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Archaeological Recording at Tooley's Boatyard, Banbury, Oxfordshire

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Summary

A programme of archaeological recording including desk-based research, building survey and artifact analyis was carried out by Birmingham University Field Archaeology Unit on behalf of Cherwell District Council and Banbury Museum at Tooley's Boatyard, Banbury, Oxfordshire (NGR:SP 4580 4075; SAM 172). The work was required in advance of turning the boatyard into a working museum, and was accompanied by a programme of trial trenching and monitoring of geotechnical test-pitting which was reported upon seperately (Litherland 1999).

A sequence of historical development for the boatyard was established based upon map and building survey. The boatyard was built c.1790 and both the Smithy and Dry Dock date from this era. During the 19th century new wooden butty boats were built at the boatyard, in addition to repairs being carried out within the dry dock. Increasingly, during the 20th century, which was when the Tooley family came to own the boatyard, the work came to be dominated by maintenance rather than new building. This was in response to broader economic and technological changes. Nevertheless, in several important respects the development of the boatyard was also a reflection of a unique canal-side culture, and of the Tooley family, in particular. Behind what to some eyes appeared to be the muddle and mess of reclaimed materials and old engine parts was a sense of craftsmanship and versatility as well as an intense devotion to quality and service.

Tooley's Boatyard is a rare example of a small-scale boat repair yard that was unusual because of the longevity of continuous work on the site and the survival of late-18th century associated structures. For these reasons a spatial analysis was also undertaken of the artifacts left behind when the yard was deserted. The results of this survey were mixed due to various post-depositional factors, but were found to be applicable to the Machine Shop in particular. Work is now taking place reconstructing the boatyard as a working museum.

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1.0 Introduction

The following report presents the results of a programme of building survey of the Scheduled Ancient Monument of Tooley's Boatyard, Banbury, Oxfordshire. The boatyard, situated on the bank of the Coventry to Oxford canal at NGR SP 4580 4075, comprised a dry dock (SAM 172a), smithy (SAM 172b), and four sheds/workshops (Fig. 1, Plate 1). Archaeological work was required after planning permission (97/0071/16/F) was granted to turn the boatyard into a museum. This involved the replacement of some workshops and the temporary removal of the equipment and contents of the yard. Scheduled Ancient Monument consent for the above work stipulated that an archaeological survey be carried out beforehand. Birmingham University Field Archaeology Unit conducted this survey on behalf of Cherwell District Council and Banbury Museum, in accordance with a brief prepared by Paul Smith, County Archaeological Officer for Oxfordshire (Smith 1998).

Tooley's Boatyard is a rare example of a rapidly declining form of small-scale boat-building and repair yard, once common in the later-18th and 19th centuries. Varied in form and size, the few good examples that remain tend to date from the later half of the 19th century. Tooley's Boatyard is unusual because of the survival of significant remains from the late-18th century, which include the listed buildings of the forge and dry-dock, both built between 1778 and 1790. Furthermore, Tooley's Boatyard featured in Tom Rolt's famous book 'Narrow Boat' (1944). Regarded as the founder of the modern waterways restoration movement, Rolt's first leisure narrow boat *'Cressy'* was actually fitted out at Tooley's.

2.0 Method Statement

The detailed survey of the boatyard had two main components; to record the buildings affected by the redevelopment, and to record the associated assemblages of tools and equipment in specific work areas. Each building was assigned an individual structure letter (Fig. 2) and the buildings were recorded using a combination of external and internal photography, supplemented with detailed drawn records at a scale of 1:20 and 1:50. A written analytical record of the form, function and historical development of the boatyard was also made. The survey further sought to record the relationship of artifacts to operational and functional zones. Patterns of structured deposition were also examined using detailed spatial analysis, and flow patterns between areas of activity were sought, with the aim of locating changes in spatial use over time. In addition, a desk-based assessment was carried out of existing information, including the County Sites and Monuments Record data, any published sources, and historic maps.

Given the complexity and quantity of the overall assemblage, and the need to record associated artifact groups on shelving and in cupboards, one of the key requirements of the recording process was that it should allow more detailed analysis of artifact groups to be carried out off-site. To this end, a detailed photographic record of the artifact groups was made in combination with an itinerary that recorded specific groups of tools. However, it was not practical to complete a full list of each and every tool within the complex. Material previously removed from the boatyard by British Waterways was also traced and incorporated into the analysis. In addition, reference was made to a photographic survey of the boatyard carried out by the Royal Commission in January 1997, when the yard was still in use. Finally, a further photographic record was made of the interior of the buildings after they had been emptied.

3.0 Historical Background

3.1 Tooley's Boatyard

The Coventry to Oxford canal was opened in two stages between 1778 and 1790, with Banbury forming the terminus of the Coventry canal before the section to Oxford was completed. In June 1788 an advert placed in *'Jackson's Oxford Journal'* asked for people to build boats for the Oxford Canal at Banbury (Compton 1976, 47). The boatyard was built by the time that the canal had been completed to Oxford in 1790 (see 3.4, below). The initial owner of the boatyard was called Evans. From 1837 to 1864 Rusher's Directory gives the owner as Benjamin Roberts. Later in the 19th century, ownership passed to the Neale family and then to W.J.A. Chard (Hartland 1969, 1).

The boatyard became synonymous with the Tooley's after George Tooley purchased it in 1900, although he used to rent the dock occasionally before this. George Tooley's father ran horse-boats carrying sand and pig-iron to Samuelson's Foundry at Banbury and the family may have taken over the dock to service their own boats on a part-time basis. However, other boatmen came to the yard for repair work and the business expanded. George's brothers in turn continued the canal carrying business (Chaplin 1989, 56-58). George Tooley's sons carried on the boatyard business, with Herbert Tooley, his youngest son, working until his death in the early-1980s. The business was then taken over by Barry Morse of Morse Marine.

3.2 The Evolution of the Narrow Boat

The precursor of the narrow boat is believed to have been the Worsley Mine Boats known affectionately as 'starvationers.' These were rudimentary flat-bottomed boats often of very poor build (Clarke 1982, 32). The craftsmanship of the narrow boats appears to have originated on the River Severn, and moved north with migrating artisans (Clarke 1982, 30). The standard size of the narrow boats, 72 feet long by 7 feet wide, originates from the lock size upon the Trent & Mersey Canal.

The first narrow boats were designed for boatmen who lived ashore during the night, but the arrival of aggressive railway competition resulted in increasing residence on the boats (Burton 1989, 114). The typical narrow boat design of aft cabin and fore-hold was fully evolved by the 1820s. The advent of the powered motorboat necessitated several constructional alterations. Steam engines were tried in the 1880s, but were short-lived. The size of the engine, the space taken up by coal and the necessity of an engine man, meant valuable space was lost for cargo. The advent of the Bolinder diesel engine, first introduced in 1912, solved the majority of problems associated with steam engines, and conversion to powered vessels became more prevalent (Smith 1979, 95-6). This involved changes to the keel of the butty (or unpowered) boats to prevent cavitation, an effect where the propeller losses traction within the water. Thereafter, it became a common sight to see trains of butties pulled by a single motor boat.

As cast-iron became cheaper during the 19th century it began to be used in the construction of the knees and frames of boats, and by the 1890s composite boats began to be constructed at the bigger yards that had cast-iron sides and frames, with elm bottom-boards and a pitch-pine keelson. Entire malleable-iron hulls became available from the early 20th century. However, smaller yards boat-building yards continued to specialise in wooden boats until the middle of the 20th century.

The construction of craft for leisure purposes has come to dominate the production in the latter half of the 20th century. These are commonly steel-hulled boats that mimic the traditional lines of wooden narrow boats in order to satisfy the tastes of the leisure market. The dominance of the steel-hulled boats has led to the demise of the traditional wooden narrow boat, because the labour costs involved in the construction and repair of the latter are much higher. However, this fact highlights the significance of the Tooley's Yard since it represents an important window onto the now largely extinct traditional craft of wooden boat building.

3.3 The Principles of Narrow Boat Construction

The processes involved within the workings of a small boatyard differ from the larger yards. The larger yards were those such as Nurser's Yard at Braunston, established in 1870, who built for companies like Fellow's, Morton & Clayton and Samuel Barton, or the Bull's Bridge Yard built on the Grand Union Canal in the 1930s. They were highly efficient employing upwards of a hundred people, with all the facilities required for boat construction and maintenance (Crowe 1994, 105). Tooley's Boatyard was at the opposite end of the spectrum, employing just a few men and building and repairing predominantly wooden-craft. Small yards tended to build wooden boats even when cast-iron became readily available as the technology required to build composite or cast-iron boats was out of the means of most small scale boat-builders. Often the smaller yards would operate a dual-economy operating as coal merchants, boat-painters and general blacksmiths. Some basic rules for a small boatyard were never to throw anything away; never to outlay on capital investment and to have to like your customer before you will work for him

(Chaplin 1989, 55). Workmanship was of the highest quality and time immaterial. All these points were applicable to Tooley's Boatyard, and allegedly Herbert Tooley never made out a bill in his life (Webb 1999, 40).

The boats were built and repaired in one of two locations, either within the dry dock, or pulled up adjacent to the bank. Larger yards had slipways allowing the boats to be pulled out and launched with greater ease. At Tooley's it appears that the dry dock was only rarely used for boat building. Instead the boats were built adjacent to the canal, on the strip of land between the dock and the canal bank (Hartland 1969, 57). The dry dock was mainly used for general repairs. A key component of an overhaul included caulking the boats to make the seams watertight. Oakhum - untreated rope teased into loose hemp impregnated with linseed oil - was forced between the seams and treated with 'chalico', a mixture of gas tar, tallow, horse dung and horse hair. Other common repairs included the replacement of old or smashed planks, and repairs to paint work.

3.4 The Economic History of the Oxford Canal

The Oxford Canal was intended to carry coal from the West Midlands. Work began on the canal in 1769 under James Brindley who died in 1772, before the canal was completed. Work was halted at Banbury in 1778, due to the exhaustion of funds raised under the Parliamentary Act (£205,148.22). A further act of parliament was required in 1786 in order to complete the canal to Oxford (Compton 1976, 34). This section of the canal was completed by 1790 at the cost of *c.*£102,000. Isis Lock was completed in 1796 at Oxford allowing coal transferral directly onto the Thames to London. Shortly afterwards the Duke of Marlborough commissioned a cut north of Oxford avoiding the city and shortening the journey onto the Thames. The Oxford Canal now provided a direct route from the Staffordshire and Warwickshire coalfields to markets in the south, including communities within the Chiltern Valley. Other trade included salt, road-stone and lime. This was unloaded at wharves positioned along the length of the canal. Fly boats also operated from Banbury transporting market products such as meat and butter, to Oxford and London.

The construction of several newer canal-links from Birmingham to London resulted in a loss of trade on the Oxford Canal, which was an early meandering contour-canal. However, the necessity to use the section of the Oxford Canal between Napton and Braunston to reach the Grand Junction, and the general impetus that the arrival of canals had on trade, meant trade value and revenues did not diminish (Table 1). Complaints about the shallow winding course of the canal and the threat of a new link between Birmingham and London in 1828, meant a series of improvements were undertaken at a cost of £131,877 (Compton 1976, 95). These aimed to shorten tunnels by converting them to cuttings where possible and to straighten the winding sections, using cuttings and embankments.

Table 1: Tonnage and Revenue from the Oxford Canal, 1801-9 (Compton 1976, 88)

Year	Tonnage	Revenue	Dividend(%)
1801	37,929	37,996	8
1802	40,061	40,791	10
1803	44,371	46,02	1
1804	49,272	48,901	12
1805	53,353	56,503	13
1806	59,992	57,832	16
1807	57,914	60,162	19.5
1808	65,698	71,677	22
1809	78,253	79,438	25

Tonnage receipts improved steadily throughout the late-1830s, from £72,465 in 1835 to £86,638 in 1839 (Compton 1976, 100), as the improvements were implemented and the 1840s saw trade at its height on the Oxford Canal.

However, this period of prosperity was threatened by the arrival of the railway. The tolls through Braunston were first to be hit, declining sharply from 1838 to 1841, as competition forced toll reductions. Railways had been constructed to Oxford and Banbury by the 1850s, and the period after this was therefore one of decline.

Table 2: Tonnage and Revenue from the Oxford Canal 1828-68 (Compton 1976, 129)

Year	Gross Tonnage	Revenue
1828	450,000	£89,300
1838	520,000	£86,600
1848	420,000	£56,000
1858	400,000	£24,700
1868	482,000	£24,700

Although gross tonnage did not decline (see above), competition from the railways led to a decline in revenues as tolls were reduced (Table 2). The Oxford Canal Company remained profitable because any debts from construction and improvement of the canal had been paid in full by 1848. The fiscal decline of the canal continued throughout the later part of the 19th century, but actual tonnage increased until 1914. World War I resulted in a drop in trade from which the Oxford Canal never recovered. During the war the canal was taken over by the Government, and not returned to private ownership until 1920. In 1929 the section between Napton and Braunston was sold to the Grand Union and thereafter, real decline set in. The Government took over the canal again during World War II and improvements were made as it represented an alternative route to London. However, trade continued to decline throughout the war period. When the canals were nationalised in 1947 there were fewer than 16 boats registered on the Oxford Canal. However, in 1964 a British Waterways Board report encouraging leisure-use on the canals, highlighted the tourist potential of the Oxford Canal (BWB 1964).

Overall, the development of the Oxford Canal can be broken down into a series of distinct periods.

- **1778-1840** The Growth Period. This was a period of unrivalled economic prosperity, reflected in large profits and substantial dividends paid to shareholders.

- **1840-1914** Competition with the Railways. Movement of goods along the canal did not decline, however profits were forced down by railway competition.

- **1914-1960s** Decline. Although decline began to occur throughout the later half of the 19th century, it became more pronounced due to the disruptive impact of both World Wars, and post-1945 trade was almost non existent.

- **1970s-present** The Leisure Period. Represented by continued growth of the leisure industry and growing interest in canals amongst the general public led by the Inland Waterways Association.

4.0 Survey of the Standing Buildings

(Note that the figure numbering from Fig. 3 to Fig. 10 relates to the specific structures surveyed. Where reference is also made to a sequence of historic maps ranging in date from 1853 to 1968 these are numbered from Fig. 11 to Fig. 15 and are arranged chronologically).

4.1 Structure A: The Store (Fig. 3, Plate 2)

Structure A was built against Structure B, the smithy and a former boundary wall of the boatyard to the west. The building was wider at its southern end, giving it a roughly trapezoidal plan. The earliest component of Structure A was the north wall that comprised the southern gable of the smithy. The west wall was built of clamped red brick, in a two-phase construction. The initial phase of the wall was *c.*2m high with crude Flemish-style bond brickwork, one-and-a-half bricks wide, supported by two buttresses placed centrally and slightly to the south. A blocked opening was centrally placed between the two buttresses. Attached to the wall were two iron rings for tethering horses. Several courses of cleaner-cut clamped bricks, with larger mortar joints served to raise the height of the wall. The south and east walls were both built of concrete-blocks and dated to 1947 (Barry Morse pers comm.). The east wall faced onto the yard. There were two openings; an eight-light steel framed window to the north, and a garage-sized sliding door to the south. The wall was a single block deep, but was buttressed at both ends for stability. The wall directly abutted the smithy and was not keyed-in. The south wall was plain with no openings. The corrugated steel roof was supported by a pair of north - south running purlins, supported by a centrally-placed joist rebated into the back and front walls. The southern wall acted as a truss, while a sawn-pine frame was bolted to the northern wall. There were two lights in the roof.

The development of Structure A started with the construction of the west wall against the south gable of the smithy. A structure in this position was depicted on the First Edition Ordnance Survey map of 1882 (Fig. 12), although the use of clamped brick would imply an early or mid-19th century date for its construction. The first building with a similar plan to Structure A was depicted on the 1922 Ordnance Survey Map (Fig. 14), although the concrete walls are clearly later. During Barry Morse's occupation the structure had been used as a carpentry store and workshop. However, earlier it had been used for stabling horses prior to shoeing in the adjacent smithy. However, by 1939 the Tooley's had let the smithy (Rolt 1944, 22), which may have been an indication of the decline of horse-drawn traffic in the inter-war period.

4.2 Structure B: The Smithy (Fig. 3, Plate 3)

The smithy was originally a free standing, clamped redbrick building of single-phase construction, with some later alterations. The brickwork was in Flemish bond and the eaves were dentilated. The roof was of pitched red tile, with gables at the north and south ends. A single stack in the north wall served the smith's.

The east wall faced the yard. At the southern end was a plain doorway with a wood lintel. Further north, were two windows, under a single wooden lintel. The south window was a narrow eight-pane casement window, while the north window was wider and shorter with six panes. Both windows may have replaced a smaller unglazed opening, as light within a smithy was usually kept to a minimum to see the subtle changes in colour as the metal cooled. A doorway and a small window had been punched through the south wall, presumably when the precursor of Structure A was built. The west wall was blind, while the hearth, and associated smoke hood and stack above dominated the north wall (Plate I). An ash-hole, measuring 12 inches wide and 16½ inches tall was located to the west of the hearth. In front of the hearth was the anvil, an early example with evidence of repair (Barry Morse pers comm.). A work-bench was located under the window in the eastern wall to maximise light. The floor was brick paved with evidence of wear, principally by the hearth, the eastern doorway and the bench located at the eastern wall.

The two gables and a central truss supported the roof structure. The principal rafters were supported by a strut on either side, with a pair of iron ties extending from the apex to the tie beam symmetrically and equidistant from the centre and end of the tie beam. An iron plate held the principal rafters together at the apex. The smithy was one of the first buildings to be constructed *c.*1790, and has been statutory listed (Oxon. SMR 172a). The roof and chimney were re-built with advice from English Heritage in the 1980s. Alterations included the insertion of the doorway in the south wall that opens into Structure A. These alterations appeared to have been contemporary with the construction of the structure depicted on the 1922 Ordnance Survey Map (Fig. 14). The openings in the eastern wall were probably original with varying levels of alteration.

4.3 Structure C: The Carpenter's Shop (Figs. 4 & 5, Plate 4)

Structure C was a long thin lean-to structure built against the boundary wall of the boatyard that that incorporated sections of ironstone walling and later phases of brickwork. There were two clear builds. The southern office section was clad with corrugated-iron sheets, while the longer workshop section was walled with re-used boat timbers. The frame of the building used recycled timbers throughout, including several cut-down telegraph poles. The roof was lined with corrugated-iron sheets.

The east elevation to the yard had a doorway entering the office and a five-pane window. Within the re-used timber section there were three further bays of windows, two of seven panes and one of five panes. The southern elevation abutted the smithy at an angle. The rear elevation was of red brick in English Garden Wall bond. The brickwork overlay a length of ironstone wall at the northern end of the structure. The north wall had two doorways, one entered the paint shop, the other opened onto the yard.

The workshop had a counter at the southern end where the yard shop was stationed in Barry Morse's tenancy. A workbench ran the length of the eastern wall. The floor was a mixture of concrete screed and brick paviours. The brick floor extended *c.*5m from the northern end of the building and may be a survival of an earlier structure.

Structure C was visible on pictures of the boatyard compiled in the 1940s (Mackersey 1985). The ironstone wall within the build of the rear wall was earlier, probably dating back at least to the mid-19th century (Fig. 11). The southern room of the structure was originally a store, once containing the rechargeable glass batteries used in the crystal radio sets and commonly found on the boats in the 1920s and 1930s (Barry Morse per. comm.). The main part of the structure was a chandelery store for passing trade. Barry Morse used the store as an office during his tenancy with the main area relatively unchanged.

4.4 Structure D: The Paint Store (Fig. 6, Plate 4)

A small lean-to structure acted as a corridor between Structures C and E. The rear wall was a continuation of the ironstone rubble wall that extended from Structure C into Structure E. The construction of the building was similar to that of Structure C with re-used timbers and a corrugated-iron roof. Doorways connected south to Structure C and north to Structure E. The front, eastern elevation had a single central doorway, which gave access to the yard. The door had a 'rainbow' patina of excess paint applied to the interior where different coloured paints had been tested (Plate IV).

The interior of the paint store was divided into two portions located north and south of a central entrance from the yard that was directly opposed by a paraffin tank. The southern portion had two opposing sets of shelves containing nails (Plate VIII). The northern half likewise had two sets of opposing shelves that housed a wide variety of tins of paint (Plates V, VI, VII and VIII).

