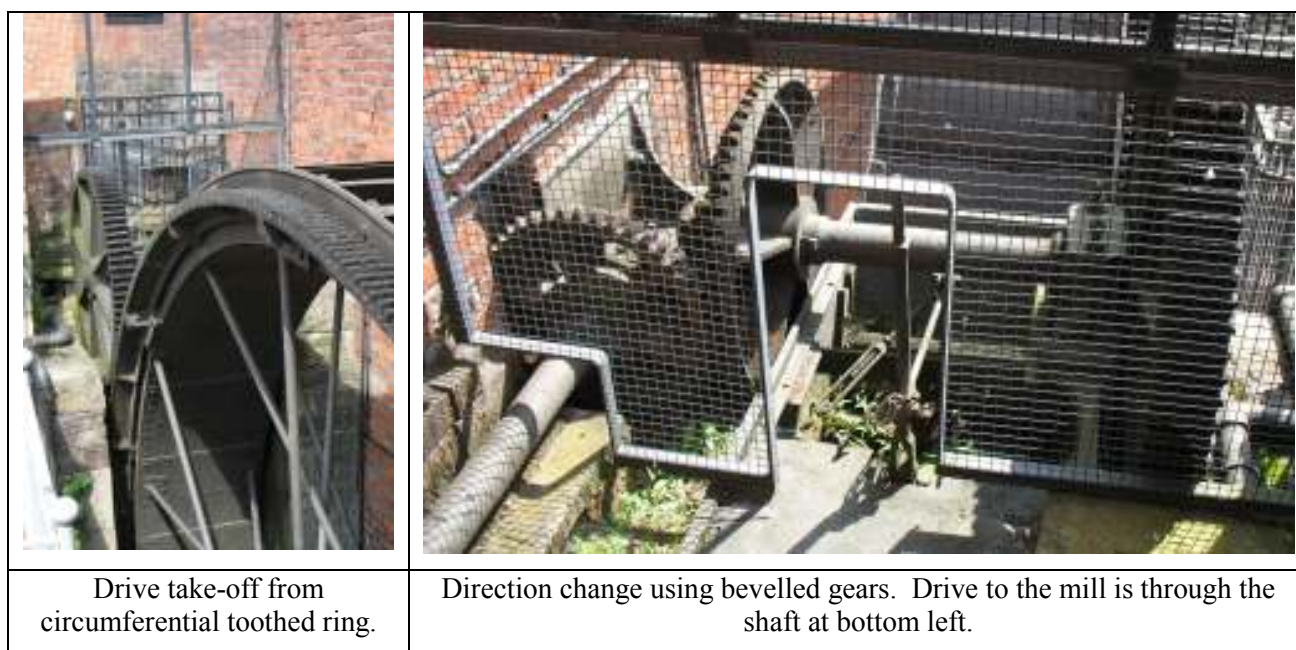


Figure 2: Example of power take off from waterwheel using a geared ring and bevel gears. Picture taken at Portland Basin, Ashton-under-Lyne.

4 THE UNDERGROUND FEATURES

The visit to the site suggested that the tunnels can be grouped into five types as follows: feeds and tailraces for the waterwheels; tunnels for machinery associated with the waterwheels; drains; underground rooms; and, others. A further type which was not visited is the flue to the main factory chimney.

4.1 Waterwheel feeds and tailraces

It is known that there were three waterwheels on the site, Wellington in the centre of the mill, the southern wheel

(name unknown) and Waterloo fed by Wellington and the southern wheel. The maps do not show a wheel at the northern end of the mill although this is a distinct possibility and would have made good sense to the mill designer. The hypothetical northern wheel would have been replaced when the steam engine was installed. That there was a wheel at the southern end cannot be said for certain without excavation of the site but the existence of the corn mill strongly suggests a wheel existed there and that it fed power into the mill.

4.1.1 Wellington Wheel

The Wellington wheel was approximately 22 ft in diameter and is supposed to have been built with an oak axle (Newton, 1859). The evidence remaining in the wheelpit shows that it was breast shot with a wide feed of water and, although now buried by debris, it probably had a curved floored housing. The points where the main bearings stood can be seen although the stone support for the bearing has been removed on the southern side (photographs 1.1 and 1.3). The northern bearing support is still in place. The layout of the wheelpit suggests that power was taken off the circumference of the wheel as at Styal.

Studying the 1909 map (see Figure 1) suggests that the tailrace (feature 1) probably drained straight to the river Goyt in its own tunnel (feature 3) followed by a channel leading to and then turning north to run parallel to the riverbank. When buildings were erected on the river bank at a date unknown, it is possible that the mill owners extended the tunnel by creating a brick arch over part of it as shown in the photographs (3.4). A question remains as to why the last section of the tunnel is arched in stone: was it for esthetical reasons? It is possible that this section of the tailrace had already been bridged to provide a riverside track and the brick tunnel was simply run up to it.

The eastern section of the tunnel (feature 1) is driven against the dip of the rock and is stone-arched the whole length. Near the inner end (inner will be used to refer to the end nearest to the wheel pit and outer nearest to the outfall), a section of roof has collapsed (photograph 1.8) but the crown in² is easily passable. The problem has been caused by shale in the roof expanding and forcing the arching down. Just before the inner end, a circular opening on each side is filled with brick rubble (photograph 1.6). There is no clear evidence on the surface where this debris or the circular shafts have come from but they are neatly constructed on opposite sides of the tunnel. Further surveying work would be necessary to see where they could start on the surface. There are signs in the southern tunnel (see below) that there may have been facilities to divert water into the tunnel without it passing the wheel, possibly to flush the tunnel. From the inner end, daylight can be seen at the Waterloo entrance and at the far end of further tunnel (feature 3), indicating that this was a single straight tunnel at one time.

The channel parallel to the river has a sluice (marked “*SP*” on the 1:2500 map in figure 1) of which there are visible remains. This may have been used in times of flood to prevent water backing up to the Waterloo wheel pit.

4.1.2 Southern wheel

It is possible that the southern wheel may have been the first on the site because of the corn mill which was built of stone. Others with knowledge of the history of the site may be able to say whether the corn mill pre-dated Oldknow’s mill. In any case, the current tailrace (feature 2) turns to the north shortly after its inner end to join the water from the Wellington wheel running to the Waterloo wheel. It appears probable that the tailrace originally ran in a straight line from the wheel to the river, taking the route now used by the spillway in a smaller culvert (feature 5). This presumed older route is marked on Figure 1.

The tunnel from the outer Waterloo end runs along the strike of the bedding with a good roof of sandstone on a slope and walls of dry stone walling holding back a shale band. This structure can clearly be seen in the photographs 2.8 and 2.9. Shale has pushed down the higher (eastern) wall in places but there are no serious problems of collapse or infilling. At the inner end, the tunnel curves to the left (to the east) before coming to a substantial stone-built arch with large blocks alternately recessed to give an attractive decorative effect on inner side (not presumably visible from either side when the wheel was operating). The last curved section of the tunnel is walled on both east and west sides and roofed with stone (see photograph 2.3), supporting the theory that the tunnel originally ran straight on to the river.

² Crown in: domed collapse in the roof of a tunnel with a corresponding heap of debris on the floor below.

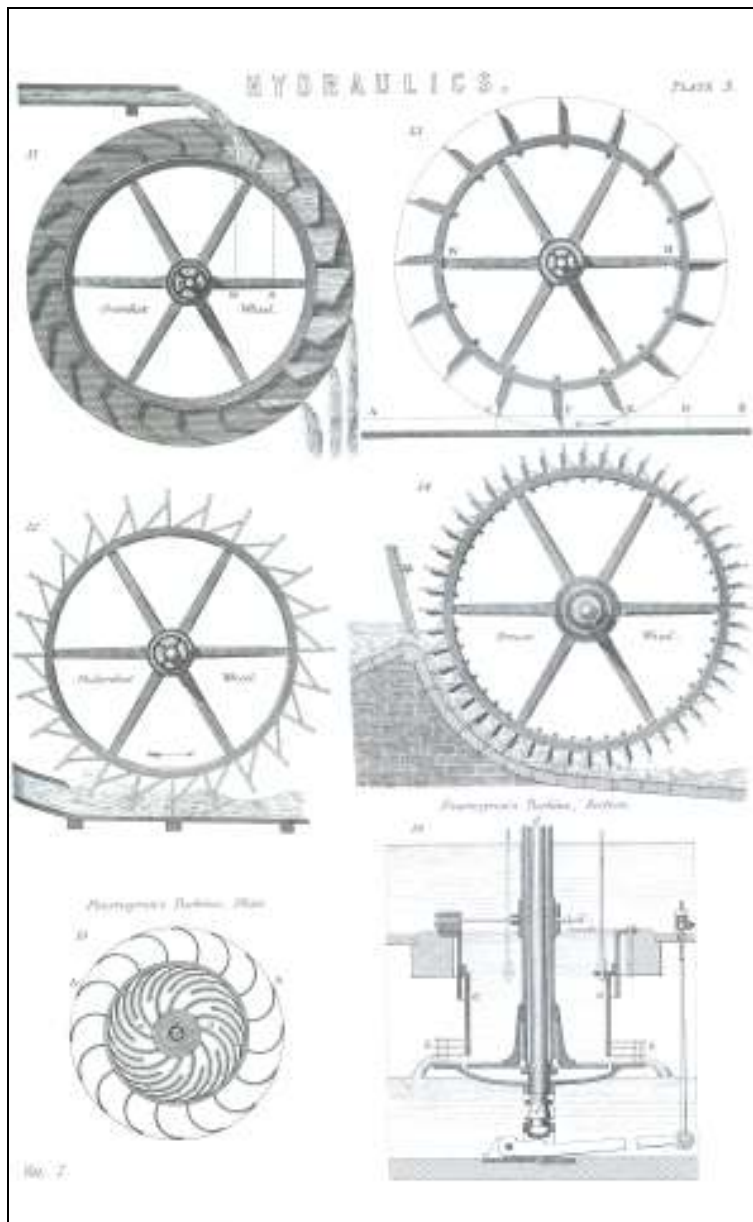


Figure 3: Waterwheel designs (from MacKenzie (publ.) c 1876)

Just before the inner end is a side passage on the north west side. This starts as an excavation in solid rock and then becomes arched in stone. The purpose of this tunnel is not clear but it could have served as a point from which water could be let in to by-pass the wheel so as to keep the Waterloo wheel fed with water when the southern wheel was out of service. Where the tunnel is rock arched may correspond with the back-filled section of the original, straight tailrace. The side tunnel starts at the foot of a very neatly built circular stone lined shaft to surface which had a sluice from the bypass spillway. The groove and a small part of the mechanism of the sluice can still be seen on the surface (photograph 2.7).