This structure was another example of the temporary structures that feature largely in the Tooley's development of the boatyard, constructed from reclaimed materials from skips or demolition sites. Of a single-phase construction it post-dated the 1922 Ordnance Survey Map (Fig. 14). It was probably contemporary with the construction of the adjacent Machine Shop in the early-1930s. Much of the material contained within it, particularly the paints dated back to the 1950s and 1960s. The paraffin was used in stoves and lights on the canal boats.

4.5 Structure E: The Machine Shop (Figs. 7 & 8, Plates 4 and 5)

Structure E was also constructed using reclaimed materials and clad in corrugated-iron sheets. The framing was substantial, enabling it to support a power-boom assembly. Re-used roof trusses were placed centrally and at the north and south gables. The trusses were of king-post design, with a strut either side of the central post, and a central ridge piece. The timber frame was bolted to the floor. The average scantling of the posts was 10 inches by 3 inches.

The east elevation had two short, rectangular windows, a six-pane window to the south and an eight-pane window at the north, both located directly beneath the eaves. The southern elevation contained a single doorway into the Paint Store, but the main access to the Machine Shop was via a double-sliding door that took up the west half of this wall. The north wall had a similar-sized doorway with a large hinged door. The build of the west wall was a continuation of the ironstone boundary wall.

Several machines dominated the interior layout of Structure E. The layout of the machines was determined by the arrangement of the lay-shaft assemblies that powered them (Fig.7). There were two sources of power. In the north-west corner of the machine shop was a single cylinder Lister Diesel Engine that dated to the mid-1930s, and was reputedly the only new piece of equipment ever bought by the Tooley's (Barry Morse pers comm. Plate IX). The diesel engine drove a lay-shaft running the width of the building, attached to the posts of the central truss by two hinges, and supported in the centre of the room by hinges hanging from two longitudinal timbers, which connected the central and northern roof trusses. When the survey was carried out this lay-shaft drove a single machine, the circular saw located in the north-east corner of Machine Shop (Fig.8).

The rest of the machines were powered from the other main drive lay-shaft, which ran on a north-south axis. An electric motor powered this assembly that was located directly above the door in the south-west corner of the Machine Shop. The assembly was connected to four machines located in the southern half of the room; the medium sized 'Ransome Lathe'; the large floor mounted 'Aurora Drill'; the 'Horizontal Miller' and the small 'Judson-Jackson Lathe'. Each machine had an associated fast/loose shaft, except the drill which has a single drive located above the machine. Belts ran from the drive shafts to the main lay-shaft.

Against the west wall was a large 'Gap-Bed Lathe', and opposite, on the eastern wall was a mounting adjacent to a saw-pit for a reciprocating saw. Both these machines were positioned perpendicular to the diesel engine lay-shaft, but there were no mechanisms to utilise this power source.

There was a cluster of uninstalled machines located at the northern end of the machine shop (Plates XI and XV). These included a dismantled band saw; an electric power plane; a 'Kirchner and Co.' electric powered circular saw and an electrically powered bench drill. All appeared to represent later deposition of material from elsewhere within the complex. The electric tools were housed in the store, Structure A in 1997 (RCHME BB97/249). Barry Morse also stated that there was some equipment present when he took occupation of the site that had been purchased, but not installed, by the Tooley's.

It is clear that the drive system was the product of a gradual evolution, and did not represent the power system operated by the Tooley's from the 1930s. The big lathe and the circular saw which were both connected to the diesel motor may represent the earliest arrangement which was probably utilised towards repairs to timber butty boats. Whereas, the lathes powered by the electric motor above the door may have been installed as a result of more work being done on powered boats.

The main development of the Machine Shop seems to have been in the Inter-War years, and post-dated the 1922 Ordnance Survey Map (Fig. 14). The purchase of the 'Lister Diesel Engine' in the 1930s clearly represented a unique capital investment. It replaced a small steam-powered engine, which operated using the same boiler as the plank steamer (Chaplin 1989, 56). It would not seem unreasonable to assume that the purchase of the new engine coincided with the establishment of the Machine Shop, to provide a single locale for the increasing number of machines used by the Tooley's.

4.6 Structure F: The Dry Dock (Figs. 9 & 10, Plate 6)

Structure F, the Dry Dock consisted of an 86 feet long, and 16½ feet wide dry dock, with a depth varying from 4' to 4'6". Three planks at the northern end formed a cofferdam. Tooley's originally had a four-plank coffer dam, which Barry Morse had subsequently replaced. The top plank was removed in order to fill the dock with water from the canal. The dock had a concrete base that covered the remains of a brick paved floor (Plate XVIII). Barry Morse replaced an earlier mud floor in the 1990s. Along the side of the dry-dock two drainage channels carried away water that had leaked from the cofferdam. An iron sluice in the south-east corner allowed the water to drain under the canal and into the River Cherwell (Plate XVII). The culvert was constructed in elm that survives well when waterlogged, making an ideal construction material. However, it had been recently lined with a plastic pipe after dredging of the canal caused the elm culvert to become fractured. The sides of the dock were brick lined. The dock was extensively refurbished in the 1980s, when the brickwork at its southern end was entirely rebuilt.

Boats entered the dock fore-end first. The draught of the dock was shallow at 2'6", which often created difficulties for the deeper drafted motor boats, and in the drier summer months when the water level in the canal had fallen the dock was often unusable. Once the dock was full of water it took an hour to drain. The boats rested on wood blocks known as bostocks that had a rounded foot so they could be tilted. More recently rigid steel joists had been used, three of which were still in the dock.

The dock was entirely covered when the survey took place, but originally it was open to the elements. Then a sliding-roof assembly was fitted which ran on rails (Fig. 10). This was first depicted on the 1922 Ordnance Survey Map (Fig. 14). The sliding-roof assembly was incorporated into the construction of the present dock cover and one section of narrow gauge rail survived in the north-west corner. The sliding roof assembly consisted of two bays defined by three trusses. The three trusses rode castors over the rails and were held together by a series of bolted beams. When the boatyard was open the sliding-roof assembly was moved to cover the area in which work was taking place. The northern part of the dock was roofed over, probably in the post-war period, and in the 1990s Barry Morse was responsible for the enclosure of the south end of the dock. Both phases incorporated re-used material throughout.

Both long elevations of the dock were dominated by a series of windows, seven towards the yard on the western elevation, twelve towards the canal, stressing the requirement for good light inside. Access to the dock came from four points. A stairwell ran from the north-west corner of the dock, to a doorway onto the north of the yard. Two doorways roughly opposed each other halfway down the dock; the one to the yard connected by brick steps, the one to the canal by moveable steel steps. The southern end of the dock had an entrance that led to another larger series of brick steps into the dock. There was also a large gap deliberately left under a window so that long timbers could be passed into the working area. The larger steps here may have been to aid the passage of heavier materials into the dock. There were numerous power points located around the dock.

4.7 Outside (Fig. 2, Plates 1 & 2)

The exterior of the boatyard was defined into a series of areas by the layout of the structures within the yard. North of the machine shop and south of the bridge was a refueling area. The second area was between the dock and the main range of buildings built against the yard wall. Within this area were a number of key installations. The principal instillation was the plank steamer, which was positioned parallel to the exterior of Structure C. Two caulking stoves were positioned at either end. A steam boiler situated in a wooden hut outside the dry dock used to heat the plank steamer, but this had since been dismantled in the latter-half of the last century. Instead, the steam for the plank steamer came from the boiler inside the machine shop, via a series of copper pipes. A steam gauge regulated the amount of steam that entered the plank steamer. A large wooden bench was located adjacent to the dry dock. A number of railway sleepers were stacked against the dry dock for use in supporting docked boats. A series of power points outside Structure E would have run to the side of the dry dock by the canal entrance.

To the east of the dry dock and adjacent to the canal was an area originally used for building new boats (Hartland 1969, 56). By the time Herbert Tooley was running the boatyard in the late-1960s this area was occupied by a considerable amount of seasoning timber. It was also the location of the Tooley's caravan where they lived on-site. The final area defined within the site was the adjacent to the land entrance to the boatyard. Originally this led directly onto Factory Street. However, after the 1960s the boatyard was reached via the bus station.

5.0 Spatial Analysis of the Structural Remains (Figs. 16 – 18)

5.1 Background

The use of analytical approaches to examining archaeological remains was first pioneered in the late-1960s and 1970s by eminent archaeologists such as Binford (1973) and Clarke (1968). They proposed to take the analytical methods used in other disciplines and apply them to archaeology. The movement towards a greater analysis of the archaeological remains resulted in the adoption of many of the techniques used in geography, particularly where these techniques were used to examine physical or human processes in relation to space. However, the adoption of these analytical techniques has been slow to permeate the discipline of historical building analysis. Johnson (1997, 13) lamented the lack of synthetic analysis within the field of vernacular architecture, where despite the fact that techniques of recording and description had improved markedly in recent years, the corresponding analysis still had not progressed beyond simple analytical and comparative techniques.

Various techniques of spatial analysis were applied to the study of Tooley's Boatyard and a summary of these follows below, for a fuller treatment of the theoretical background to this work reference should be made to Hewitson (2000). Like vernacular architecture, the adoption of analytical techniques has been slow within industrial archaeology mainly because of the prevalence of documentary evidence, which has led to a tendancy to negate analytical analysis when the 'black and white' of documentary evidence is available. However, the use of theoretical analysis can allow the archaeologist to view meaning beyond that seen in the remains, and to view these as a product of cognitive and social processes. This approach seemed to have particular relevance to the study of Tooley's Boatyard, especially if one remembers the story about Herbert Tooley never making out a bill in his life!

Spatial analysis seeks to retrieve information about spatial relationships. Clarke (1977, 9) defines these relationships existing at three different levels of resolution: the micro level, the semi-micro level, and the macro level. The micro level exists within structures on site. Here, Clarke defines individual and cultural factors as dominating the economic. These factors are expressed in terms of locational structure, which comprises the non-random or reiterative allocation of artifacts, resource spaces and activities to particular

relative loci within these structures. The semi-micro level is found at the level of the site, here social and architectural models are highly applicable. At site level notions of communal space, and other social and cultural factors often continue to outweigh most economic factors, but at a more general level economic location becomes more significant. Locational structure emulates that for the micro level with the inclusion of the interaction of various structures between one another. The macro level exists between sites. Here, geographic models are largely relevant and economic factors tend to dominate. This level of spatial analysis lies beyond the jurisdiction of this report.

At the micro and semi-micro level a complex set of spatial relationships exist between artifacts, resource spaces and structures.

	Artifacts	**Structures**	**Resource Spaces**
Artifacts	AA	AS	AR
Structures		SS	SR
Resource Spaces			RR

Here, artifacts have been defined as groups of tools and objects. The concept of the resource space has been defined as a 'locale', for example around fixed machines, or the smithy hearth, work-benches, and the dry dock a whole. The resource space was where specific products were produced and distributed elsewhere around the site. Finally, structures simply refer to the various buildings within the boatyard. The analysis of the changing interrelationship of structures around the boatyard through time follows below. Analysis of artifacts and resource spaces follows in Section 6.

The techniques of the planning diagram developed by Faulkner (1963) and access analysis Hillier and Hanson (1984) were applied to the study of the structures. The planning diagram was designed to highlight access and flow within or between buildings. The importance of access to the canal was immediately apparent, as was a significant reorganisation of space in the late-19th or early-20th century that shifted the focus of this access further north around the dry dock. In addition, the technique showed that the boatyard became more complex in the 20th century as more buildings were erected particularly towards the south of the boatyard and west of the dry dock that remained the most important focal point within the boatyard. Access analysis is based upon the notion that the design of space influences social interactions and that the relationship between space and society is reflexive and mutually determining. Again this technique reinforced the importance of the canal and the tendancy in the 20th century towards inter-connection between a larger number of structures based around the open space between the dry dock and the other workshops, particularly after 1922.

5.2 Conclusions

The conclusion from these results is that a change in work practices occurred within the boatyard. In the late-19th century the yard had a greater concentration of work associated with the building of new boats. This work was carried out adjacent to the canal, with a comparable concentration of work carried out adjacent to the dry dock associated with

the repair of boats. This balance in terms of space changes dramatically post-1922 as a direct result of a concentration upon maintenance work associated with the dry dock, rather than the construction of new boats.

The reasons for this change may be seen as a direct result of three factors.

1. Change in ownership. The Tooley's took over the site around 1900. Initially their work concentrated on the repair of their own fleet of carrying boats and only diversified into general repair after time. Therefore, they were predominantly concerned with repair work from the outset. Construction of new boats was unlikely to have been a key source of income.

2. The decline of canals generally and the localised decline of trade along the Oxford Canal in particular, combined with the advent of larger boat construction yards would have led to a decline in small-scale boat construction.

3. The increased use of iron and steel within construction would have likewise led to a decline in the construction of the wooden boats that the Tooley's specialised in.

The shift in the focal point of the boatyard towards the northern end of the site and the dry dock in particular may also have reflected the increased mechanisation of work practices, and the necessity to locate these machines undercover led to the construction of workshops. Naturally, location of these poorly built workshops would be against the most significant standing structure in the area, the yard wall. Figures 16, 17 and 18 highlight this movement north of the complex from the mid-19th to early-20th centuries together with any resultant changes in access and flow.

6.0 Analysis of the Artifact Distributions

One of the key requirements of the recording process was that the record was sufficient that a more detailed analysis of artifact groups and the occurrence of structured deposition could occur off-site (Appendix A). Due to the complexity and quantity of the overall assemblage, and the need to record associated artifact groups on shelving and in cupboards, the artifacts were recorded by a multi-faceted approach. The specification of the work meant no in-situ recording of artifacts occurred within the Carpenter's Store, Structure C. In addition, the artifact distribution within the Smithy (Structure B; Plate I) should be regarded within caution as this had been reconstructed by Barry Morse essentially for display purposes.

The written and photographic record provided the framework upon which the spatial analysis of artifact distribution was based. The extent of the record was insufficient to allow detailed plotting of artifact to two or three-dimensional points. However, it has been sufficient to enable locale to be indicated on 2-dimensional plans of specific structures. Although simplistic, this initial approach to the archaeological record allows more specific areas of detailed analysis to be highlighted.

6.1 The Results of 2-Dimensional Artifact Distribution Analysis (Figs. 19 - 24)

This method was designed to highlight general trends in artifact distribution as opposed to specific distributions of tool groups. The artifacts were analysed by separating them into one of four groups, according to the way in which they were deposited.

- Original Location - Red.
- Modern Addition - Blue.
- Dismantled - Yellow.
- Later Deposition - Green.

Importantly, this approach allowed material deposited upon the abandonment of the boatyard to be identified, which was subsequently excluded from the historical analysis of tool groups. Structure E became the focus of this activity because it was a large, reasonably secure, building with good access and a large open floor space where material could be easily dumped. Examination of the RCHME photographs taken prior to abandonment in January 1997 was particularly useful as these revealed that the Electric Power Plane, the Kirchner & Co. Electric Powered Circular Saw and the Electric Powered Bench Drill, were moved from the Store, Structure A to Structure E (RCHME photo no. BB97/249). However, much of the original *in situ* material also had a 'dumped' appearance about it. This was a direct result of the philosophy of recycling prevalent within the boatyard, with material repeatedly re-used and stored for later use, which made it difficult to differentiate between the various depositional categories.

Another factor affecting the interpretation of the artifact distribution pattern was the loss of artifacts. Archaeological artifacts by their nature tend to represent the 'rubbish' of the society operating within that site. It appeared that the majority of useful tools; in particular readily portable artifacts were stripped from the site (Plate II). Articles highlighting the closure of Tooley's Boatyard specifically advertise the sale of machinery and tools from the yard (Needham 1998, 29). Furthermore, it was likely that specialist tools like caulking equipment and adzes, many of which were purpose-made, would have been removed by the proprietor (Nigel Jackson, Black Country Museum, pers comm.), although the heavy coppers were left *in situ* (Plate III).

Therefore, it is clear that the recorded artifacts represent an incomplete record of the yard. Nevertheless, examination of artifacts within specific areas can reveal trends of activity within the areas.

6.1.1 Structure A: The Store (Fig. 19)

The artifact distribution within the store was representative of its penultimate function as carpentry area. The majority of the remains, off-cuts of wood, wood saws, drill bits; a wood-horse and paint were remnants of woodworking activity. The distribution of

artifacts does not appear to have been drastically altered after the abandonment of the boatyard, with the exception of movable machine tools mentioned above. The distribution pattern appeared to have been dictated by the need for light. The western windowless wall was entirely taken over by the storage of wood. The majority of this wood was off-cuts. The eastern wall facing the yard was where the activity areas appear to have been. Light and access made this area more suited for work, with the eastern wall acting as a repository for easily accessible tools such as saws, wood drill-bits and large clamps. However, evidence had also survived of an earlier phase of use as a stables for horses prior to shoeing represented by the survival of iron rings for tying up horses, located on the west wall.

6.1.2 Structure B: The Smithy (Fig. 20)

Key to the artifact distribution of the smithy was the central locale of the hearth and anvil. The smithy represented a specialist work area, with a centrally located resource space (the hearth, B/1/5) and associated artifact distributions radiating away from it. Stored principally to the east of the hearth were clamps, hammer, grabs, pliers and punches associated with the use of the hearth. To the west were more clamps and the bellows. Directly in front of the hearth was a steel drum containing further tools. A short distance from the hearth and located directly in front of it was the anvil. The space surrounding the anvil (B/1/12) was uncluttered. The speed and accuracy necessary to work heated metal meant access to tools was paramount. Therefore, the distribution of tools was radial from the hearth – anvil work area, with an approximate radius of c.1.5-1.8m taking in all the tools. The work bench (B/2/5) was located to the edge of this radius suggesting the activities undertaken here were not associated with the hearth or involved the working of the metal in its cold form.

Located around at the edge of the room were two gas cylinder bottles, a welding mask and a welding unit. These were later additions to the structure and represent the necessity to adapt trade to a modern market. Their location represents storage, because although welding may have occurred in the smithy, the presence of the jig (B/1/4) suggests that the gas bottles were portable and moved to the specific location in which they were required.

Unfortunately, the artifact distribution within the smithy was a relatively recent construct (Barry Morse pers comm.). The artifact distribution was devised after the structural repairs to the smithy in the late-1980s to the early-1990s and included several tools purchased at markets and fairs. Therefore, the assemblage represented a modern reconstruction, rather than the remnants of a working boatyard smithy.

6.1.3 Structure D: The Paint Store (Fig. 21, Plates IV - VIII)

The spatial examination of the paint store cannot be taken beyond the observations made during the survey of the standing buildings, as there were no specific resource spaces within the store around which tool group clusters could be examined. Comparison

between Plates VI and VII taken in 1998 and 1997 respectively also shows how the distribution of artifacts was random and associated with random use.

6.1.4 Structure E: The Machine Shop (Fig. 22, Plates IX - XV)

Structure E, the Machine Shop represented the best opportunity to examine the deposition of artifacts within the boatyard after the recently dumped material was subtracted from the equation. This was because the locale of the various machines situated here dominated the room layout. The boom layout, which has described earlier, had a profound effect on the distribution of the machines and associated artifacts as these were clustered at the southern end of the room near the power source from the electric motor.

The circular saw was the only machine to run from the diesel engine via a boom assembly. The relative isolation of the circular saw is not entirely clear, but may be due to a number of factors, including frequency of use, health and safety concerns. Perhaps, the over-riding factor, however, may have been the need to pass long objects such as wooden planks through the machine and into and out of the building through the large opposed doors of the Machine Shop.

The lathes and other metal working machines were concentrated within the southern end of the Machine Shop. Two key storage-points for tools were linked to these machines. Three shelves were located in the south-west corner next to the lathes, along the western wall (E/4/1, E/4/70 & E/4/74), and further storage shelves below the 'Ransome Lathe' (E/3/1-8).

More detailed examination of specific tool groups is undertaken in Section 7.1, below.

6.1.5 Structure F: The Dry Dock (Fig. 23, Plates XVI - XVIII)

There were few remaining artifacts within the dry dock, although some essential items associated with the working of the dock had survived. These included the cofferdam planks, the sluice, pump equipment to drain the dock and rigid steel joists to rest boats upon. The south-east corner was dominated by three sets of shelves, containing paint. The paint appeared to be of the types most commonly used, with the shelves acting as a directly accessible repository for paint. The paint store contained the less frequently used paints. A workbench was located against the west wall with easily access to the boat when docked.

6.1.6 Outside (Fig. 24)

Examination of the artifacts located outside the workshops revealed two principal areas of activity. Again, there were a number of artifacts randomly distributed after the abandonment of the yard. However, there was a cluster of artifacts associated with the repair and construction of the boats within the dock in the area between the work sheds

and the dry dock. The key factor in their location was access to both the dock and the workshops. This space appears to have acted as a key distribution point and included the plank steamer from which planks had to be hurriedly moved while they were still malleable. The enclosure of the dock appeared to have restricted access directly to the dock. Larger double doors still existed within the west elevation although these would not have been as adequate as the open access that existed before, and may reflect the decrease in the repair of wooden boats within the yard. Copper 'pitch ovens' were located at either end of the plank steamer for the preparation of 'chalico'. Their spatial priority, like the plank steamer, was easy access to the dock.

A stack of railway sleepers was located adjacent to the dock. These were used to prop boats in dry-dock. A workbench adjacent to the dock entrance acted as a useful locale for work, with immediate access to the workshops and the dock. It may also have been used as a place to rest hot 'steamed' planks prior to entering the dock.

The second major focus of artifacts was to the north of the workshops adjacent to the canal. Here were located a fuel pump and tank, with another tank for engine oil. This represented a service area for passing boats.

7.0 Detailed Spatial Analysis of Artifact Distribution in Structure E (Figs. 25 – 27)

The Machine Shop artifact assemblage represented a more complex distribution, encompassing a high level of post-abandonment deposition, and several independent tool groups. In order to examine the artifacts it was necessary to firstly categorise them according to specific groups outlined below:

Post-Abandonment Deposition	Green Circles
Cogs/Pulley/Boom Associated Artifacts	Cyan Circles
Lathe Associated Tools	Red Squares
Drill/Miller Associated Tools	Blue Triangles
Circular Saw Associated Tools	Yellow Triangles
Reciprocal Saw Associated Tools	Yellow Diamonds
Electrical Tools	Purple Squares
Clamps and Vices	Orange Diamonds
Miscellaneous Hand Tools	Blue Stars

Each tool within the group can then be represented as a point and their location plotted as a point on a scatter graph. This allows a comparison of location to be easily made between tool groups and there associated machines, clustering of tool groups to be identified to location and post-abandonment deposition to be understood.

7.1 Examination of the Scatter Graphs

Examination of the post-abandonment depositional layers of the scatter graph (Fig. 25) revealed a distinct level of clustering. The tendency of the clustering was in three general locales. Firstly on the shelves against the south-west wall of the room, and beneath the Ransome Lathe at the southern end of the room. The second area of deposition was against each wall of the Machine Shop. This occurred up the remainder of the west wall where there were no shelves, adjacent to the east wall by the south-west entrance and in the north-west of the room behind the diesel engine. The third area of clustering was on top of the machines. This was clearly a product of post-abandonment deposition. The overall pattern of deposition was, perhaps, most significant where it was absent. There was little deposition in the central open floor space, in front of the north and south exits, and towards the entrance to the paint store. This well defined the space within which movement occurred through the building. The distribution of cogs, pulleys and boom equipment (Fig. 25) suggested these were predominantly remnants of primary deposition. However, closer examination revealed much of the cog clustering occurred within the shelf area to the south-west of the structure, with pulleys found elsewhere. This may suggest the cogs were specifically associated with the machines in the south-west area of the room, whereas the pulleys were more generally deposited.

Examination of the machine associated tool scatters (Fig. 26) revealed a concentration of lathe artifacts within the shelving area. When circles of access are superimposed upon the artifacts with each lathe as its centre point, specific clustered distributions can be assigned to each machine. The Judson-Jackson Lathe (south-west corner) has an area of control over two groups of clustering within the shelving units. However, the northern cluster is shared with the Large Lathe and it would seem more likely this cluster was associated with that lathe. The medium-sized Ransome Lathe appears to have an associated tools clustered on the shelves beneath it, and directly adjacent to it.

There appeared to be none or little clustering of the drill/miller tool group (Fig. 26), with neither machine having easy access to their specific tool groups. Three possibilities may be suggested. Firstly, that the tools once existed close to the machines but have been subsequently removed. Secondly, that the machines were less commonly used, and that therefore easy access to specific tools was not a priority, or that thirdly, the machines did not have many inter-changeable tools, in contrast with the lathes.

The saw tool groups (Fig. 26) were clustered in the proximity of the machines at the north-east corner of the room. This suggested a specific area assigned to the use of the saws. However, this can be discounted, as it was known that the smaller, electric powered, circular saw was a result of later deposition and that the reciprocal saw had been dismantled and removed from its original position. Therefore only the large circular saw tools may be regarded as original. However, the distribution of these was directly over the saw, which suggested that these, too, were the result of later deposition and were not in their original location.

The non-machine associated tools (Fig. 27), revealed a degree of random clustering, although electrical spares tended to be located within a cupboard against the west wall. Various clamps and vices were clustered randomly, although predominantly within the shelving and adjacent to the walls, and adjacent to the south door was a cluster of hand tools.

8.0 Conclusions

This report has soought to understand the development of Tooley's Boatyard through analysis of historical and map evidence relating to the yard, study of its built-form and the final distribution pattern of tools and artifacts in various workspaces. These changes need to be understood within the broader context of various economic influences which mainly relate to the decline of the canal system during the 20th century, the evolutionary development of narrow boat construction, and broader technological change associated with increased mechanisation of work practices. Nevertheless, in several important ways the development of the boatyard was also a reflection of the unique culture of the boat people, and specifically of the character of the Tooley family. Here, concepts such as craftsmanship, versatility, and a devotion to the recycling of any materials were crucial, notions that Tom Rolt highlighted in his book 'Narrow Boat' (1944), and Barry Morse continued at the yard and through his stories of the work that was done there.

In terms of structural development the survey confirmed that the two listed buildings of the Smithy (Structure B), and the Dry Dock (Structure F) were the earliest survivals on the site and probably date to *c.*1790 when the yard was first set up. Originally the dry dock was open, but it was later provided with a sliding roof-section that could be positioned where work was being carried out on sometime around 1922. The other buildings within the yard were all constructed using reclaimed materials and probably developed between the 1920s and 1950s, with most being built sometime in the 1930s. The dry dock was only completely roofed as late as the 1980s when various repairs were carried to the yard.

Spatial analysis using the techniques of the planning diagram (Faulkner 1963) and access analysis (Hillier and Hanson 1984) highlighted further historical changes that had occurred in the development of the yard. In the mid-19th century, and probably form its construction, buildings within the yard tended to be situated to the south of the yard. One was located adjacent to the entrance off Factory Street, and the other was located on a strip of land next to the canal. By the early-20th century the emphasis of the yard had shifted further north and centred around an open space directly adjacent to the dry dock. The complex as a whole had become more complicated and the number of buildings had increased. This change may be explicable in terms of the economic and technological changes noted above. These resulted in fewer new wooden boats being constructed and the emphasis of the yard's work shifting towards repair work. Therefore, the area adjacent to the bank of the canal, which was where new boats were constructed and launched, became less important relative to the dry dock, which became the focus of repair work. The new buildings constructed from recycled materials reflect the hard

economies of the inter-war years and changes in work practice, particularly the need to keep machines out of the weather. The impetus towards a more mechanised work environment was also a response to the decline of the horse-driven butty boat and the increase in oil-powered boats, which further affected the function of the smithy.

Analysis of the spatial distribution of relict artifacts around the site posed several problems, but was nevertheless found to be applicable, particularly within the Machine Shop (Structure E), and the plank steamer and copper pitch heaters which were located in the open space adjacent to the dry dock. Problems included the fact that when the survey was conducted the yard had already closed down and had been in the process of running down for some time. Also, the spread of artifacts reflected the occupation of Barry Morse, and not the Tooley's. In the Tooley's time the yard had been solely devoted to repair work and not open to the public to look around on open days. For example, the distribution of artifacts within the Smithy was largely a reconstruction for these open day displays.

Inside the Machine Shop artifacts tended to cluster upon shelves, work surfaces and at the sides of rooms leaving access routes clear. The distribution of artifacts upon shelves was probably the closest to how it had been when the yard was operation and was clearly skewed by the layout of the machines in the Machine Shop. Pulleys, cogs and boom equipment tended to emulate this distribution, although there was a suggestion that the cog-clusters were associated with the machines in the south-west corner of the Machine Shop. Clustering also occurred of other artifact groups including electrical equipment that was placed on specific shelves and miscellaneous everyday tools, such as hammers and saws near the door leading to the dry dock.

Spatial analysis has enabled differences between structures, resource spaces and artifacts to be examined with respect to one another, but needed to be utilised in combination with more traditional survey techniques. Nevertheless, the application of these techniques was shown to be applicable within an industrial archaeology context and to have widened the scope of conventional analysis. However, the main message of the survey has been to emphasise that surveys of this type are best conducted when the workshop is still in use.

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Maps

Davis & Davids (1853) 'Map of the Parish of Banbury in the Counties of Northampton And Oxford', Oxon. Archives Private Records Ref. BL XVII/i/1 Accession No. 1352

Ordnance Survey Maps 1:2500 (1st, 2nd, 3rd, and 4th Editions)

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Appendix A: Artifact Analysis

A Store (Fig. 19)

A/1/1 Wood Off Cuts
A/2/1 Large Steel Clamps (2)
A/2/2 Metal Off Cuts
Wood Drill Bit
Paint
Protractor Saw-Blade
A/2/3 Wood Saws
Templates
A/3/1 Wood-Framed Storage Unit
A/3/2 Wood Horse
A/4/1.1 Miscellaneous Wood
A/4/1.2 Barrel Containing Wood Off Cuts
A/4/2 Steel Clamps
A/4/3.1 Iron Ring
A/4/3.2 Iron Ring

B Smithy (Fig. 20)

B/1/1 Electric Bellows for Hearth
B/1/2 Iron Clamps (2)
B/1/3 Metal Cylinder Containing Iron and Steel Bars
B/1/4 Jig
B/1/5 Hearth
B/1/6, 7 & 9 Iron Grabs and Pliers in Rack
B/1/8 Iron Grab in Hearth
B/1/10 U-Clamp
B/1/11 C-Clamp in Box
B/1/12 Anvil
B/2/1 Pile of Hammer Heads, Punches and Handle Holders
B/2/2 Oil Container of Miscellaneous Metal Rods and Bars
B/2/3 Steel Drum Containing Miscellaneous Tools
B/2/4 Iron Hand-Powered Bench Drill
B/2/5 Wooden Work Bench
B/2/6 Hook
B/2/7 Gas Bottle
B/4/1 Welders Mask
B/4/2 Iron Clamp
B/4/3 Welding Unit

B/4/4 Gas Bottle

C Carpenter's Store

No recording of tools undertaken.

D Paint Shop (Fig. 21)

West Nail Shelves, Steel, 7 shelves
East Nail Shelves, Wood, 7 shelves
Paraffin Tank
Bracket Shelf
Tools Over Paraffin Tank
East Paint Shelves, 3 shelves
West Paint Shelves, 6 shelves

Each paint tin was recorded in detail, noting manufacturer, colour and size. These contents of these shelves suggested that the paint was a store for colours which were not regularly used in canal boat painting, whereas more regularly used paint was stored in the dry dock. The collection of nails may have operated differently being taken as required for a particular job.

E Machine Shop (Fig. 22)

E/1/1 Long Saw Blade (Reciprocating Saw)
Pulley Wheel (Block and Tackle)
Scaffold Pipe Connectors (2)
Band Saw Blade
Broken Shovel Blades (3)
Bricks, Pipes, Pieces of Wood
E/1/2 Metal Axles for Drive Shafts (14)
Circular Saw Blades, Large
E/1/3 Fabricated Wood Pulley Wheel
Fire Iron
Metal Pipe, Flexible
Plastic Pipe
Plastic Cover
E/1/4 Tea Chest (within)
Winder for Coiling Fenders (3)
Plastic Funnel
Metal hook
Metal Oil Tray
Stirrup Pump
Plastic Pipes (various)
Welding rod (metal)

(By the tea chest) metal oil tray
metal tool chest, nuts, bolts, broken spanner

E/1/5 Spanners (2)
Bottle (Solvent)
Metal Pipes (4)
Oil Can (5 gallon)
Coiled Belt Pieces, 3½"-4", (13)
Wheelbarrow Wheel

E/1/6 Band Saw (Dismantled)

E/2/1 Circular Saw Blades, 6"-12" diam. (40)
Grinding Stone 11" diam.
Oil Can
Machinery and Metal Paint, Can (2)

E/2/2 Oil Cans Castrol Motor Oil, 25l
Castrol Water Pump Grease, 500g
Morris SAE 30 Motor Oil (2)
Metal Oil Can (¼ gallon)
Plastic Autosafe Flushing Oil (5l)
Esso Uniflo Oil (5l)
Plastic Parrifin (5l)
Plastic Comma Solvent Flushing (2.5l)
Plastic Container (5l)
Plastic Funnel (2)

E/2/3 Plastic Chemical Toilet
Painted Wooden Box
Metal Axle End, with Pulley Attached
Oil Funnel
Gas Heater Element
Mounting (with 3 belt and 1 belt mounting)
Nut, large
Saw Blade

E/2/4 9" X 10" boat spikes nailed into wooden sub-frame (2)
Hand Saws (10)
White Spirit Container (2)
Pipe Bending Adapters
Large Screw Cap
Scythe Blades (4)

E/2/5 Bicycle, 'Morse Marine Advert'
Container (25kg), contains off-cuts of plastic pipes and pipe insulation
Sheets of Metal (2mm gauze) (5)
Glass Window Panels, top (9)
Broom Heads (2)
Plastic Pipe End Expander

E/2/6 Belt Wheels, 27", for Band Saw (2)
Cast Iron Angle Bracket, Supports Drive Shaft

E/3/1	Wooden Shelving Unit, southern half, 3 shelves (see E/3/2-4)	
	Box, contains	Cogs
		Plumb Bob (2)
		Circular Saw Blade
E/3/2	Top Shelf	Iron Shovel, broken handle (24")
		Log (12½")
		Ransom Lathe Clamp (22½")
		Small Motor (8")
		Lathe Attachment (9")
		Box of Lathe Tools Cutting Tools and Drill Bits
		Metal Plate with Bolt through Centre (6¼" length)
E/3/3	Middle Shelf	Sandpaper Squares
		Logs (3)
		Wood Turned Chair Leg (20")
		Thin Metal Strip (26¼" length, ¾" wide)
		Toothed Cog (8" diameter)
		Cylindrical Rod with Threaded End (13")
		Drill Bit (20½")
		Steel Tubing (4¾ length, 2" diameter)
E/3/4	Bottom Shelf	Metal Box of Nuts, Bolts and Washers
		Yellow Plastic Bucket of Rusted Nails
		Copper Stirrup Pump (23½")
		Wooden Chair Legs (5)
		Metal Cylindrical Shaft
		Wooden Cube (3¼")
		Lathe Associated Metal Plate
E/3/5	Wooden Shelving Unit, northern half (see E/3/6-8)	
	Rear of Lathe	Fluorescent Lights
		Heavy Duty Electric Cable
		Water Hose (3)
		Spare Belts for Lathe
		Vent Ducting for Boiler
		Poll of Plastic
E/3/6	Top Shelf	Large Sanding Wheels (3, 10", 12", 14")
		Sandpaper Squares
		Wooden Cylinders, with hole through centre (2)
E/3/7	Middle Shelf	Cutting Bit for Lathe
		Nails
		Cog (15" diameter)
		Pulley Wheel (2, 3", 7½" diameter)
		Jig for Lathe (2)
		Laboratory Clamps (2)
		G-Clamps (10" diameter)
E/3/8	Bottom Shelf	Circular Wood Tubes (7)
		Wood Chocks (10)
		Circular Chock of Wood

Metal Jig Holder
Broken Wooden Handles (2)
Banister Rib
Leant Against Lathe Front
Steel Plates (2)
File Attached to Spade Handle
Steel Roller, on Circular Base and Steel Frame
Steel Boiler Flue (2)
Metal Funnel

E/3/9 Wood Box, contains Metal Cylinders
Spring, Attachment for Lathe

E/4/1 Shelving Unit against Wall, 6 shelves (see E/4/2-65)

Top Shelf

E/4/2 Wood Spade Handles (3)
Plastic Handle Tops (3)
E/4/3 Soldering Irons (5)
E/4/4 Electrical Switch (2½" x 3")
E/4/5 Iron Tongs (14")
E/4/6 Chain Clamp (2')
E/4/7 Spanner (7")
E/4/8 Unknown Metal Tool (15½")
E/4/9 Wrought Iron Decorative Gate Piece

2nd Shelf Down

E/4/10 Wooden Square Block Paddle (15 x 2")
E/4/11 Incomplete Circular Iron Fitting
E/4/12 Lump Hammer (10")
Metal Hammer Heads, lump, claw and other (10)
E/4/13 Iron Screw Clamp (9½" x 3½")
E/4/14 Iron Door Handle
E/4/15 Metal Dome, Unknown Use
E/4/16 Cobbler's Foot (6" x 8½")
E/4/17 Part of Vice, no screw shaft
E/4/18 Cylindrical Shaft (5" length)
E/4/19 Metal Rod, with Cylindrical Wooden Handle
E/4/20 Cutting Tool from Lathe/Punch (15")
E/4/21 Small Metal Funnel (2¾")

3rd Shelf Down

E/4/22 Toothed Cogs (18, 1¾"-9" in diameter)
E/4/23 Metal Plate, Unknown Use
E/4/24 Hammer Head, Lump (2"x 4¼")
E/4/25 Iron Disc, Screw thread through centre
E/4/26 Lathe Cutting Tools (25, 4"-8")
E/4/27 Drive Shaft (12¾" length, 1¼" diameter)
E/4/28 Cylindrical Shaft (5¾" length, 1½" diameter)
E/4/29 Axle (5½" length)

E/4/30 Metal Plate, unknown use (4¼ x 2¾")
E/4/31 Electrical Transformer (4½" x 5½")
E/4/32 Drill Bits (2, 9½" and 7½" length)
E/4/33 Cylindrical Shaft, unknown use (18" length)
E/4/34 Tin Containing Metal Filings
E/4/35 Lamp
E/4/36 Drill Pieces (3, 6½", 6½" and 3")
E/4/37 Clamp (6½")

4th Shelf Down

E/4/38 Buffing Discs (9)
E/4/39 Axle (12" length)
E/4/40 Drill Bits (8, 4½" in length, one 6½" in length)
E/4/41 Cutting Tools for Lathes (c.50, varies 5"-12")
E/4/42 Roll of Insulating Material
E/4/43 Switches, Light (3)
E/4/44 Clamps (3, 6½", 9" and 12½" length)
E/4/45 Circular Lathe Attachment with Screw Thread in Centre (6¼")
E/4/46 Sharpening Discs (13, varies 3¾"-9")
E/4/47 Electrical Plug Socket
E/4/48 Tin of Metal Filings

5th Shelf Down

E/4/49 Buffing Discs (2, 6½" diameter)
E/4/50 Roll of Cable
E/4/51 Clamp (9½")
E/4/52 Toothed Cog (3" diameter)
E/4/53 Starter Motor
E/4/54 Electrical Machine Switch
E/4/55 Hinge Plate with Attachment, unknown use
E/4/56 Sharpening Disc (2, 12" diameter)

6th Shelf Down

E/4/57 Cogs (5) stored on Hooked Rod
E/4/58 Iron Jig for Lathe (6¼" x 10¼")
E/4/59 Fuse Switch
E/4/60 Unidentified Heavy Metal Object (5½" square)
E/4/61 Tin of Paint
E/4/62 Metal Vessel, Ornamental

Beneath Shelves

E/4/63 Toothed Cogs (3, 11"-14" diameter)
E/4/64 Canisters (3)
E/4/65 Hand Shovel
E/4/66 Electrical Motor
E/4/67 Stack of Metal Rods/Shafts (c.20)
E/4/68 Cylindrical Shaft on Circular Stand (41")
E/4/69 Iron Chest containing Spanner
Door Hinge Plates
Trowel

Jigs
Tool Heads
Sanding Disc
Door Handle and Latch
Lengths of Wire

E/4/70 Wooden Cupboard, 3 shelves (see E/4/71-73)

Top Shelf

E/4/71 Electrical Equipment including:
Heating Filament attached to 3-Pin Plug
Fuse Switch
Bulb with 4 Round Pins
Small Reels of Insulated Wire (2)
Plug Sockets, 2-Pin Round (2)
Plug Sockets, 3-Pin Round (2)
On/Off Switch
Light Bulb Fitting
On/Off Switch on Wood Plate
Cord Switch
Electrical Coils
Sandpaper
Small Bulbs (2)
Ceramic Light Fittings (2)
On/Off Light Switch