4.1.3 Waterloo wheel

The Waterloo wheel pit is a large excavation on the hillside below the road with clear evidence of where the wheel bearings once stood on stone-built platforms each side. The power appears to have been taken off from a ring gear on the south west side, only, as shown by buildings on the map (Figure 1) and tunnels on the site. Measurements on site

give the diameter of the wheel as about 20 ft. The wall on the upstream side was curved to match curvature of the wheel as would be expected. This was normal practice and helps to keep water in the buckets and increase efficiency (see SREG, 2008). On the south west side, there is a curious channel cut into the wall at about the maximum diameter of the wheel. This may be evidence of a gear ring being replaced or enlarged as the cut seems to have been made after the walls were completed and there is a corresponding groove on the north side. The inner diameter of the cut notch in the south west wall is about 17 ft diameter. On the opposite side, the north east side end of the axle, there is a cut-out in the stone wall for the hub of the wheel.

Water is fed to the wheel from the two tunnels described before. The two channels meet, roughly at the outlet point for the Wellington tailrace, before turning south where there was probably a sluice to feed to the breast of the wheel. At the meeting place of the tailraces, Waterloo is carved in the wall in typical period characters. The walls around the tunnel portals are smartly constructed with a string course and coping. The string course has been imitated on the solid rock wall west of the southern wheel tailrace by some inferior carving of the native rock.

The tailrace from the Waterloo wheel (feature 4) is still accessible with a stone arch to support the retaining wall above. The crown of the arch is about 600 mm above the silt but almost immediately inside, the tailrace closes down to less than 150 mm high. The rock through which it has been cut is a solid sandstone bed (in situ) with iron bars to support it because of the risk of the rock flaking. About 5 or 6 bars are visible still in place although there is a gap between some bars and the roof, suggesting that wedges were present but have gone and that the roof has not moved at all. The floor is soft mud. The depth of the wheel pit and absence of standing water suggests that the drain under the Goyt is still functional although a topographical survey would be necessary to prove this.

Given that the wheel was about 20ft diameter and the water was fed at breast height, just below the centre, the tailrace would need to have a floor some 3-4 m below the inlet level. If the tailrace is 2 m high, then the roof is about 1-2 m below the inlet level. There appears to be a slope down to the Waterloo wheel from the feed channels and guessing this at 1 m, then the roof of the Waterloo tailrace is 2-3 m below the level of the tailrace from Wellington wheel. This put the roof very close to the bed of the River Goyt! Clearly, further survey work is necessary to establish whether the tailrace actually goes under the Goyt.

4.1.4 Northern wheel

The layout of the mill buildings, the location of the later steam engine and the shape of the platform between the mill and the lodge on the later map seems to suggest that there may have been a wheel at the northern end. If so, this would have discharged to the Goyt at the same point as the Wellington wheel which drains into a channel parallel to the river for a short distance. Excavation and further research would be necessary to establish whether this hypothesis is supported.

4.1.5 Spillway culvert

In line with the Southern wheel, there is a culverted stream (feature 5) running from just east of the road to the bank of the river. This culvert is mostly flat roofed although some parts are arched. It is readily entered from either end or from a stepped access point near the centre. It is possible that the spillway originally ran into the southern wheel tailrace and was diverted into this culvert when the southern wheel tailrace was turned to the north to meet the Wellington tailrace.

4.2 Power take off

Take off from the Wellington wheel appears to have been by rim-driven pinion at a high level. Probable positions for the bearings can be seen on the walls of the pit and it is likely that the drive was taken from both sides of the wheel to balance the torque on the wheel. For Waterloo, the drive was taken off from the southern side only and fed by some means, probably a bevel gear as shown in Figure 2, to a drive shaft running west to east. The western section powered the workshops by the river and the eastern section the mill. The building that housed the drive shafts is visible on the 25" map. Beyond the building, the shaft entered a tunnel in each direction. The tunnel towards the workshops (feature 8) was short but towards the mill (feature 6) runs under the road.

The tunnel towards the mill contains two bearing blocks with the bearings missing but clear signs of where the shaft

ran. Another bearing block (feature 7) is still visible in the central channel that runs through the mill from north to south; this channel is presumed to have housed the main drive shaft. Near the mill end of the power tunnel, there is a manhole to the surface from one side which is slabbed over. Where the block is located under the road, there is a discontinuity in the stonework suggesting that the tunnel was extended at some time.

The tunnel towards the workshops has also been altered over time and appears to slope upwards from Waterloo wheel and then levels out. There are bearing blocks in the floor of this tunnel too.