Middle Shelf

E/4/72 Ceramic Light Fittings (3)
Plug Socket, 3-Pin Round
Plastic Ceiling Light Fittings
Leather Goggles
Assorted Bulbs
Nuts and Bolts
On/Off Switches
3-Pin Plugs

Bottom Shelf

E/4/73 Boxed Fuse Switch
Roll of Insulated Wire (3)
Insulated Lead, Attached 3-Pin Plug and 2-Pin Socket
GEC Amp Meter
Iron Dashboard with Gauges for Oil
Amps
Fuel and Water Heating elements (3)
Large 3-Pin Round Plug Socket
Ceramic and Bakelite Light Fitting with Pull-Cord
Boxed Fuse Switch
Large Boxed On/Off Switch and 3-Round Pin Plug Socket
Cutting Tools from Lathe
Winding Handle

Small Motor

E/4/74 Iron Shelves, 7 shelves (see E/4/75-110)

2nd Shelf Down

E/4/75 Weights (1oz, 4oz, 8oz, 1lb)

E/4/76 Iron Object, unknown use

E/4/77 Tool, Unknown

3rd Shelf Down

E/4/78 Tool for Removing Nuts

E/4/79 Cog (3)

E/4/80 Lathe Attachments, Spacers (c.50+)

4th Shelf Down

E/4/81 Swivel Joint (4½" x 2")

E/4/82 Disc from Electric Motor (5")

E/4/83 Iron Object, unknown (3½")

E/4/84 Iron Objects, Rectangular (3, c.3" long)

E/4/85 Flat Iron Object with Three Notches (12" x 2½")

E/4/86 Iron Stamping Machine (7" x 6")

E/4/87 Steel Machine Fittings and Springs, in plastic box

E/4/88 Iron Wheels (3)

Pulley Wheels (12)

5th Shelf Down

E/4/89 Cogs (11)

E/4/90 Allan Keys (4)

E/4/91 Wooden Box Contains Drill and Lathe Attachments (17)

E/4/92 Machine Part (3" x 7")

E/4/93 Small Wooden Box, Small Iron Machine Fitting Within

E/4/94 Iron Rods (4), 3 Hexagonal in Cross-section

E/4/95 Iron Axe Head

E/4/96 Bolts (c.20+)

E/4/97 Cylindrical Iron Object, possible lathe attachment

E/4/98 Group of medium sized cylindrical iron objects

6th Shelf Down

E/4/99 Lamp Shade

E/4/100 Lathe Attachment

E/4/101 Vices (3)

E/4/102 Lathe Attachment

E/4/103 Tool for Adjusting Lathe Attachments

E/4/104 Drill Attachment

7th Shelf Down

E/4/105 Iron Guard

E/4/106 Circular Lathe Attachment

E/4/107 Cogs (8)

E/4/108 Circular Lathe Attachment (2)

E/4/109 Wheels for Belt Driven Machinery (2)

E/4/110 Spanner

In Front of Shelves

E/4/111 Boiler Unit (26" x 14")
E/4/112 Lampshade
E/4/113 Allan key
Press
E/4/114 Iron Chain Link
E/4/115 Glass Window Pane
E/4/116 Iron Pipe
E/4/117 Spread of Metal Shavings and Splintered Wood
E/4/118 Tobacco Tin full of Nails
E/4/119 Wooden Step Ladder
E/4/120 Water Boiler
E/4/121 Circular Lathe Fitting
E/4/122 Group of Electrical Equipment
E/4/123 Boilers (2)
Small Boiler
Kitchen Sink
E/4/124 Possible Lathe Fitting
E/4/125 Pipe Bending Machine
E/4/126 Clamp Press
E/4/127 Wheels (4, 15" diameter)
E/4/128 Saw Blade (4' long)
E/4/129 Vice, large (3' x 17")
E/4/130 Large Circular Lathe Attachment
E/4/131 Tools (2) Purpose Unknown
E/4/132 Belt Wheel
E/4/133 Stamp/Punch
E/4/134 Electric Motor
E/4/135 Electric Motors (2)
E/4/136 Tin, containing copper shavings
E/4/137 Drawing Ruler
E/4/138 Possible Machine Fitting
E/4/139 Belt Coil
E/4/140 Wheel, for belt driven machinery
E/4/141 Cogs, for lathe (4)
E/4/142 Boiler
E/4/143 Wooden Rollers (3)

F Dry Dock (Fig. 23)

F/1/1 Dry Dock Planks for Closing Dry Dock (3)
F/2/1 Steel Steps
F/2/2 Sluice
F/2/3 Shelves (Paint)
F/2/4 Shelves (Paint)
F/3/1 Shelves (Paint)

F/4/1 Rigid Steel Joists (3)
F/4/2 Hooks
Fire Extinguisher
F/4/3 Pipes for Pump
F/4/4 Bench

O Outside (Fig. 24)

O/1 Plank Steamer
O/2 'Copper' Pitch Oven
O/3 'Copper' Pitch Oven
O/4 Fuel Pump
O/5 Fuel Tank
O/6 Marine Diesel Engine
O/7 Tank (Engine Oil)
O/8 Timber Table
O/9 Pail (1)
Fuel Cans (3)
Oil Jug (1)
Shovel (1)
O/10 Timber Railway Sleepers
O/11 Tank (Water)
O/12 Wheel
O/13 Trolley
O/14 Liquid Propane Gas Water Heater
O/15 Discarded Tools/Depositional Debris

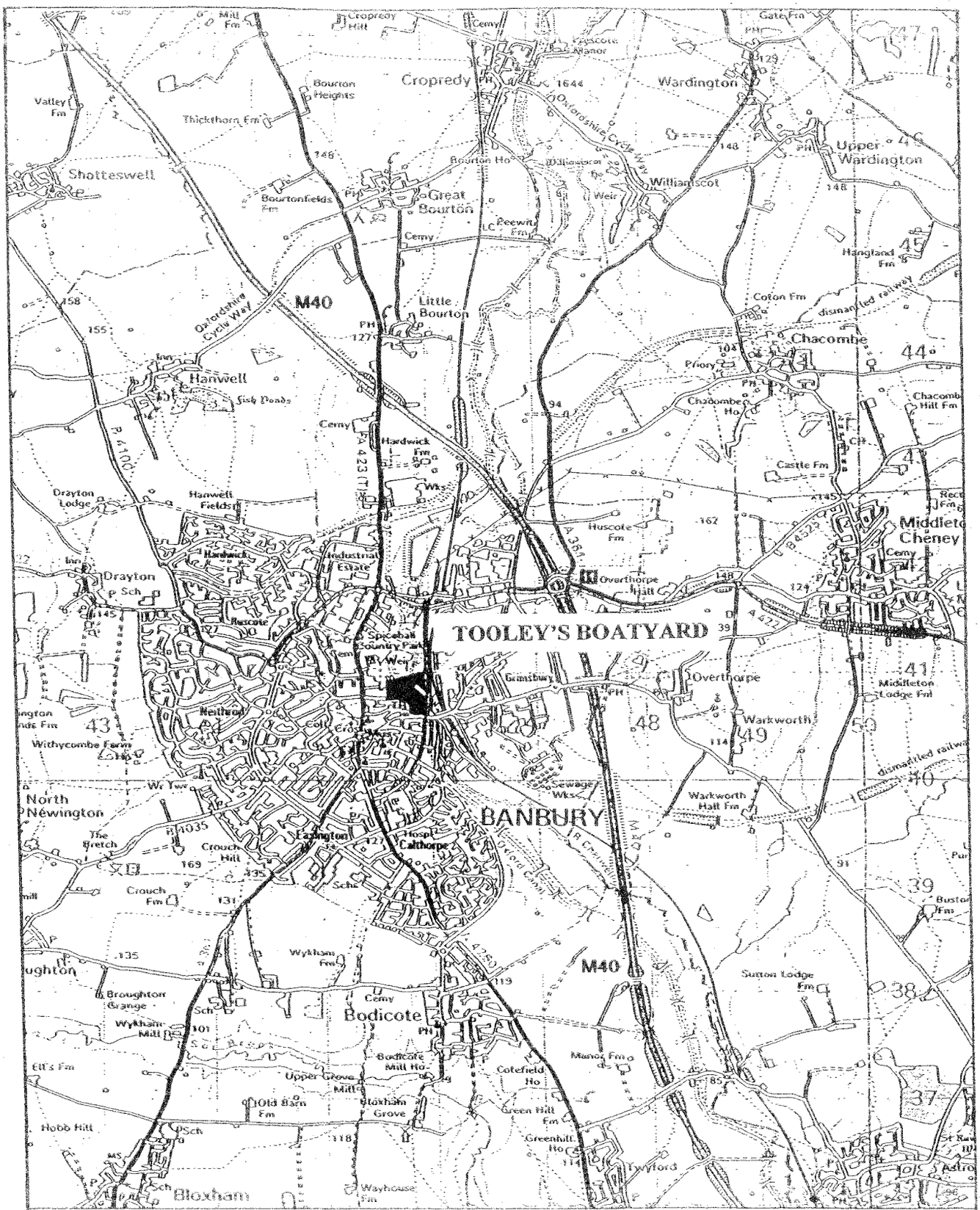


Figure 1: Tooley's Location

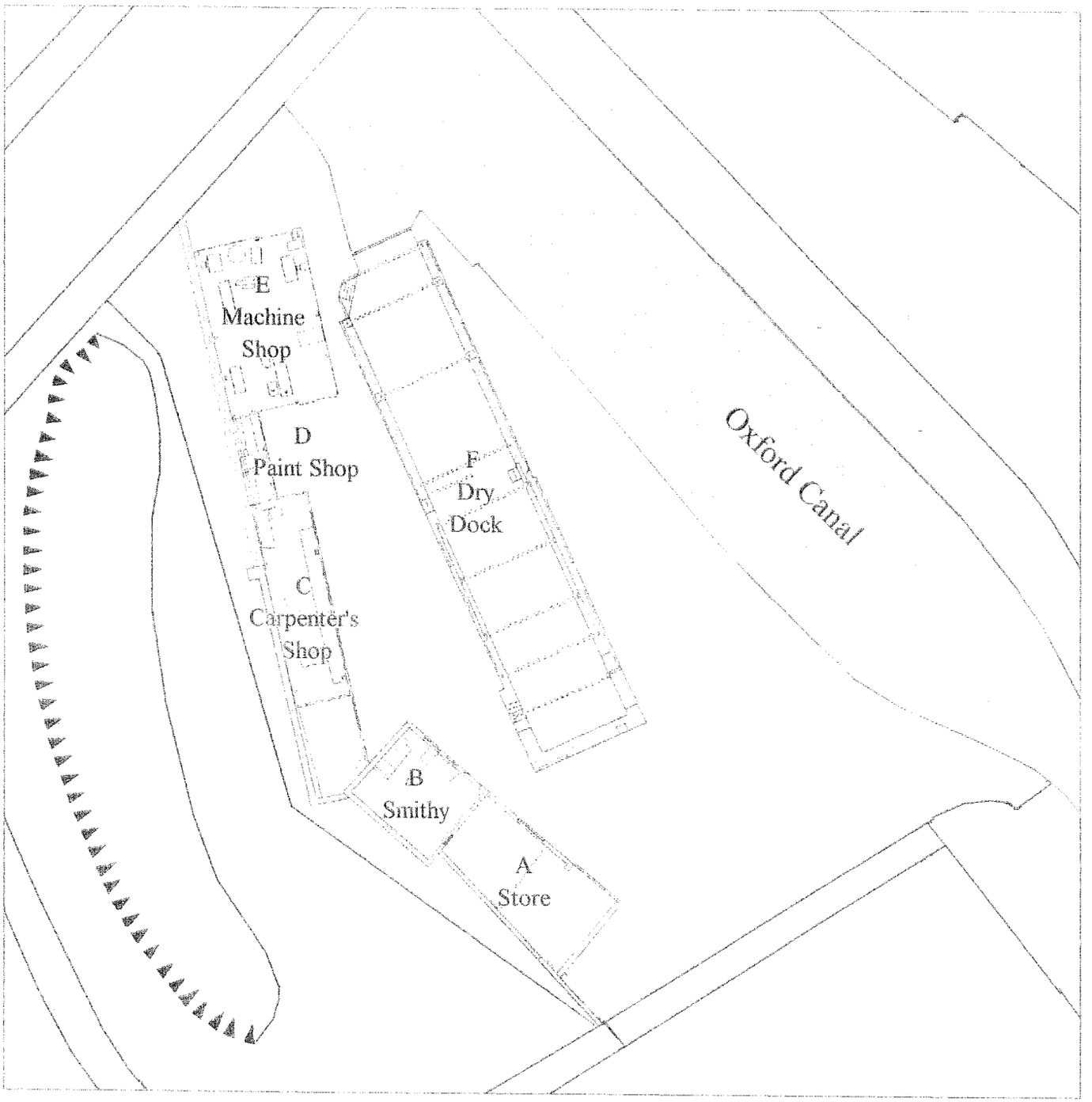


Figure 2: Tooley's Boatyard, 1998 (1:500)

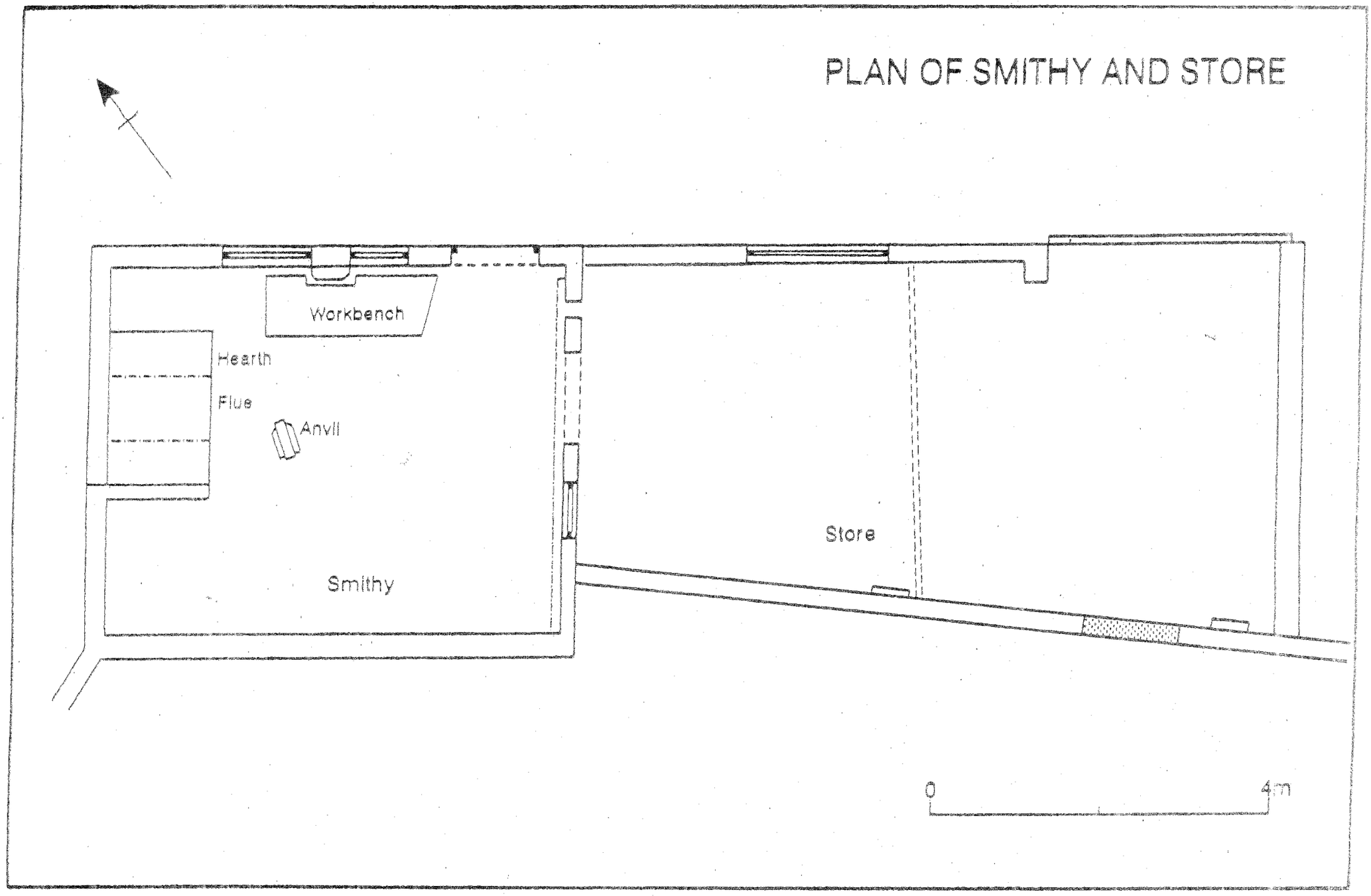


Figure 3: The Store (A) and Smithy (B)

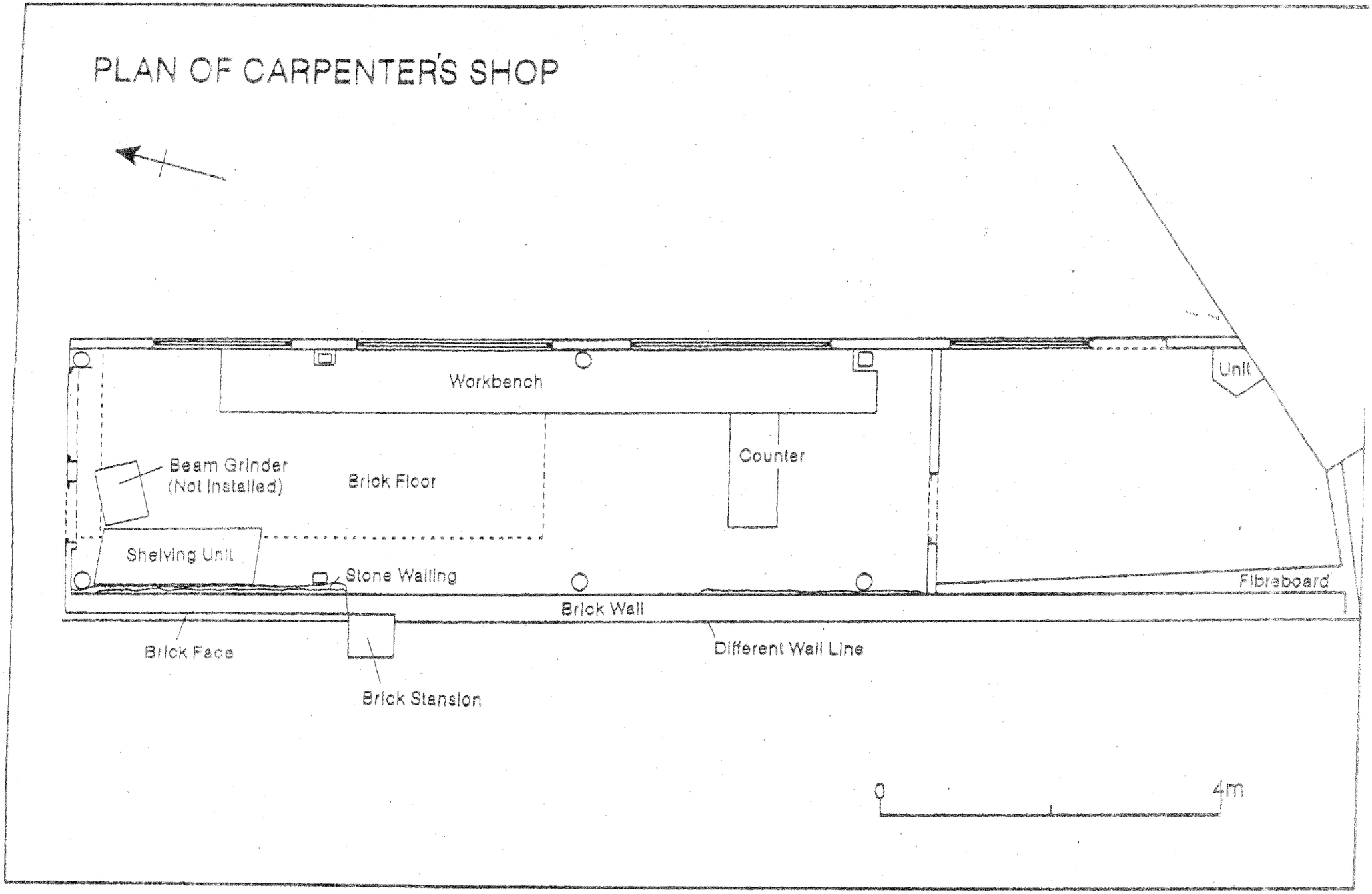


Figure 4: The Carpenter's Shop (C)