4.3 Drains

A set of shallow but substantial drainage tunnels can be entered from the drive shaft tunnel. One section runs south (feature 12) and curves gently to the east before coming to an abrupt end at a rubble-filled opening. The last section is brick lined but the rest is stone arched. A side drain, also brick lined, enters shortly before the end from the south side. This is open to daylight but could not be readily found on the surface. The tunnel is clearly a drain as the floor is stepped and the general shape is oval so as to encourage a more rapid flow of effluent on the floor in times of low water. This would make the drain self-cleaning. The second tunnel goes north from the drive shaft tunnel (feature 13) and is a continuation of the southern drain already described. It curves gradually towards the river and emerges high up in the woods. It does not slope much down towards the river. Shortly before the end, there is a branch that starts low but becomes reasonable walking height heading back towards the mill. This again ends in a brick-arched section and a rubble filled opening. Just before the end, there is a filled manhole. The floor of this drain does not become narrower as in the southern limb but is covered in large stone slabs.

The drains look as if they may originally have been brick lined running straight from the building in the direction of the river but were later stone arched and connected to direct them away from the Waterloo pit and the workshops. There are probably other drains on the site.

4.4 Other underground features

During the visit, we inspected a number of other features. These were:

4.4.1 Coal cellar

There is an underground feature (number 9) just north of the Wellington pit which was probably a coal cellar. There is an arched passage heading away from the wheel pit and the coal cellar is on the west side of this, between the building and the road. The cellar has a chute on the western side which would emerge at the front of the mill building near the Wellington pit. The cellar may have fed the office heating system.

4.4.2 Access tunnel and steps into Wellington pit.

A neat tunnel equipped with steps leads from the back of the mill (possibly for access to water control equipment) into the wheel pit. The tunnel (feature 11) is covered in corbelled stone slabs.

4.4.3 Cellars near Bottom's Bridge

A curious passage (feature 10) slopes down under the bridge abutment. It has a series of shallow steps in the upstream direction so is unlikely to have originally been a flood relief tunnel for the bridge. It contains recesses in the walls which appear to be cement rendered and it ends in three parallel chambers, one with a possible fireplace. To the left, going in, is a passage to a point where some other structure has been met. The other structure has curved walls. The 25" map shows some sort of circular structure in the garden of Mellor Lodge so this might have been connected to the tunnel. The sketch in Figure 1 is very rough and a detailed topographical survey may throw more light on this feature.

4.4.4 Possible culvert

There is a small tunnel (features 14 and 15) running along the length of the mill building. This tunnel is on the west side of the central channel and appears on both sides of the Wellington pit. It is too small to enter and may have been a

drain from the building. It is unlikely to be a power tunnel as equipment in it could not be serviced.

5 PHOTOGRAPHIC RECORD

A number of digital photographs were taken above and below ground on the day of the visit and on a subsequent visit. Selected photographs with explanatory notes will be found in Appendix A.

6 CONCLUSIONS AND FURTHER WORK

The Mellor Mill site is very interesting as it contains significant remains from an 18th and 19th century water-powered mill. These should be protected from further damage. The site is relatively free from vandalism and with the exception of one part of the roof of the Wellington tailrace is in extremely good condition. Further infilling of the waterwheel pits must be stopped. The exact routes of the tunnels need to be surveyed so that they can be protected, especially as some run quite close to the surface of the road. This work could be carried out by the Derbyshire Caving Club.

7 ACKNOWLEDGEMENTS

The authors are grateful to the Mellor Project for giving us the opportunity to explore and report on the underground features at Mellor Mill. In particular we must thank Peter Noble who contacted the club in the first instance and made the visit possible.

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Photographic Appendix:

The photographs below are selected were taken during the visit. Photograph numbers relate to the feature numbers. Higher resolution copies will be provided on request. Copyright is retained by Nigel Dibben.

1.1 Wellington wheelpit viewed from above the tailrace. The picture is looking east. The narrower walls of the axle supports are visible in the foreground. The water would have been fed over the lip in the middle of the picture. Tunnel 11 is visible in the top left of the picture.



1.2 Looking out of Wellington wheelpit towards the west. The nearer wall is the wall over the tailrace arch. The further wall is probably the limit of the mill building above. There appears to be a staircase curving down into the wheelpit in the corner



1.3 Looking west in Wellington wheelpit from the same point as the picture above. The line of a possible line of steps is visible in the facing wall (red arrow). The tailrace arch is out of sight below the debris in the foreground (blue arrow).



1.4 Close-up of wall above tailrace showing the apparent line of steps. At first sight, this appears to be a later addition although close examination shows the same masons' marks on both the left (apparently original wall) and right (apparently infill) of the steps.



1.5 Two of the masons' marks on the wall above the tailrace: a cross with a line joining two of the legs and the letters JP in 18th century script (appearing as: ÷P)



1.6 The inner side of the infilled wheelpit viewed from below. The debris infill from the inlet shafts is visible on both sides of the picture. The picture is taken looking east and represents the eastern end of feature 1.



1.7 The southern inlet shaft with rubble infill. The northern inlet shaft is essentially the same.



1.8 The roof fall in the Wellington tailrace viewed from the west. The inlet shafts on each side of the tunnel are just visible in this picture which has been artificially lightened.



1.9 Looking west down the Wellington tailrace with the roof fall behind the camera. The passage is a good walking height in the centre but the floor is covered in mud and water. A figure is visible outside the entrance and the light from the arch of the extension (feature 3) is just visible (red arrow).



1.10 / 2.1 The entrance to the Wellington tailrace (feature 1) is on the left and the Southern tailrace (feature 2) is on the right. “Waterloo” is carved above the right hand entrance.