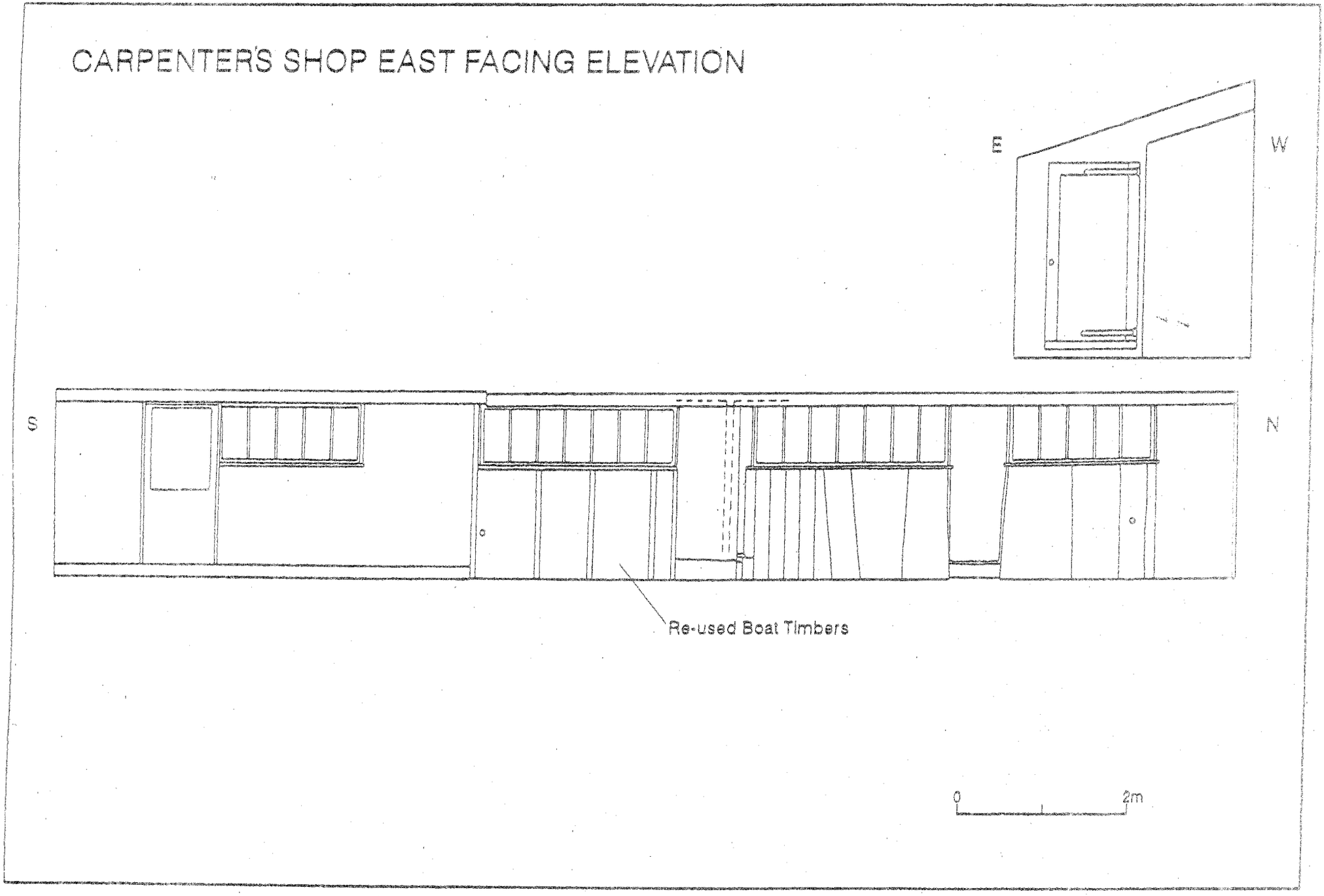


Figure 5: The Carpenter's Shop Elevation

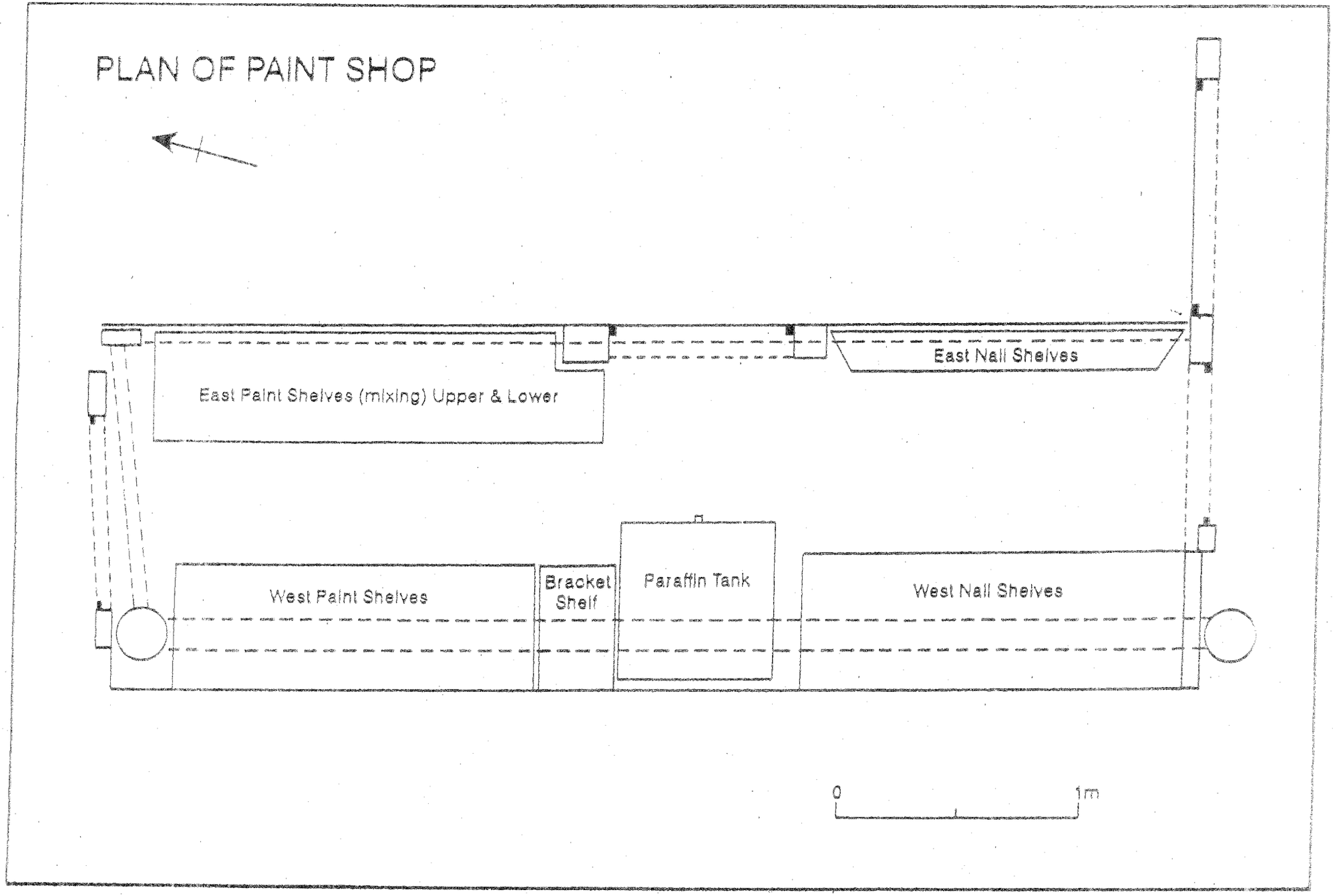


Figure 6: The Paint Shop (D)

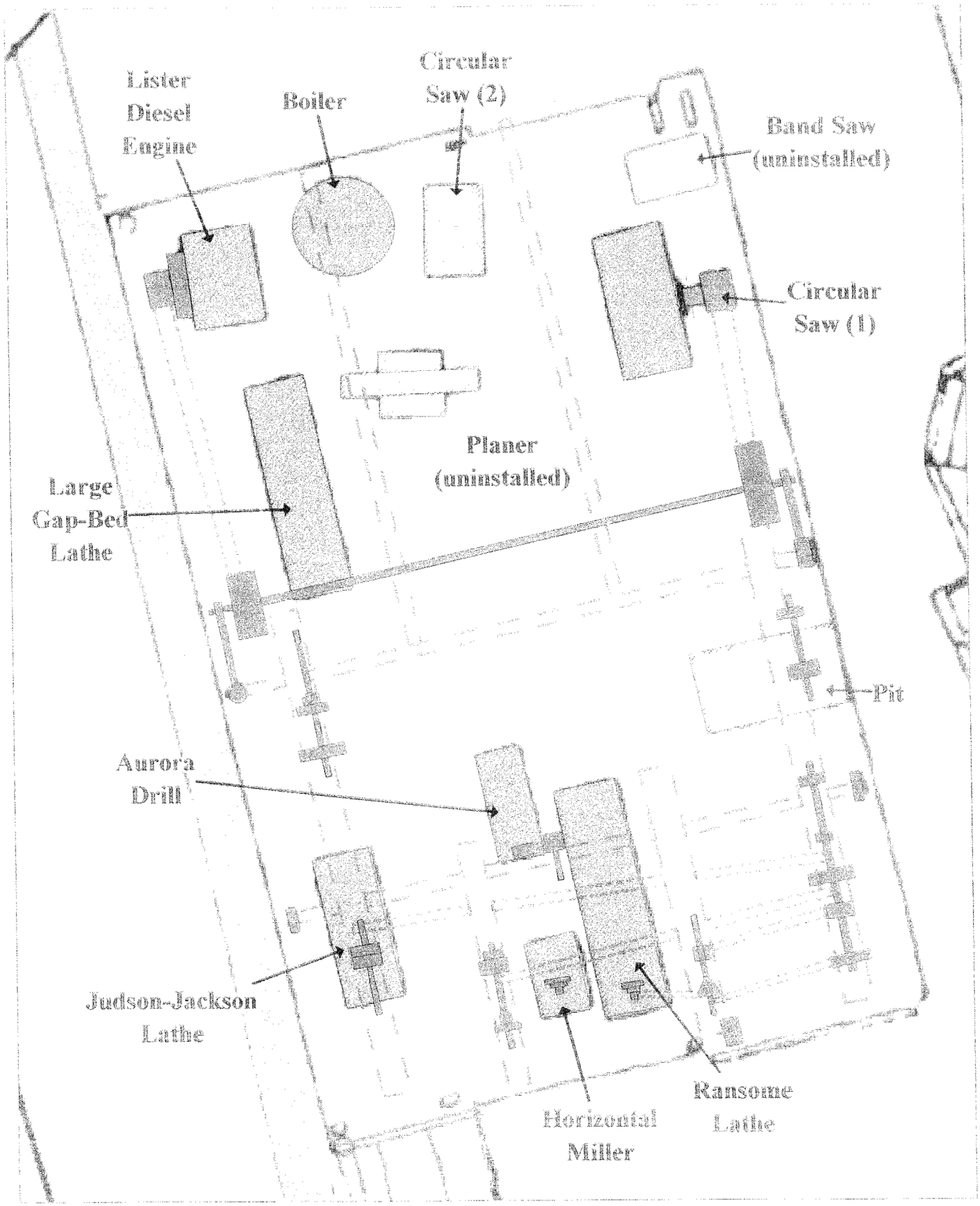
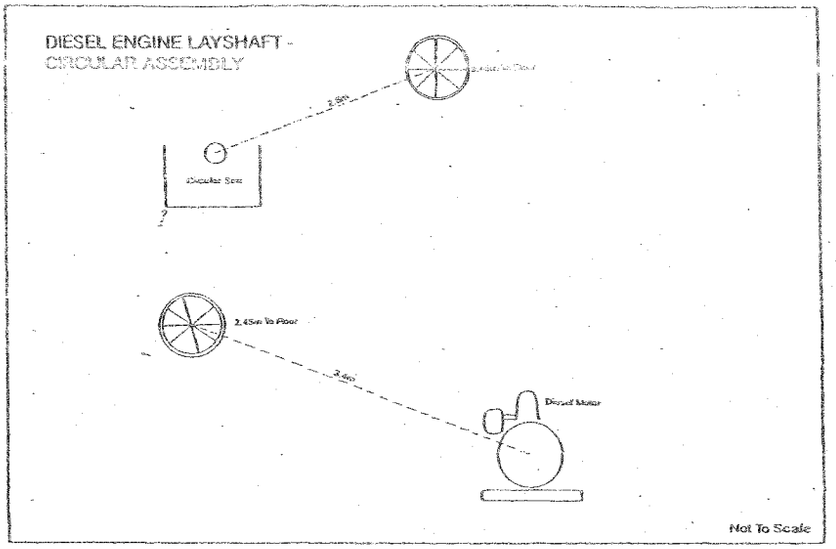
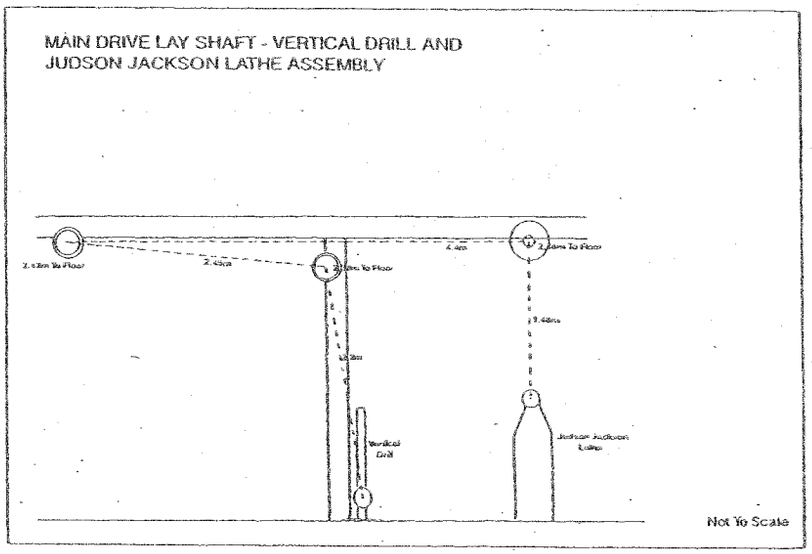


Figure 7: The Machine Shop (E), Machine Layout and Belt Layout





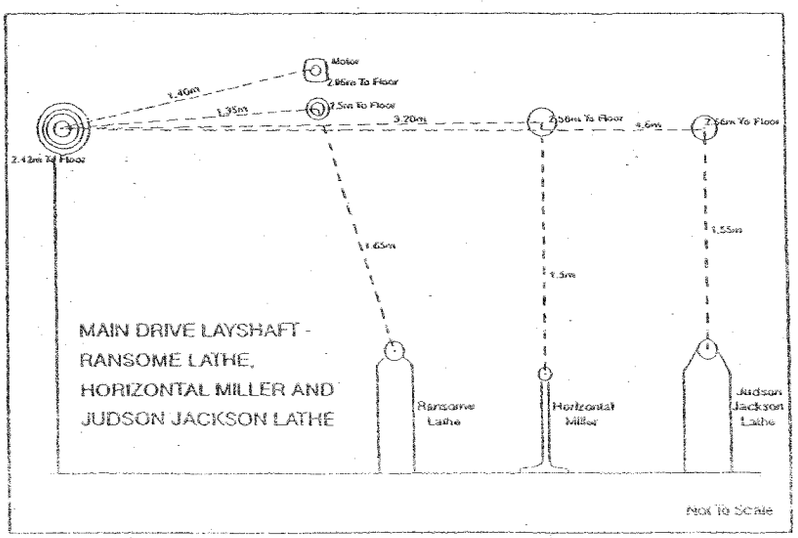


Figure 8: Machine Shop, Belt Layout Profile

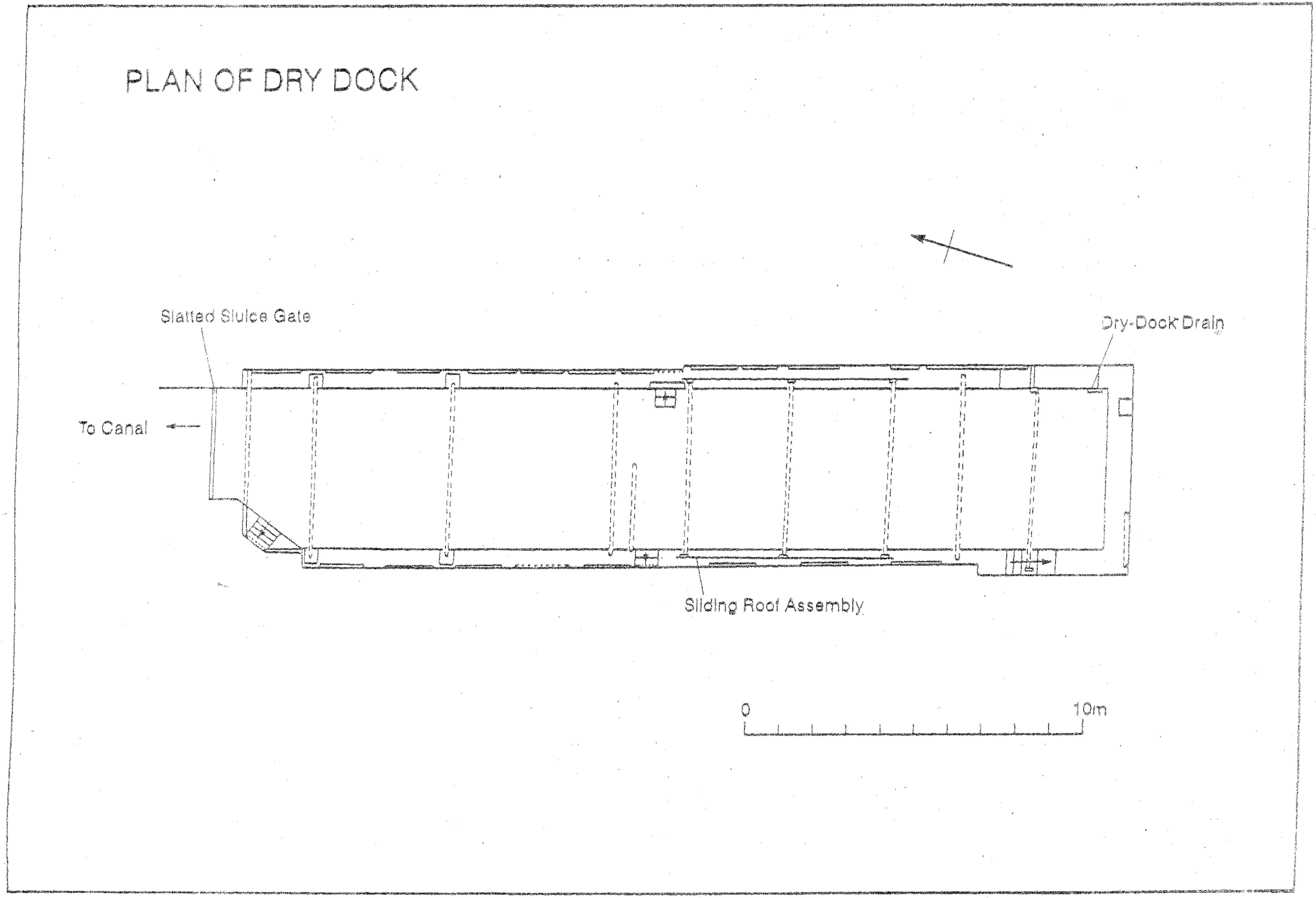


Figure 9: The Dry Dock (F)