2.2 The archway at the inner end of the Southern tailrace. Note the splendid stone arching and the flat roof (just visible at top right hand corner). The curvature of the left hand wall is believed to have been formed when the tailrace was diverted north to join the Wellington tunnel.



2.3 Detail of the stone arching. Alternate blocks are recessed suggesting a decorative function, even at this location.



2.4 The start of the side tunnel in solid rock leading off west just after the inner end of the tailrace.



2.5 Join between the side tunnel in solid rock (background) and walled tunnel (foreground). The arched tunnel may represent the area where the original tailrace was backfilled.



2.6 Inside the entrance shaft to the side tunnel. The walls are superbly shaped both inside and out.



2.7 Outside the entrance shaft showing signs of there having been a sluice and the metalwork required to lift it. The shaft would have allowed water from the spill way to enter the tailrace, possibly to supplement the feed to Waterloo if the Southern wheel was out of service.



2.8 Looking northwards out of the Southern tailrace. The solid sloping roof can clearly be seen. The walls hold back shales. Note the right hand wall which is curved by the realignment of the tunnel towards Waterloo.



2.9 Another view in the Southern tailrace. The curved section in the distance is the arched entrance.



3.1 Wellington wheelpit tailrace extension (feature 3), eastern entrance. The arching matches the entrances to the other two tailraces.



3.2 The point in the tailrace tunnel where stone (upstream) joins brick (downstream). It is possible that the brick section was covered over to make more room for the riverside buildings.



3.3 Looking west, towards the Goyt



3.4 The final section approaching the Goyt where brick ends and stone restarts.



3.5 The downstream exit of feature 3. The tunnel approaches the photographer but the channel turns away to the left of the picture taking the water parallel to the river Goyt for a short distance, through a sluice (abutments remain) to where it joins the river.



3.6 Outfall from the channel to the river Goyt.



4.1 Waterloo wheelpit seen from above. The Southern tailrace is on the left and the Wellington tailrace is below the photographer. The waters went through the gap in the centre to feed Waterloo (red arrow).



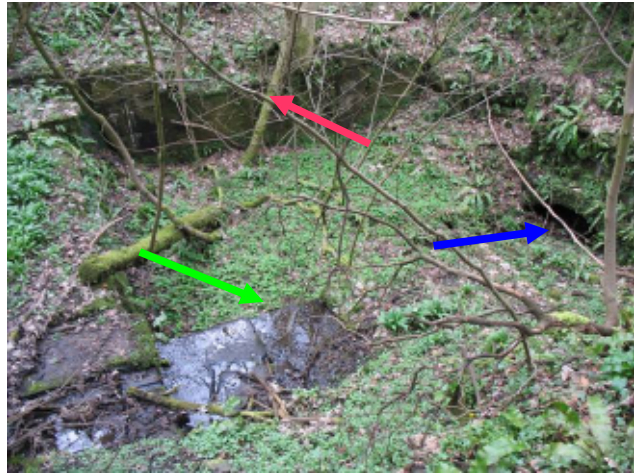
4.2 Waterloo inscribed above the entrance to the Southern tailrace. The typescript is typical of the period.



4.3 The decorative course of stone over the entrance is continued by carving in the natural rock.



4.4 Looking down on Waterloo wheelpit. The southern bearing is indicated by the red arrow and the northern bearing by the green arrow. The tailrace arch, feature 4, is in the centre right (blue arrow). The platform between the photographer and the northern bearing was probably a water spillway.



4.5 The southern side of the wheelpit. The bearing block is indicated by the arrow. The curved line around it has been carved out of the stone wall and might indicate a need to widen the pit at some time, possibly to extend the gear ring on the wheel



4.6 Cut out on the northern wall, possibly to accommodate the hub of a wheel.



4.7 Entrance to the tailrace. The opening is about 600 mm high.



4.8 Inside the first section of the tailrace showing the flat roof and the supporting iron bars. The limit of the view is about 3 m in front of the camera and is about 150 mm high by 2 m wide at the most. The water on the floor makes judging heights difficult. Further exploration would involve getting very muddy. The slope down of the roof can be judged from the coursing of stone in the right hand wall.



5.1 The spillway culvert, feature 5, upstream eastern end, where it passes under the road. Note the well-dressed stonework similar to that on the shaft entering the Southern tailrace (compare pictures 2.5 and 2.6). Daylight can be seen at the river end of the culvert.



5.2 Looking eastward up the culvert from the river end, the roof can be seen to be slabbed, arched and then slabbed again. The arching may represent an old track parallel to the river before the stream was fully culverted.



5.3 River end of the culvert looking westward with the river Goyt visible beyond. The Goyt is flowing from left to right across the picture.



6.1 Drive shaft tunnel, feature 6, through which power was supplied to the mill. The picture shows the first section leaving Waterloo wheelpit. The large slab was part of the roof.



6.2 Inner (eastern) end of the drive shaft tunnel infilled with demolition rubble from the mill. The clean stone arch at the end of the tunnel can clearly be seen.



6.3 Looking out from the end. The soil on the floor has come down the manhole on the left (see picture 6.4).



6.4 Looking up the manhole at the stone capping slab. Daylight is visible around the stone.



6.5 Looking east and out of the tunnel. The tidy cross section can be clearly seen as well as the bearing block on the floor which has a semi-circular cut-out at the nearer end.



6.6 A discontinuity in the tunnel wall (southern side) suggesting that the tunnel has been altered or extended at some time. The earlier section is on the mill side. The alcove on the right of the picture is one of several in the tunnel walls.



7 Drive shaft bearing block, feature 7, that is still lying in the open in the trench that appears to form the power distribution along the length of the mill. The top has been cleared of moss. The left hand end is semicircular to accommodate the bearing and has a bolt hole with the metal bolt still visible. There are two slots, one either side of the shaft (the right hand one is clearly visible). At the right hand side of the block which appears to be missing, there is another hold-down bolt.



8.1 Drive shaft tunnel that took power to the riverside workshops to the west of Waterloo wheelpit. The covering building can be seen on figure 1. Photograph shows eastern entrance, nearest to Waterloo wheel. Daylight is visible at the far end.



8.2 View from west to east through drive tunnel.



8.3 Stone bearing block on the floor of the tunnel. The block is on the north side as in feature 6.



8.4 View showing the arched section becoming flat-roofed at the end nearest to the workshops.



8.5 View of southern wall showing discontinuity which would relate to an extension to the west. The slope of the tunnel on the east side can be seen to change to horizontal in the coursing of the stonework.



9.1 The coal cellar, feature 9, is accessed from this short tunnel off the north side of the Wellington wheelpit.



9.2 Within the arch is a short passage with another doorway at the far end and an arched entrance on the left.



9.3 The arched entrance leads into this coal cellar (daylight can be seen through the entrance arch).



9.4 Coal chute. This would be between the front wall of the mill and the road.



10.1 Entrance to the bridge abutment cellars, feature 10. The crown of the arch is probably less than one metre below the road surface. The stonework has some reasonable architectural features about it such as rustication on the door jambs.



10.2 Main cellar passage looking out (northwards). There are shallow steps on the floor about 3 m apart. This would make it accessible by horse if required. Note the blind arch on the right and beyond it a blind rectangular recess in the wall of which there are at least two on each side.



10.3 The way into the end rooms of the cellar which have been filled with soil. Another room is accessible on the right hand side at this point.



10.4 The east side passage. It appears to open into a chamber filled with a circular stone built feature. Could this have been a circular stairway from the house above? A more detailed map of the tunnel is required to establish whether this is possible. The floor of the passage at this point is covered with broken nineteenth and early twentieth century pottery.



11 The Wellington wheelpit access tunnel, feature 11, is a short tunnel with steps into the wheelpit. It may have served to provide access from the wheelpit under the building to the controls of the water feed sluices by the mill lodge.



12.1 The drains can be accessed from the western end of the drive shaft tunnel. The southern drain, feature 12, has a roughly oval section with a stepped floor to provide increased flow speed in low water conditions (similar to the modern concrete egg-shaped sewers). The first picture is taken looking upstream shortly after entering the drain.



12.2 Near the end is a branch on the right leading to a partly closed entrance with daylight entering. This is presumably one of the inlets to the drain.



12.3 The section before the end is brick arched, possibly where it runs close to the building or the road. The picture is taken looking downstream.



12.4 The end of the drain is in debris, probably from the mill.



13.1 The northern drain, feature 13, runs downstream from the point where it is intersected by the drive shaft tunnel, feature 6, just west of the road. The tunnel is oval shaped and dry stone walled. It bends left, then right and then left again. Shortly before the end, there is a right hand branch that heads back towards the mill,



13.2 The downstream end of the drain breaks surface. It may have continued as a surface channel from this point which was probably chosen to ensure that water did not invade the workshop area.



13.3 The right hand branch tends to have a flat floor. At the point illustrated, a manhole in the right hand wall has allowed soil to run into the drain.



13.4 The floor of the northern drain is not stepped but is covered with large flat stone slabs as seen in this photograph.



13.5 Near the end of the drain, it is brick arched.



13.6 End of the drain filled with soil and bricks. A large tree root has invaded the drain.



14.1 Northern culvert, feature 14. The purpose of this tunnel is unknown. The southern entrance of this tunnel which is too small to enter can be seen to the right of the coal cellar entrance. The trench that runs along the base of the mill is indicated by the blue arrow.



14.2 Northern culvert from above.



15 Southern culvert - unknown purpose. The torch is for scale. This tunnel may have been intersected by the power tunnel, feature 6.