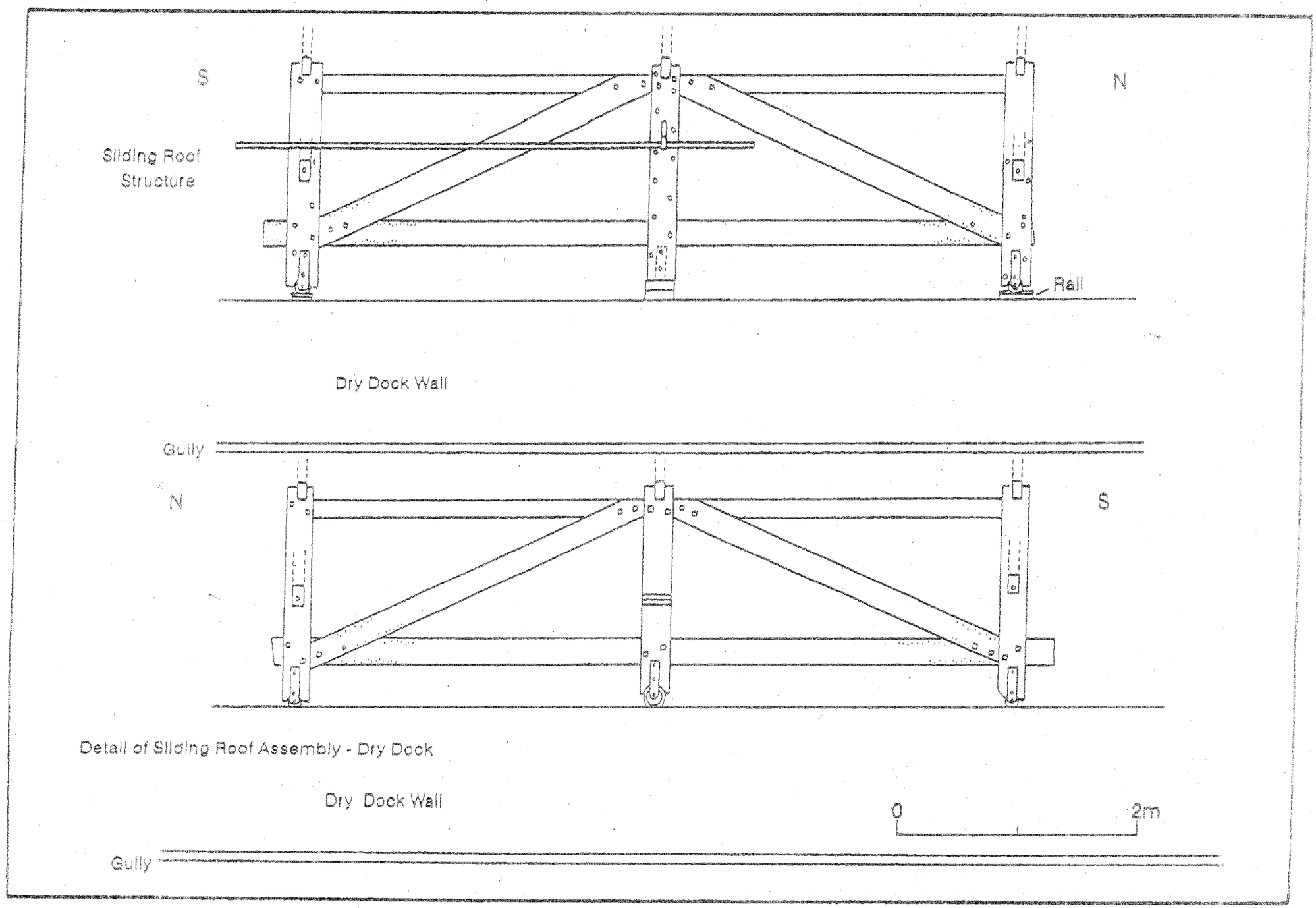


Figure 10: The Dry Dock, Moveable Roof Mechanism

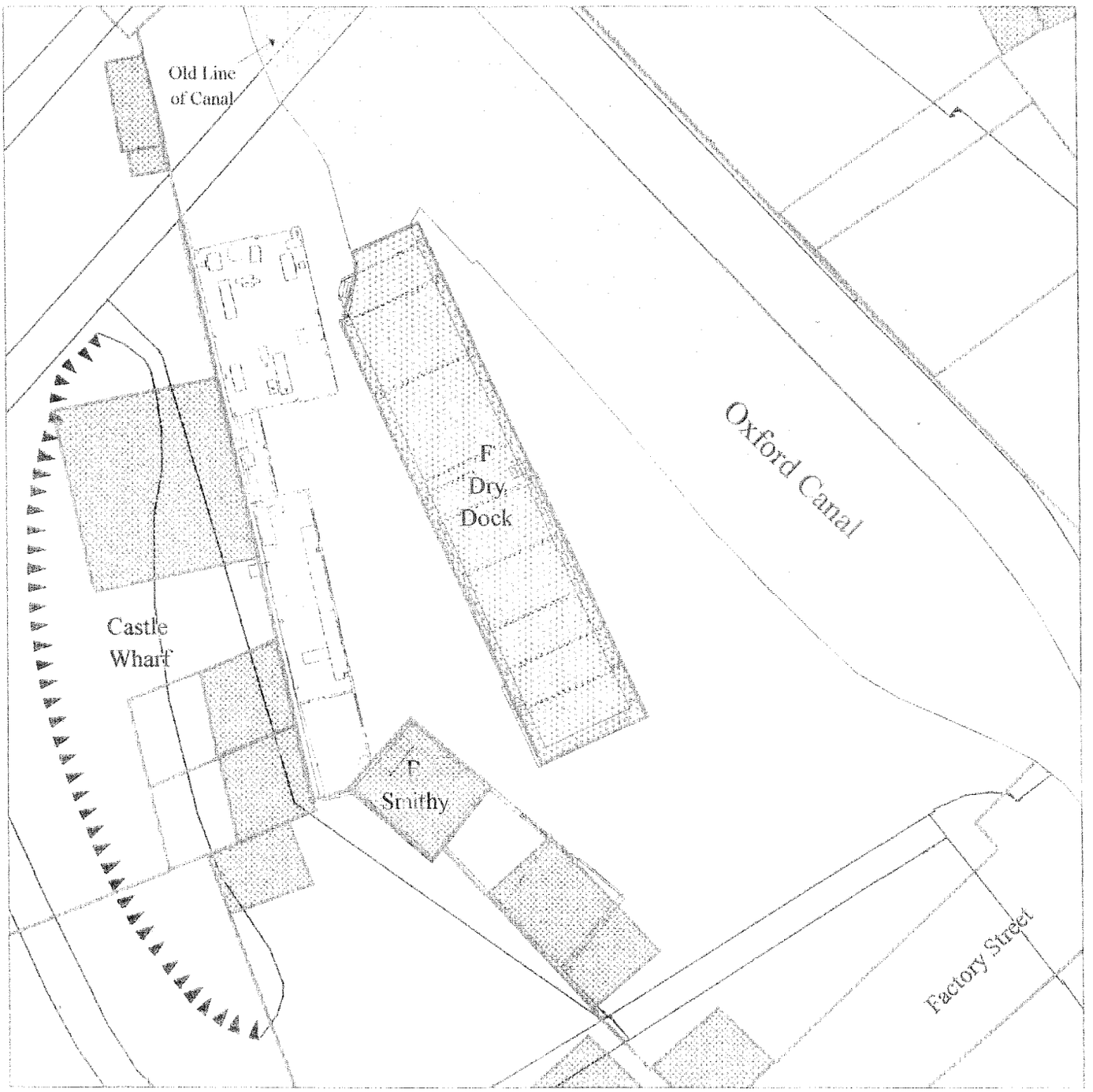


Figure 11: 1853 Davis & Davids (1:500)

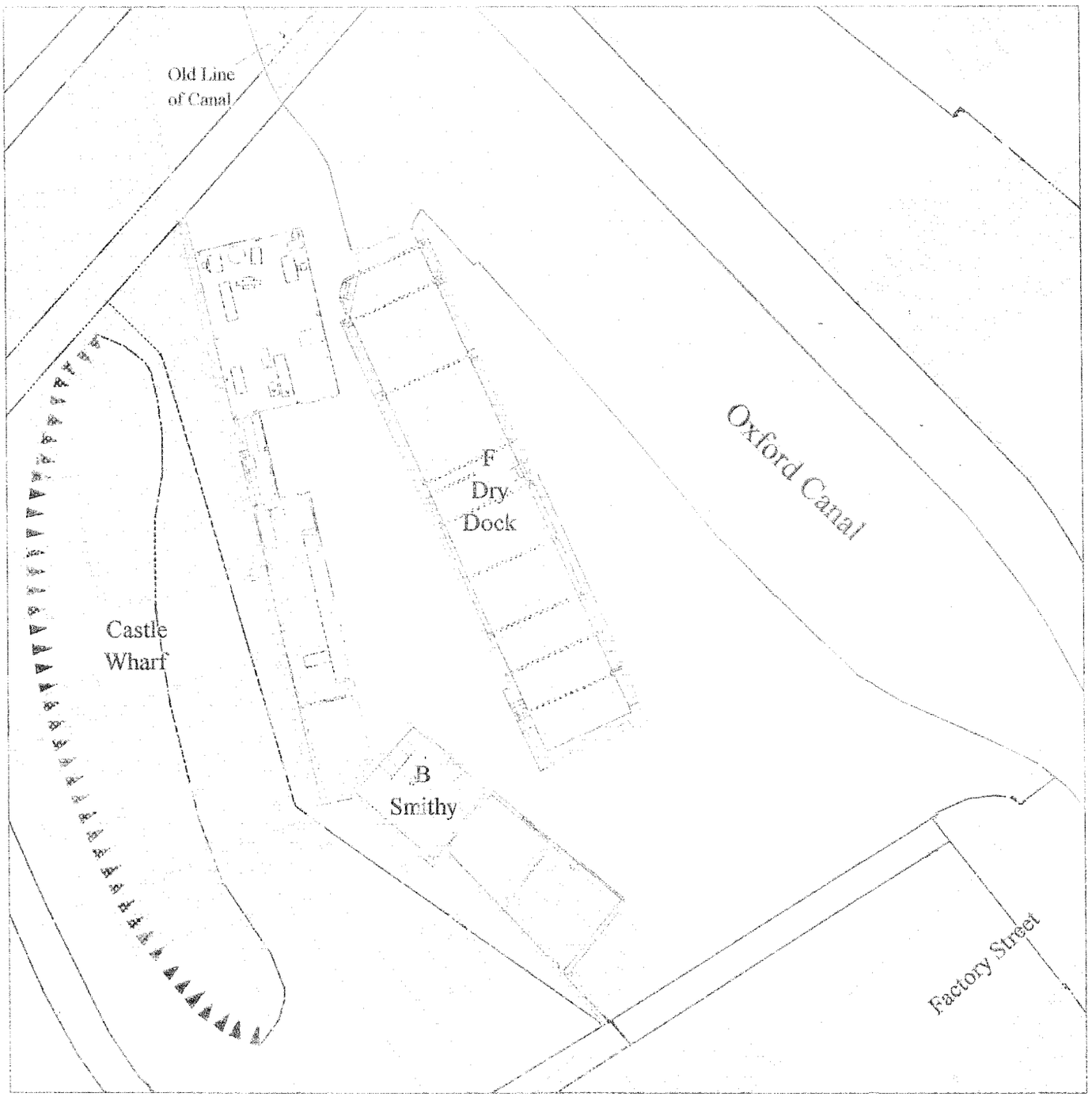


Figure 12: 1882 Ordnance Survey (1:500)

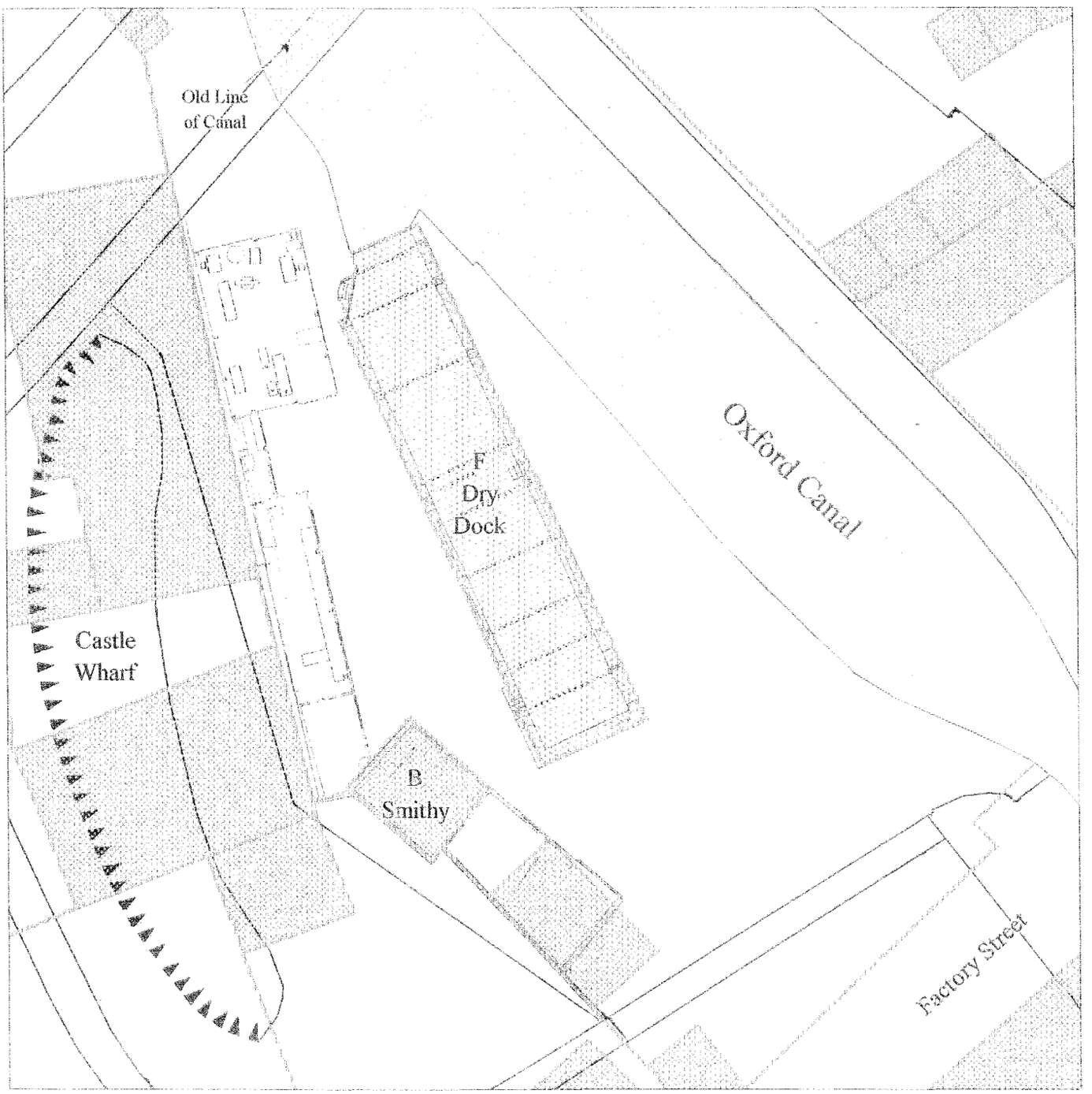


Figure 13: 1902 Ordnance Survey (1:500)

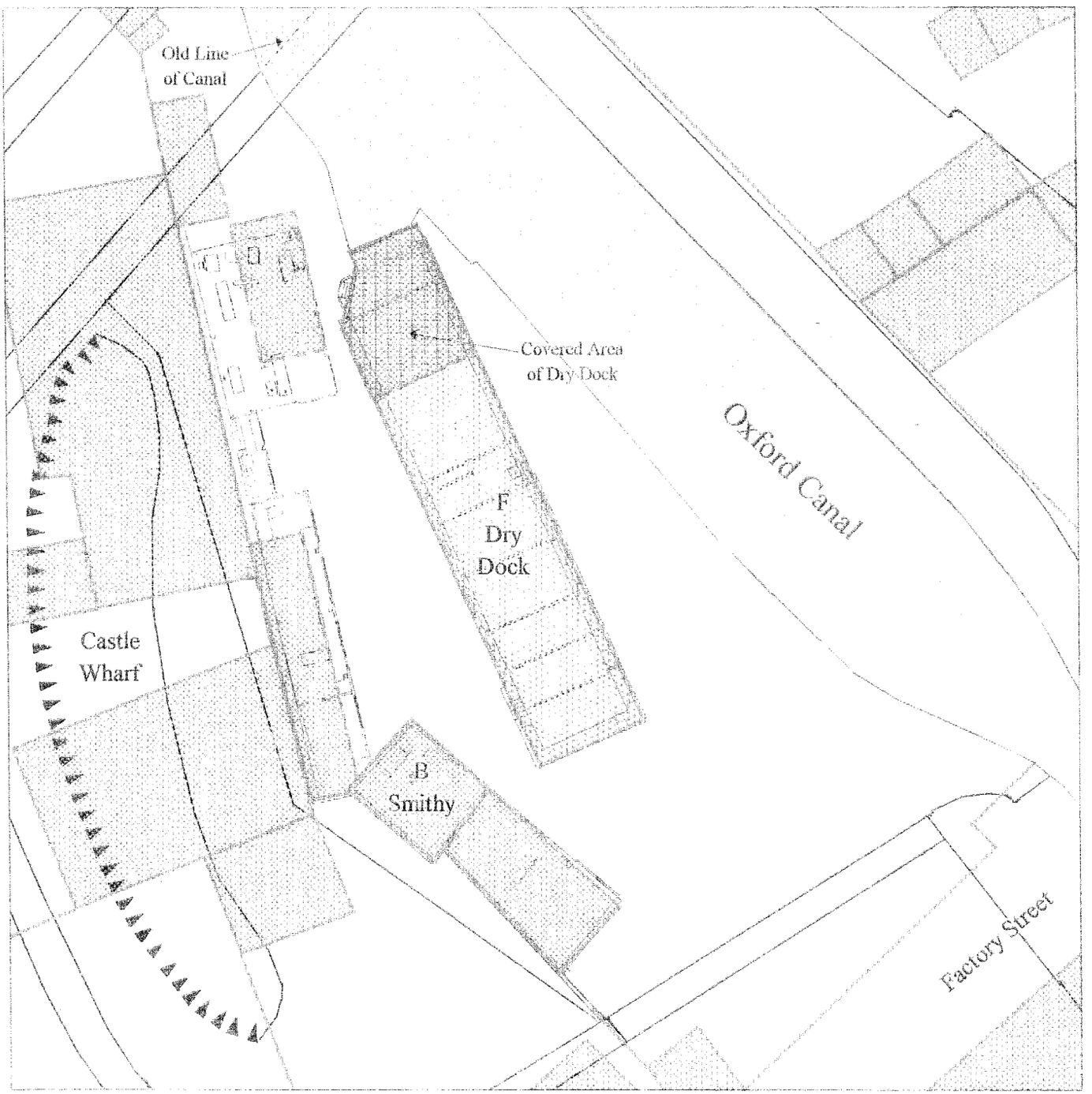


Figure 14: 1922 Ordnance Survey (1:500)