Appendix 5: Evaluation Photographic Catalogue

Photo No.	Location	Description	Viewpoint	Format
1	Trench 1	Aerial view of whole site	Looking NE	Digital
2	Trench 1	As 1	Looking NE	Digital
3	Trench 1	As 1	Looking N	Digital
4	Trench 1	As 1	Looking E	Digital
5	Trench 1	As 1	Looking N	Digital
6	Trenches 1 & 2	As 1	Looking NW	Digital
7	Trench 1	As 1	Looking E	Digital
8	Trench 1	As 1	Looking NE	Digital
9	Trench 1, Areas B, C & D	As 1	Looking NE	Digital
10	Trench 1, Area A	As 1	Looking E	Digital
11	Trench 2	Aerial view of trench	Looking NW	Digital
12	Trench 1, Areas B, C & D	Aerial view of areas	Looking NE	Digital
13	Trench 1, Areas B, C & D	As 12	Looking NE	Digital
14	Trench 1, Areas B, C & D	As 12	Looking E	Digital
15	Trench 1, Areas B, C & D	As 12	Looking NE	Digital
16	Trench 1, Areas B, C & D	As 12	Looking NE	Digital
17	Trench 1, Areas B, C & D	As 12	Looking E	Digital
18	Trench 1	Oblique angle view of trench	Looking E	Digital
19	Trench 2 and Trench 1 (Areas B & C)	As 18	Looking N	Digital
20	Trench 1	Aerial view of trench	Looking E	Digital
21	Trench 1	As 10	Looking E	Digital
22	Trench1, Areas B, C & D	As 10	Looking E	Digital
23	Trench 1, Areas B, C & D	As 10	Looking NE	Digital
24	Trench 1, Area C	Working shot	Looking N	Digital
25	Trench 1, Areas B, C & D	Working shot	Looking N	Digital
26	Trench 1, Area A	Working shot	Looking E	Digital
27	Trench 1, area B	Working shot	Looking W	Digital
28	Outside excavated area	Working shot	Looking NE	Digital
29	Trench 1, Area A	Working shot	Looking N	Digital

30	Trench 1, Area B	View of the steps at east end of the area	Looking SE	Digital
31	Trench 1, Area B	As 30, detail of the steps	Looking NE	Digital
32	Trench 1	Working shot	Looking NW	Digital
33	Trench 1	Working shot	Looking NW	Digital
34	Trench 1, Area B	Working shot	Looking W	Digital
35	Trench 1, Area B	Working shot	Looking W	Digital
36	Trench 1, Area B	Working shot	Looking NW	Digital
37	Trench 1, Area B	Working shot	Looking NW	Digital
38	Trench 1, Area B	Working shot	Looking SE	Digital
39	Trench 1, Area B	Working shot	Looking E	Digital
40	Trench 1, Area B	Working shot	Looking NE	Digital
41	Trench 1, Area C	Working shot	Looking W	Digital
42	Trench 1, Area C	Working shot	Looking N	Digital
43	Trench 1	General view of trench	Looking N	Digital
44	Trench 1	General view of Areas B, C & D	Looking NE	Digital
45	Trench 1, Area B	General view of the area	Looking E	Digital
46	Trench 1, Areas B & D	General view of the areas	Looking E	Digital
47	Trench 1, Areas B, C & D	View of the steps and southern wall of the Mill	Looking E	Digital
48	Trench 1, Area C	View of the south western elevation wall of the mill showing flagged floor between machine beds	Looking SE	Digital
49	Trench 1, Area C	As 48	Looking SE	Digital
50	Trench 1, Area C	General view of the area showing two machine beds	Looking SE	Digital
51	Trench 1, Area C	As 50	Looking SE	Digital
52	Trench 1, Area C	As 50	Looking SE	Digital
53	Trench 1, Area A	South eastern corner of the external wall in area A	Looking NE	Digital
54	Trench 1, Area A	South western internal corner of Wall in area A showing drain	N/A	Digital
55	Trench 1, Area A	As 54	N/A	Digital
56	Trench 1, Area A	As 54	N/A	Digital
57	Trench 1, Area A	As 54	N/A	Digital
58	Trench 1, Area A	Southern gable wall in area A showing brick coursing	N/A	Digital
59	Trench 1, Area A	As 58	N/A	Digital
60	Trench 1, Area A	Detail of brick manufacturer's name in southern brick gable wall of area A	N/A	Digital
61	Trench 1, Area A	As 60	N/A	Digital
62	Trench 1, Area A	Detail of concrete floor in area A	N/A	Digital
63	Trench 1, Area A	As 62	N/A	Digital
64	Trench 1, Area A	Detail of remains of concrete floor in eastern area A	Looking SW	Digital

65	Trench 1, Area A	As 64	Looking SW	Digital
66	Trench 1, Area A	Detail of column base central to the floor in area A	Looking W	Digital
67	Trench 1, Area A	As 66	Looking W	Digital
68	Trench 1, Area A	As 66	Looking W	Digital
69	Trench 1, Area A	As 66	N/A	Digital
70	Trench 1, Area A	Detail of column base towards the southern end of area A	Looking NE	Digital
71	Trench 1, Area A	As 70	N/A	Digital
72	Trench 1, Area A	View of the central floor of area A showing the line of stone column bases	Looking NE	Digital
73	Trench 1, Area A	View of the vertical side of the stone column base	Looking NE	Digital
74	Trench 1, Area A	View across the concrete floor of area A	Looking N	Digital
75	Trench 1, Area B	Detail of the steps (035) at the eastern end of area B	Looking SE	Digital
76	Trench 1, Area B	As 75	Looking E	Digital
77	Trench 1, Area B	As 75	Looking E	Digital
78	Trench 1, Area B	As 75	Looking E	Digital
79	Trench 1, Area B	As 75	Looking SE	Digital
80	Trench 1, Area B	As 75	Looking SE	Digital
81	Trench 1, Area B	As 75, detail of bottom steps	Looking SE	Digital
82	Trench 1, Area B	As 75	Looking SE	Digital
83	Trench 1, Area B	As 75, showing cast iron bottom hinge in stone block	Looking SE	Digital
84	Trench 1, Area B	Detail of cast iron bottom hinge as in 83	Looking N	Digital
85	Trench 1, Area B	As 84	Looking N	Digital
86	Trench 1, Area B	As 84	Looking NE	Digital
87	Trench 1, Area B	As 84	Looking NE	Digital
88	Trench 1, Area B	As 84	Looking NE	Digital
89	Trench 1, Area B	As 84	Looking NE	Digital
90	Trench1, Area B	As 84	Looking NE	Digital
91	Trench 1, Area C	Detail of steps at southern end of the area leading up to area A	Looking SE	Digital
92	Trench 1, Area C	As 91	Looking E	Digital
93	Trench 1, Area C	As 91	Looking E	Digital
94	Trench 1, Area C	Detail of the north western stone built wall in area B	Looking NW	Digital
95	Trench 1, Area C	As 94	Looking NW	Digital
96	Trench 1, Area C	Detail of south eastern elevation of the mill showing repair/phase	Looking SE	Digital