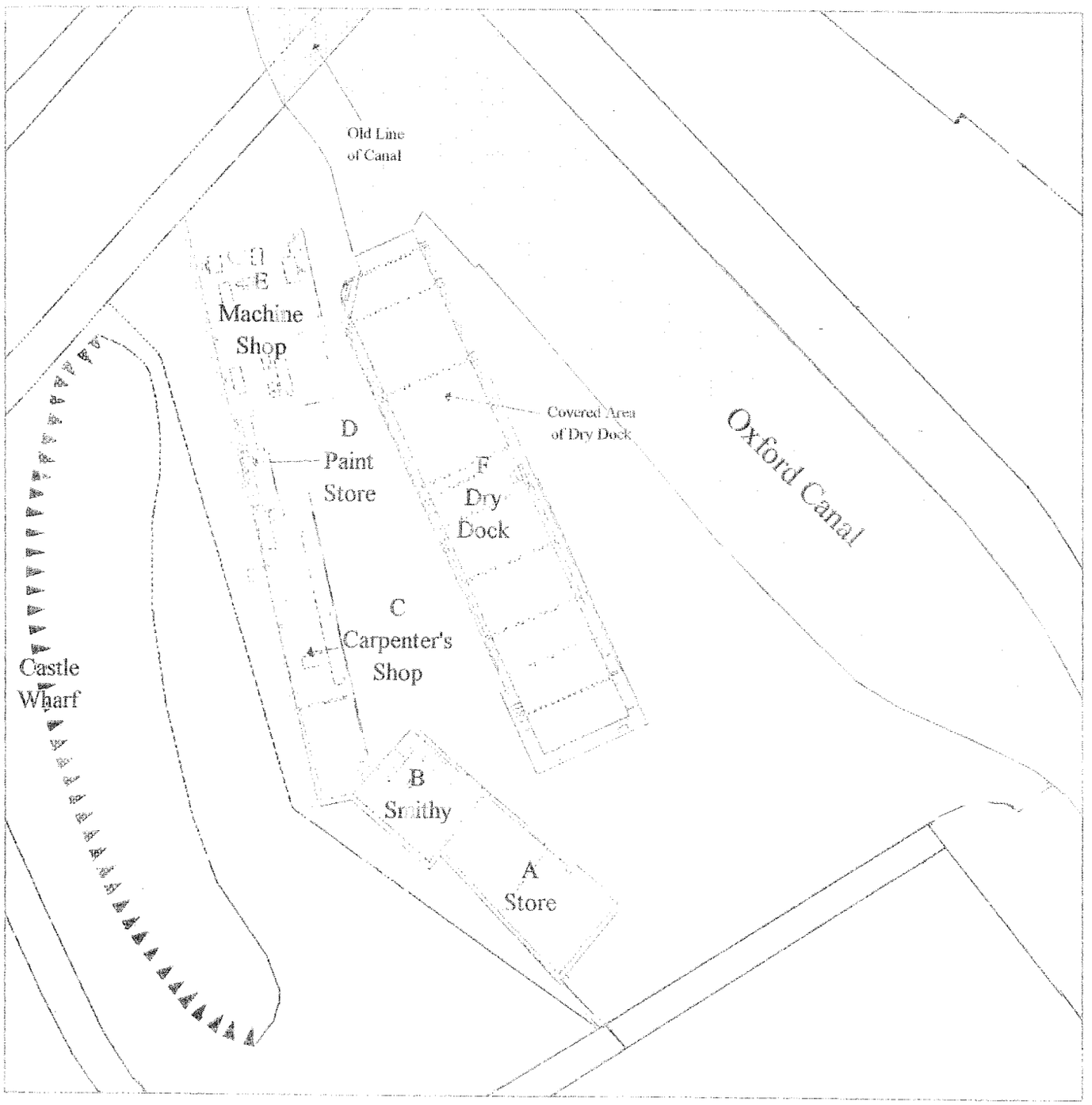


Figure 15: 1968 Ordnance Survey (1:500)