97	Trench 1, Area C	Detail of the fastening bolts and slots in the northerly of the two machine beds	Looking N	Digital
98	Trench 1, Area C	As 97	Looking N	Digital
99	Trench 1, Area C	As 97	Looking NE	Digital
100	Trench 1, Area C	Metal strap on flagged floor between the two machine beds	N/A	Digital
101	Trench 1, Area C	Stone post support on flagged floor against the south eastern wall	Looking SE	Digital
102	Trench 1, Area C	As 101	Looking Se	Digital
103	Trench 1	View along the southern wall of area A towards area D	Looking NW	Digital
104	Trench 1	Elevated view of the trench	Looking NW	Digital
105	Trench 1	As 104	Looking NW	Digital
106	Trench 1, Areas B & D	Overhead view of the southern wall and both sets of steps	Looking NW	Digital
107	Trench 1, Area C	Overhead view of the two machine beds	Looking SE	Digital
108	Trench 1, Area C	As 107	Looking SE	Digital
109	Trench 1, Areas B & C	Overhead view of the southern machine bed and steps	Looking SW	Digital
110	Trench 1, Area C	General view of the area	Looking NW	Digital
111	Trench 1, Area C	Overhead view of the flagged floor between the two machine beds	Looking NW	Digital
112	Trench 1, Area C	As 111	Looking NW	Digital
113	Trench 1, Area C	As 111	Looking NW	Digital
114	Trench 1, Area C	Overhead general view of area C	Looking SE	Digital
115	Trench 1, Area C	As 114	Looking SE	Digital
116	Trench 1, Area C	As 114	Looking SE	Digital
117	Trench 1, Area C	As 114	Looking SE	Digital
118	Trench 1, Areas C & D	General overhead view of the machine beds, walls and steps in the area	Looking S	Digital
119	Trench 1, Areas B, C & D	General overhead view of the walls, steps and machine beds	Looking S	Digital
120	Trench 2	General overhead view	Looking NW	Digital
121	Trench 2	As 120	Looking NW	Digital
122	Trench 2	As 120	Looking NW	Digital
123	Trench 2	As 120	Looking SE	Digital
124	Trench 2	As 120	Looking SE	Digital
125	Trench 2	As 120	Looking SE	Digital
126	Trench 2	As 120	Looking SE	Digital
127	Trench 1, Area B	Overhead view of eastern end of area B showing steps and yellow sandstone deposit	Looking S	Digital

128	Trench 1, Area B	As 127	Looking S	Digital
129	Trench 1, Area B	As 127	Looking S	Digital
130	Trench 1, Area D	View of the south western corner of area D showing the south eastern corner of the mill	Looking NW	Digital
131	Trench 1 Areas B & D	View of the south western corner of the mill showing the south eastern corner of the mill with the steps leading up to area D	Looking SW	Digital
132	Trench 1 Areas B & D	As 131	Looking SW	Digital
133	Trench 1, Areas B, C & D	General overhead view of the south western corner of the mill	Looking W	Digital
134	Trench 1, Area A	General overhead view of the northern end of area a showing the brick elevations, remains of concrete flooring and the line of stone column bases	Looking E	Digital
135	Trench 1, Area A	General overhead view of area A	Looking SW	Digital
136	Trench 1, Area A	As 135	Looking SW	Digital
137	Trench 1, Area A	As 135	Looking SW	Digital
138	Trench 1, Area A	As 135	Looking SW	Digital
139	Trench 1, Area A	As 135	Looking SW	Digital
140	Trench 1, Area A	As 135	Looking SW	Digital
141	Trench 1, Area A	As 135	Looking SW	Digital
142	Trench 1, Area A	As 135	Looking W	Digital
143	Trench 1, Area C	Detail of the flagged floor and stone post support between the two machine beds	Looking SW	Digital
144	Trench 1, Area C	Detail of the south western wall in area C between the two machine beds	Looking SW	Digital
145	Trench 1, Area C	Vertical view of area C	Looking SW	Digital
146	Trench 1, Areas B, C & D	Overhead view of areas B, C & D	Looking N	Digital
147	Trench 1	Overhead view of the whole Trench	Looking NE	Digital
148	Trench 1, Area B	View along area B showing steps up to area A, remains of flagged floor and inserted recess for door in northern wall	Looking NE	Digital
149	Trench 1	Overhead view of the whole trench	Looking W	Digital

150	Trench 1, Area A	Detail of the brick wall of the western wall of area A	Looking SE	Digital
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