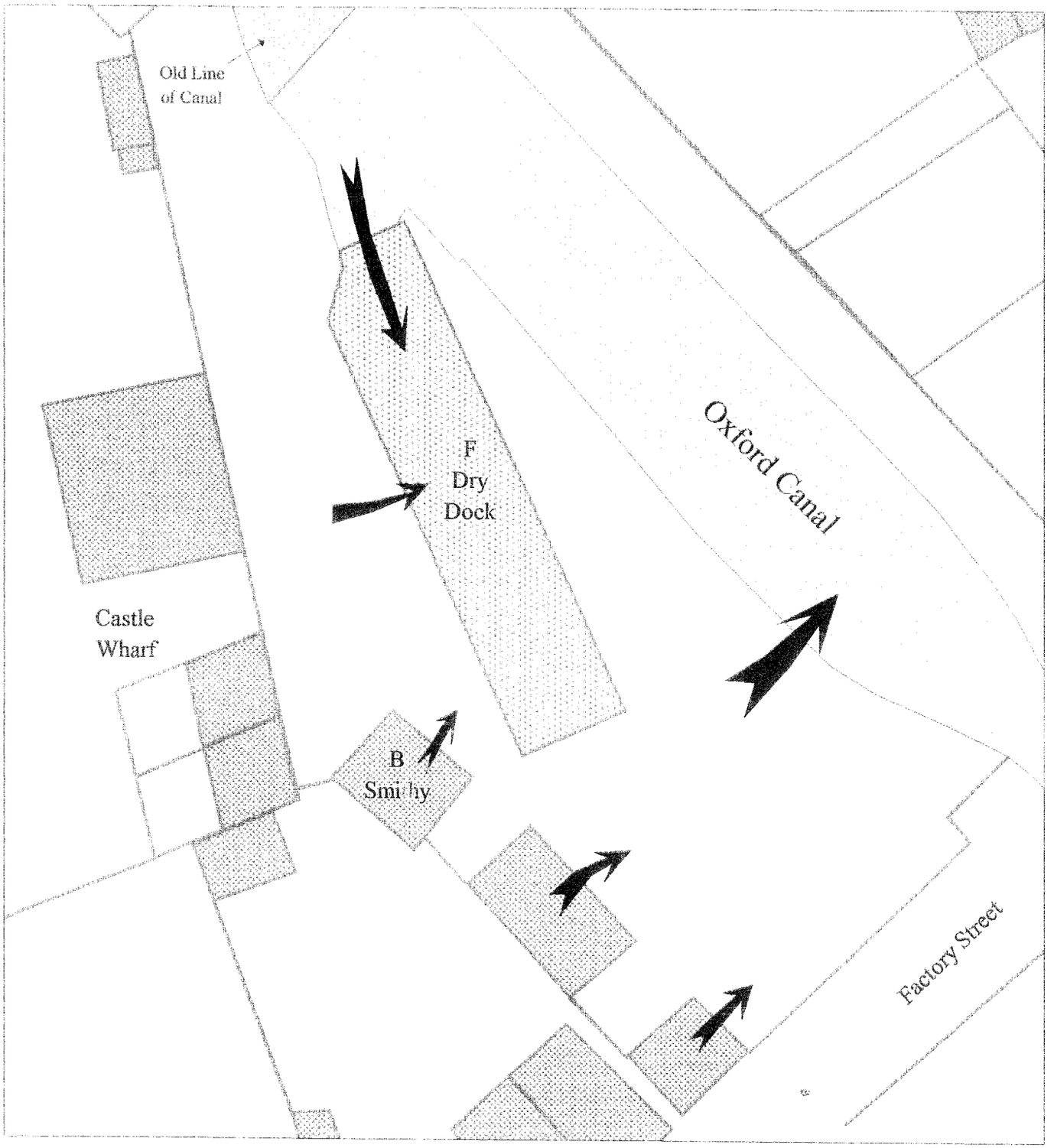


Figure 16: 1853 Flow Analysis

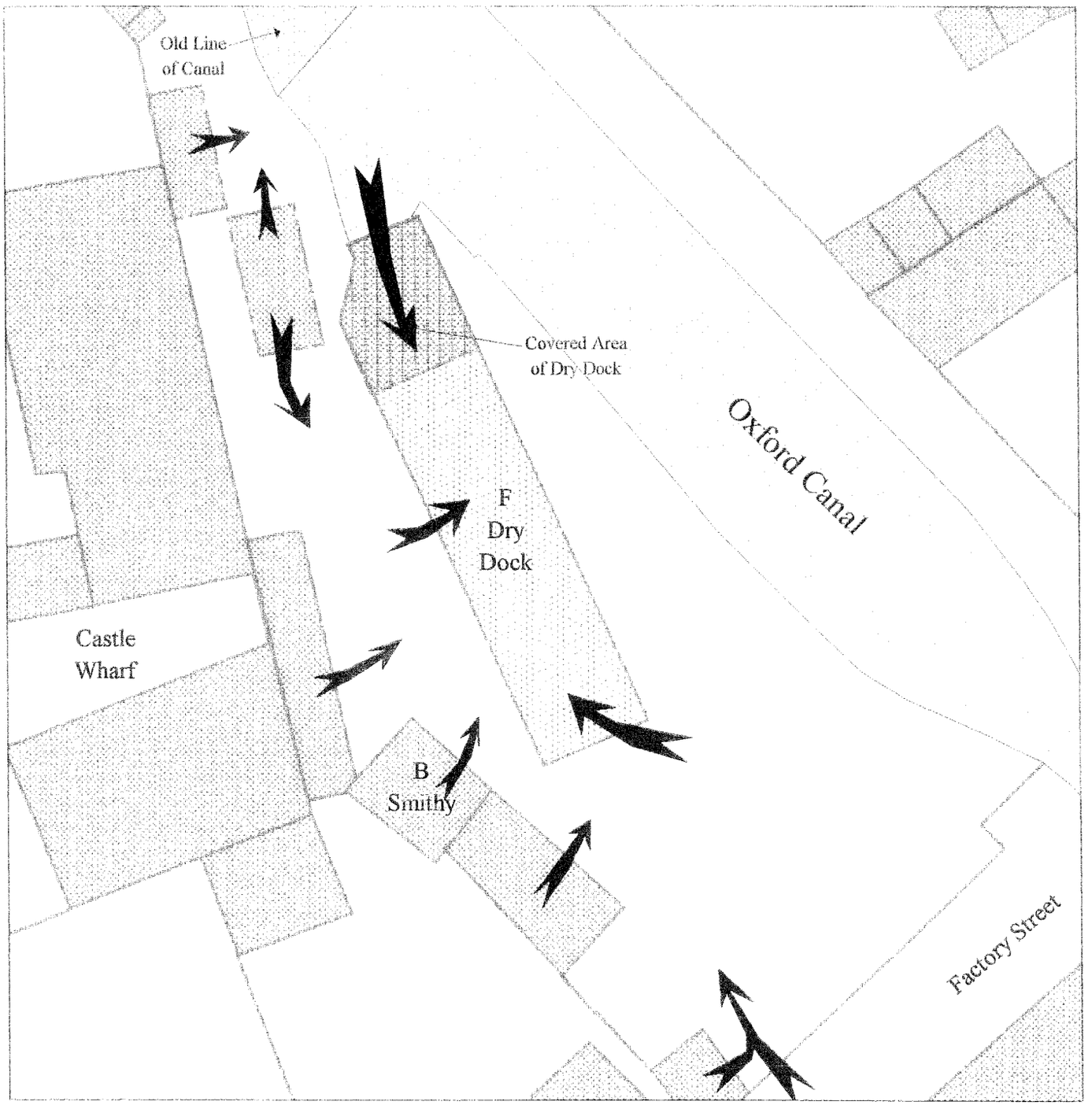


Figure 17: 1922 Flow Analysis

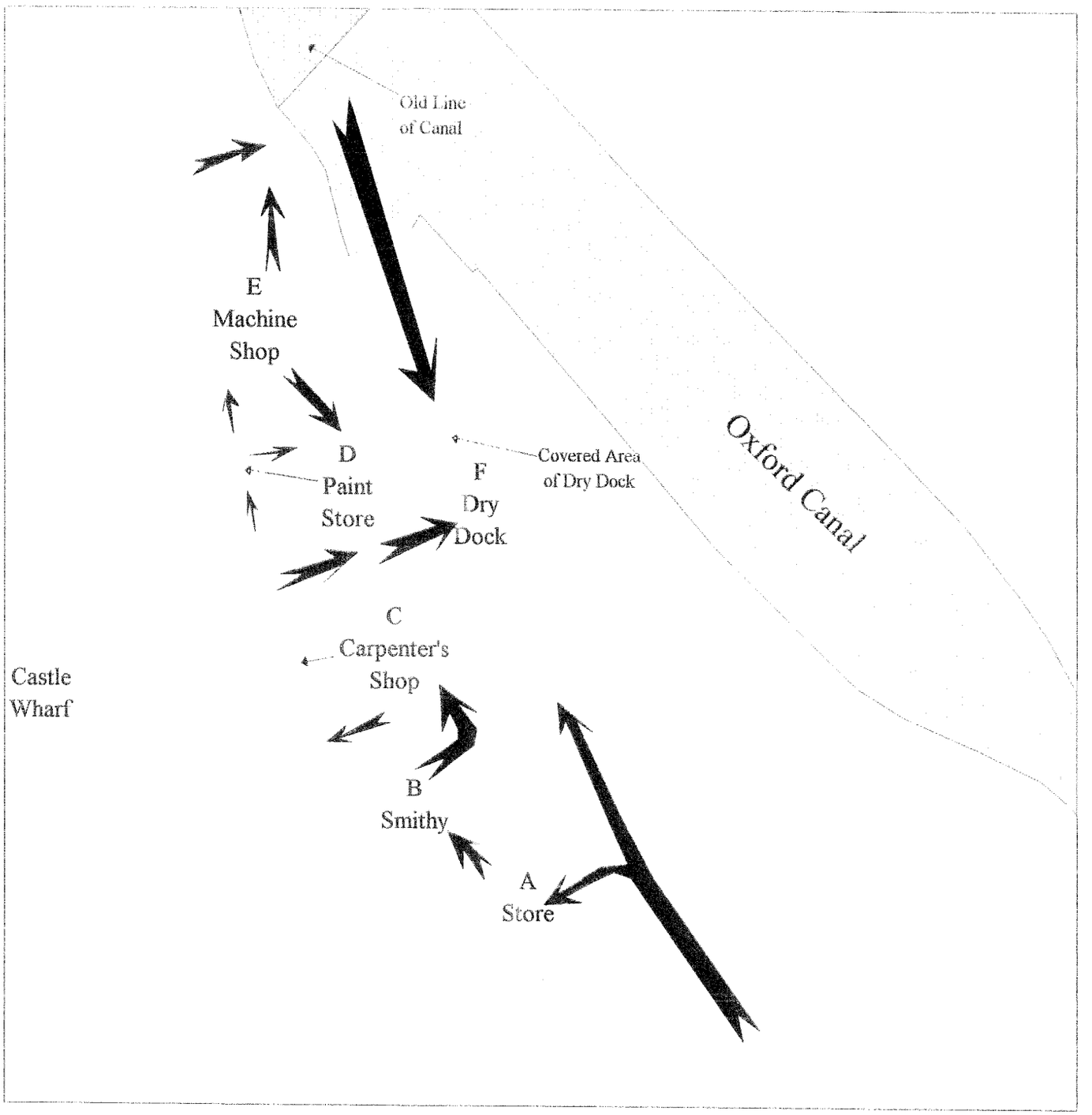


Figure 18: 1968 Flow Analysis

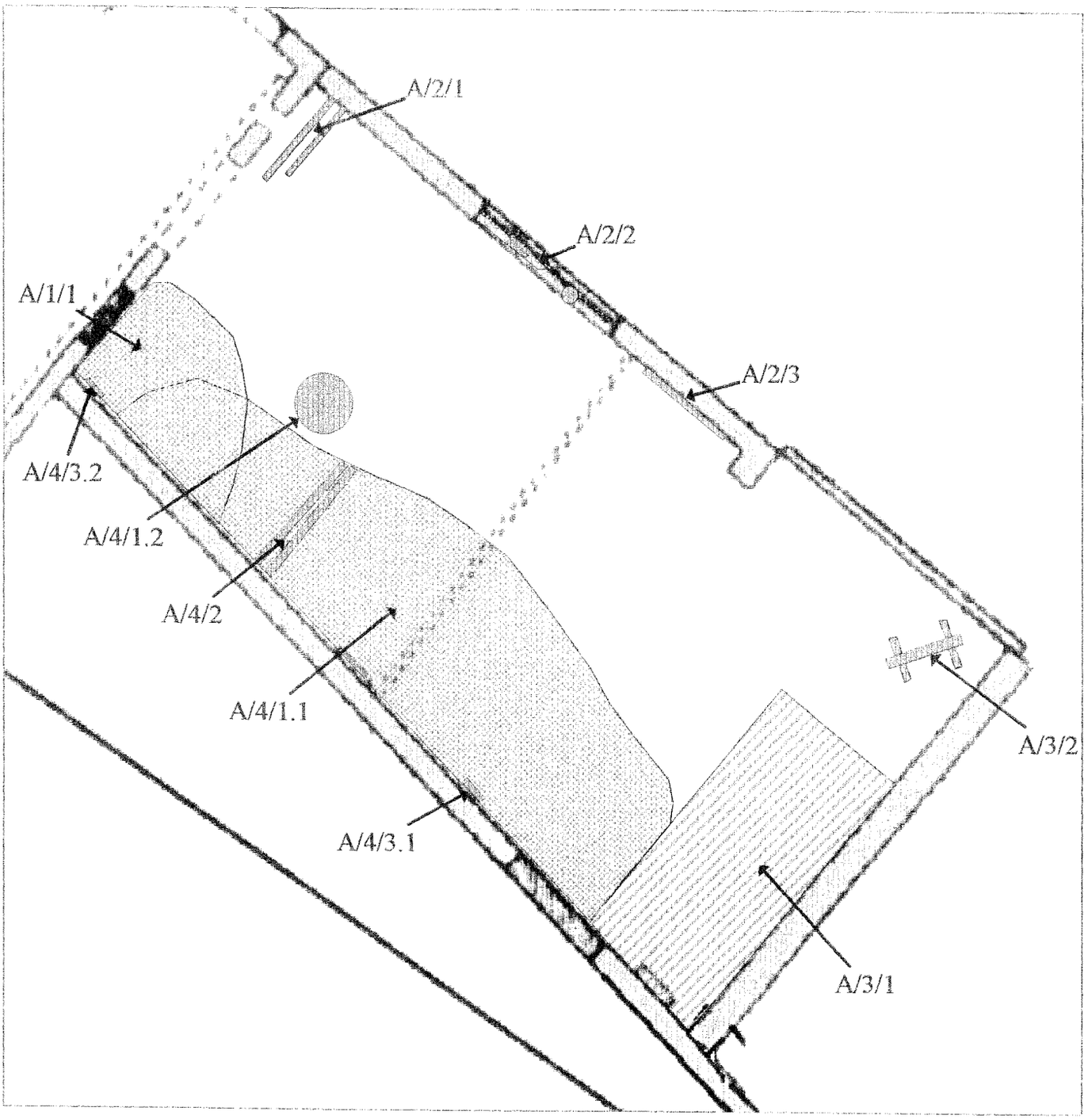


Figure 19: Artifact Distribution, Structure A

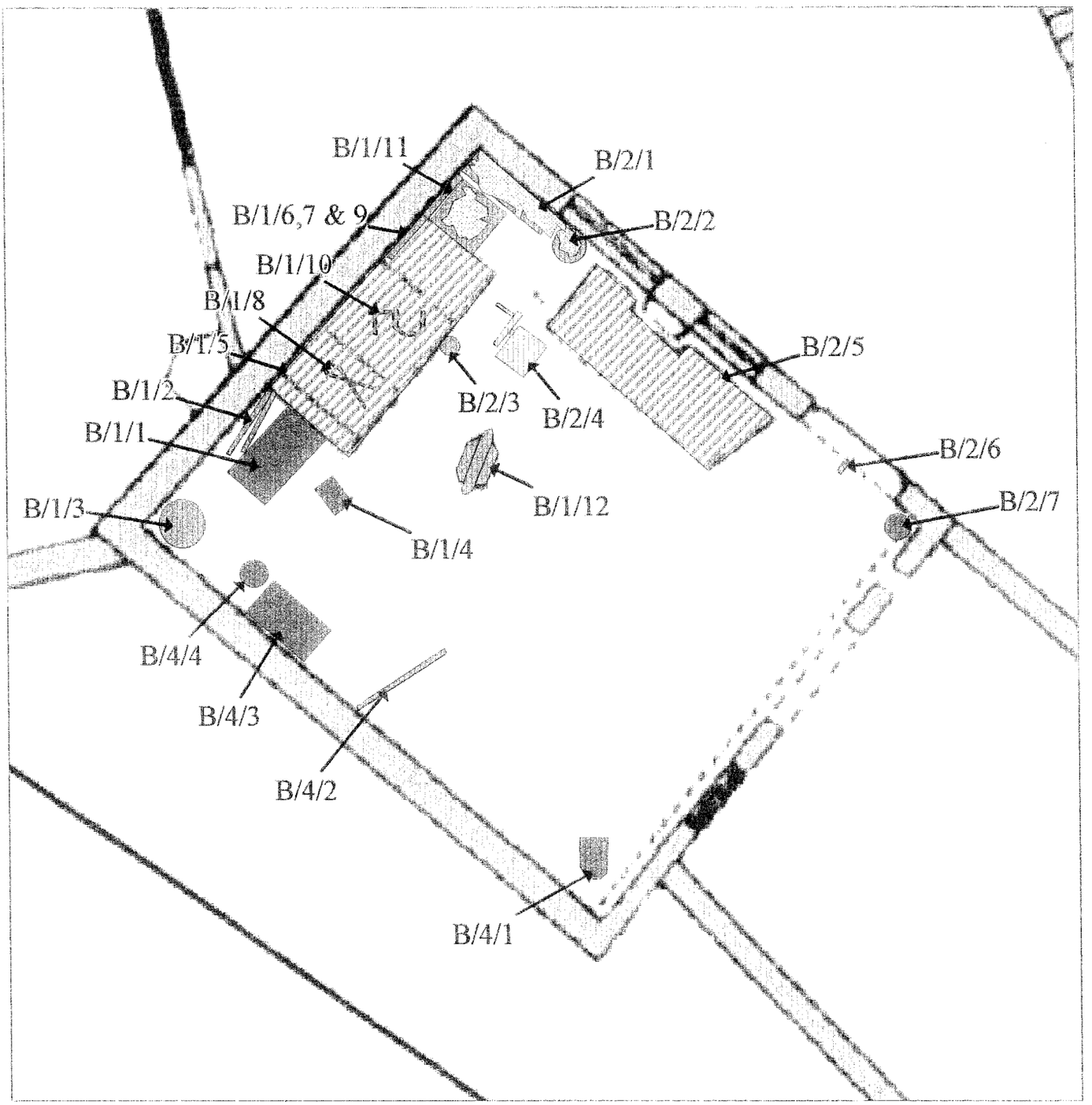


Figure 20: Artifact Distribution, Structure B

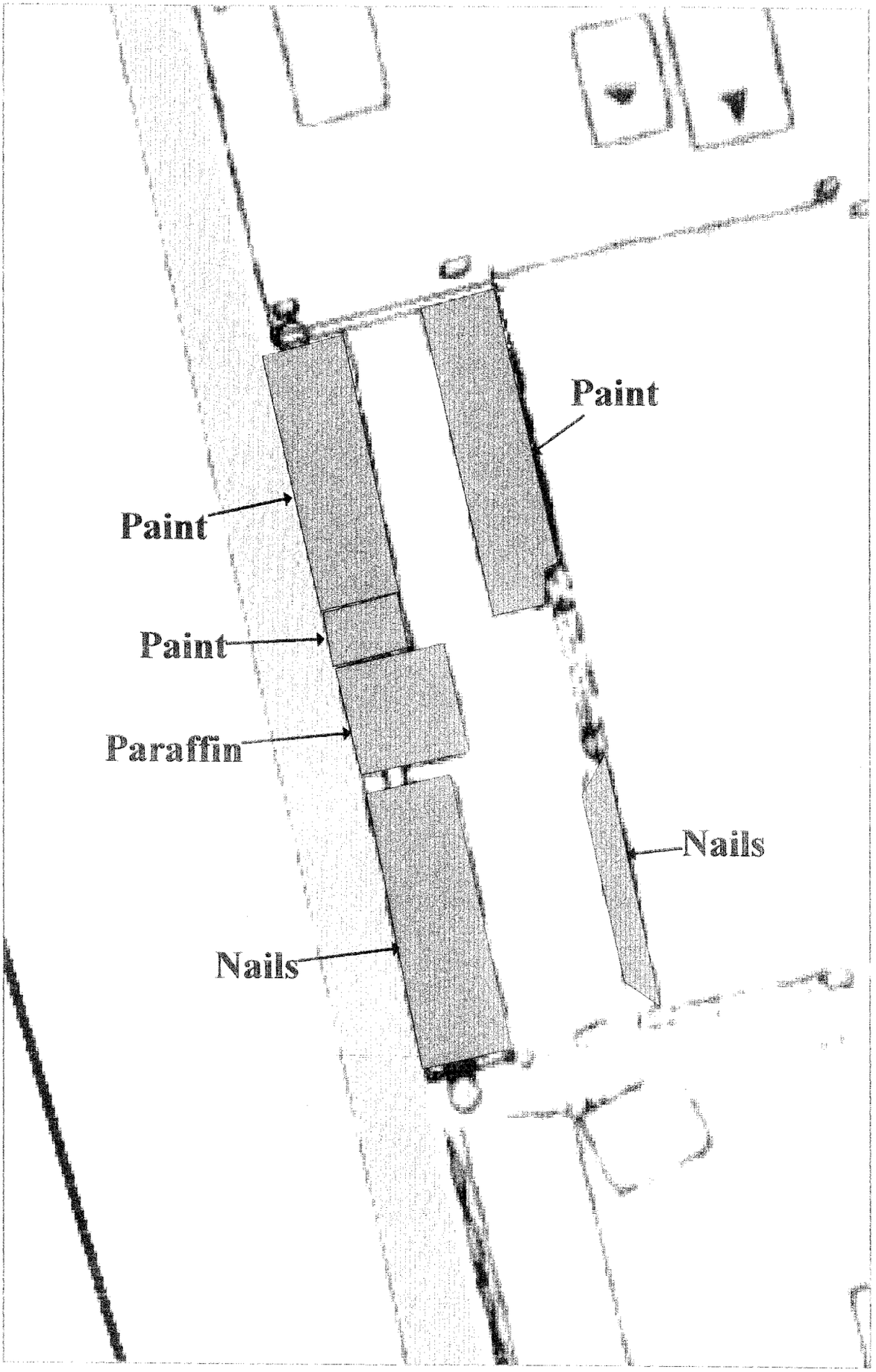


Figure 21: Artifact Distribution, Structure D

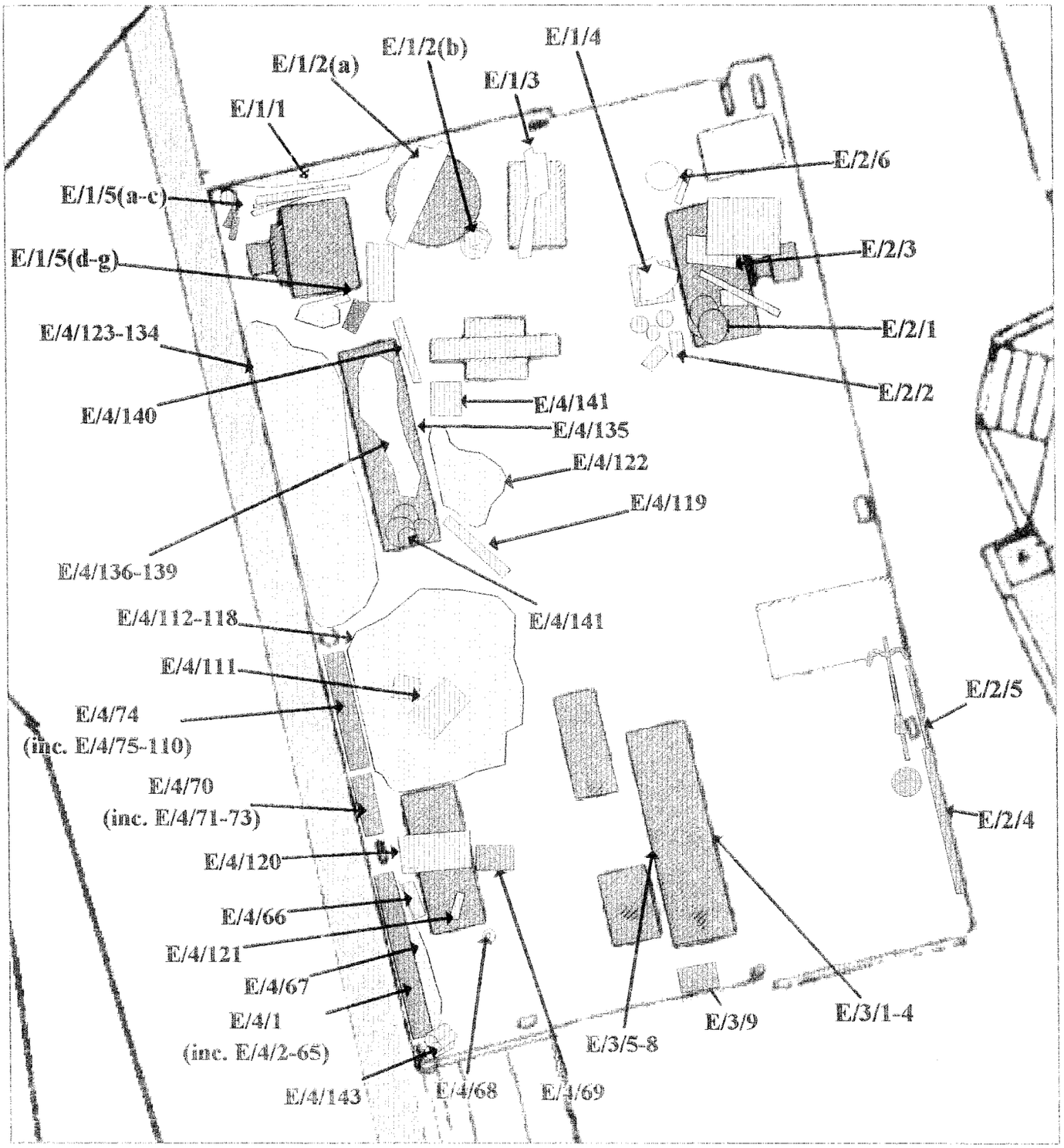


Figure 22: Artifact Distribution, Structure E

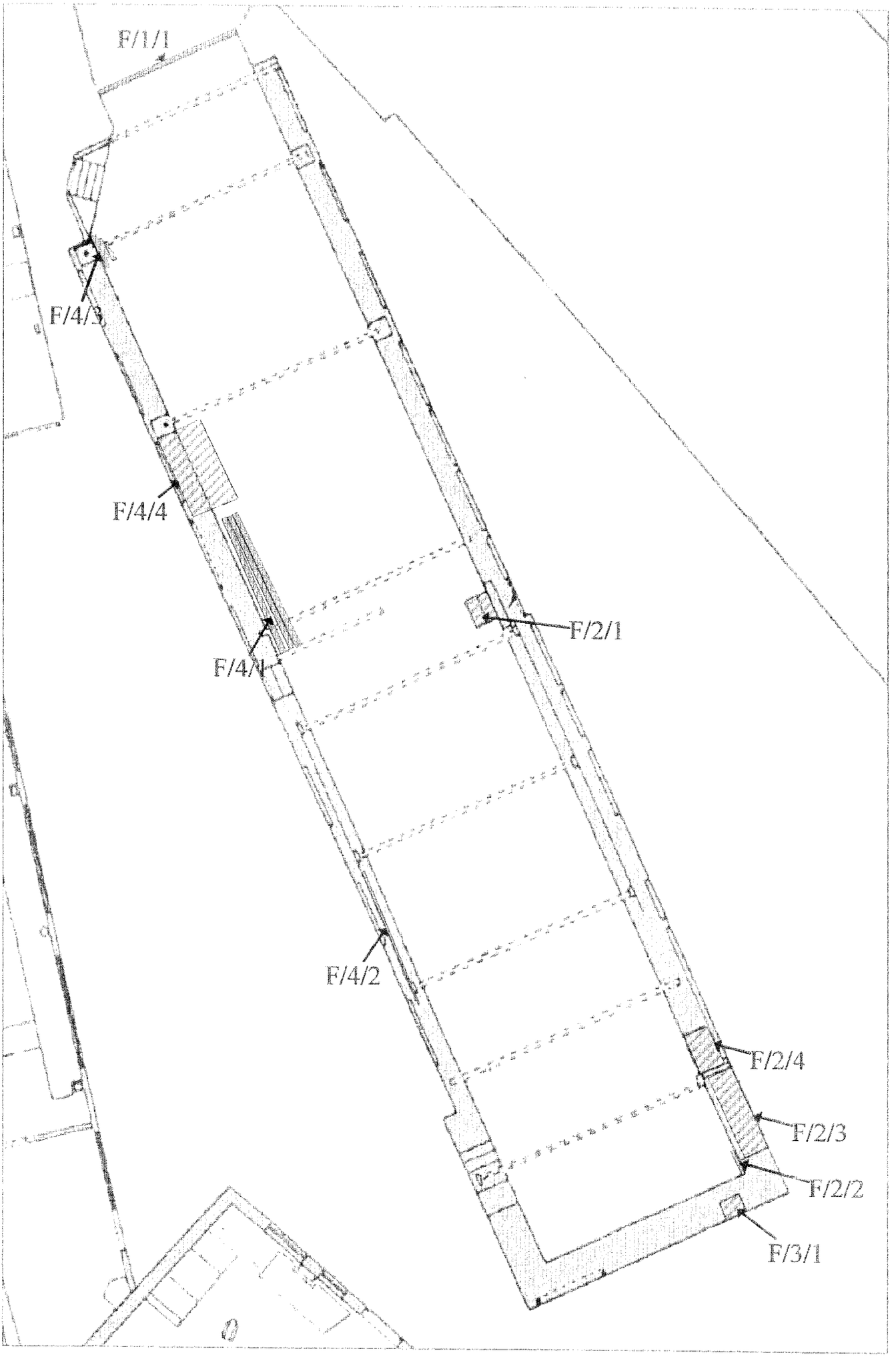


Figure 23: Artifact Distribution, Structure F

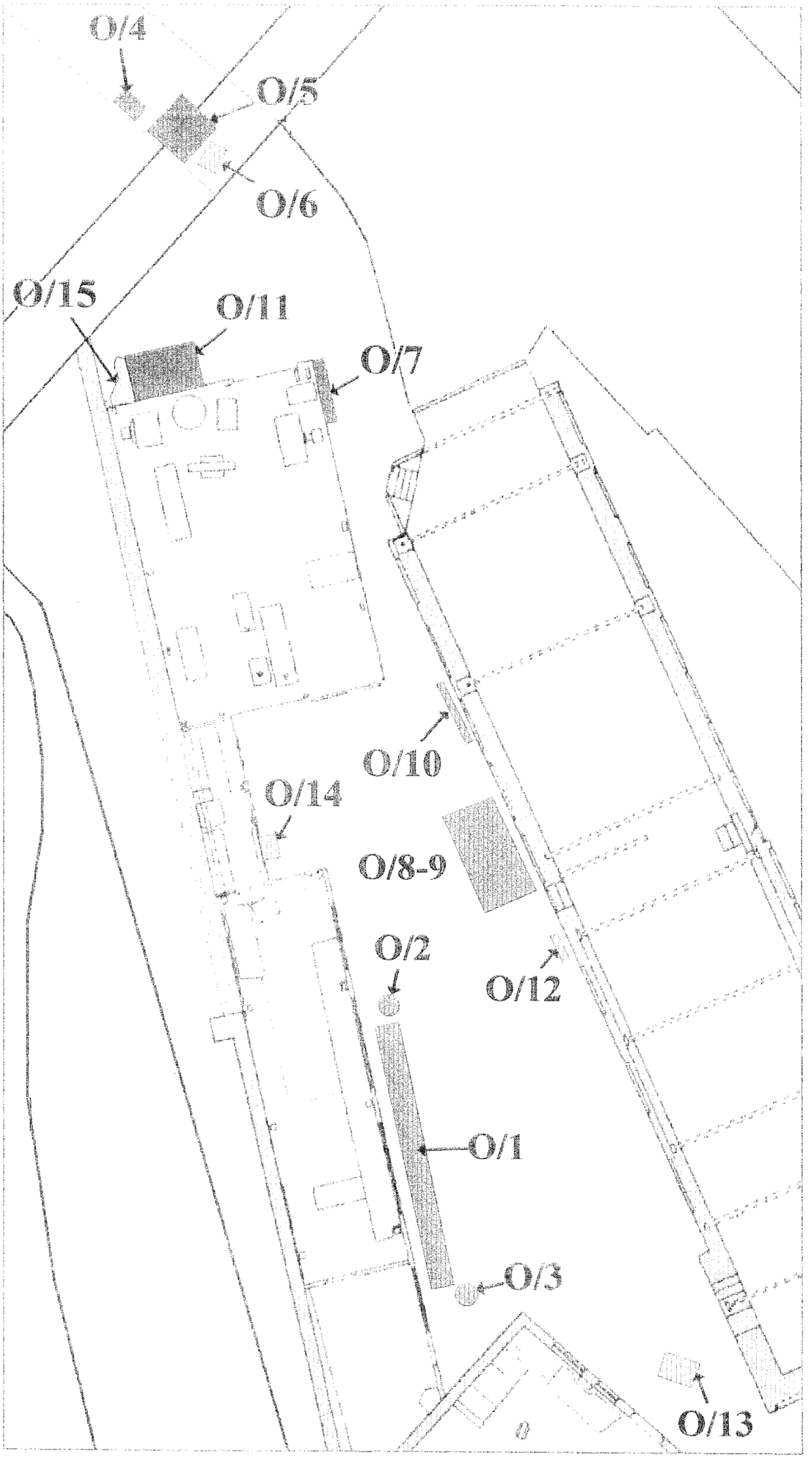


Figure 24: Artifact Distribution, Outside

Figure 25: Scatter Graph Revealing the Level of Deposition

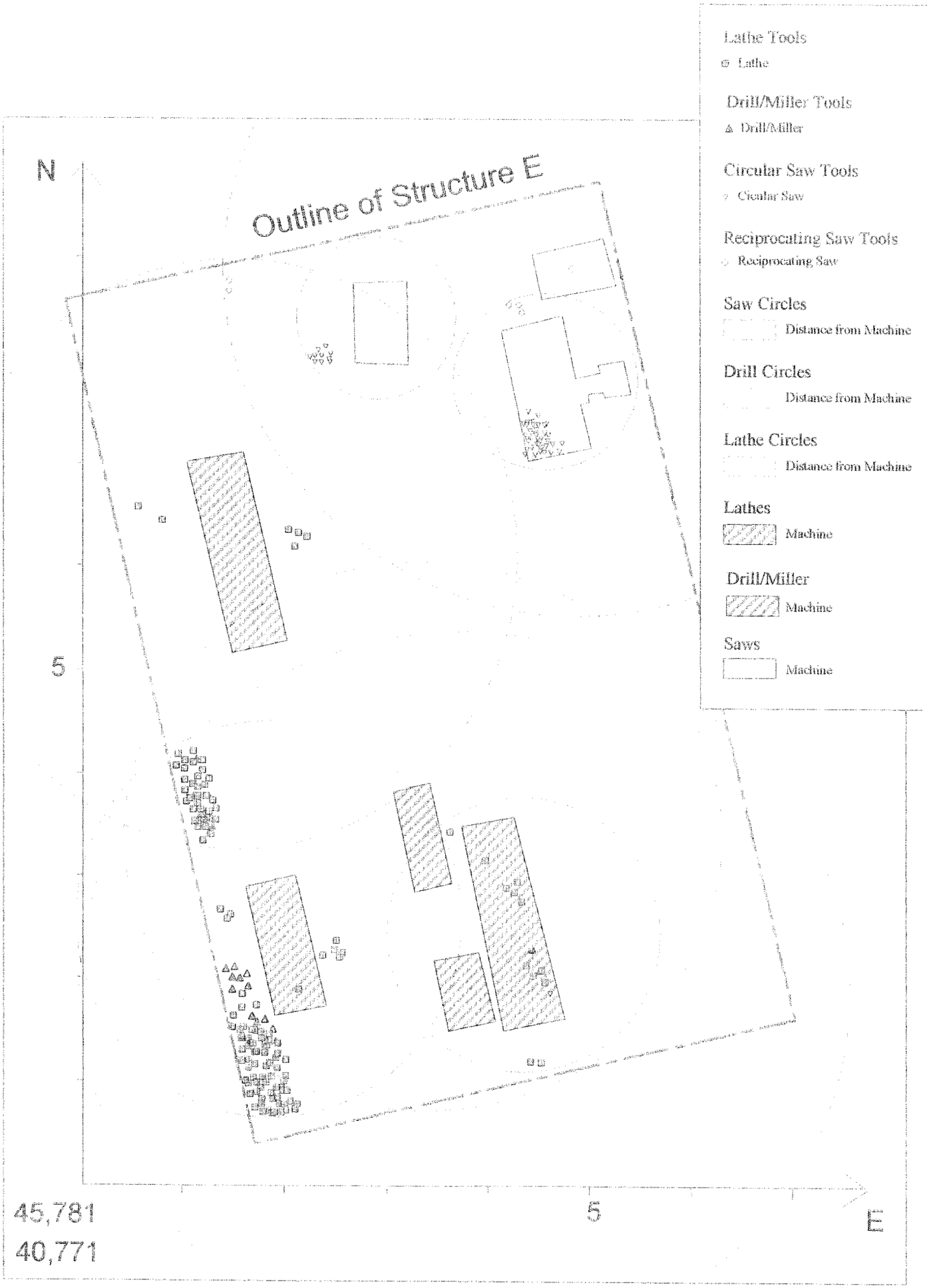


Figure 26: Scatter Graph of Associated Machine Artifacts

Figure 27: Scatter Graph of Specific Tool Groups

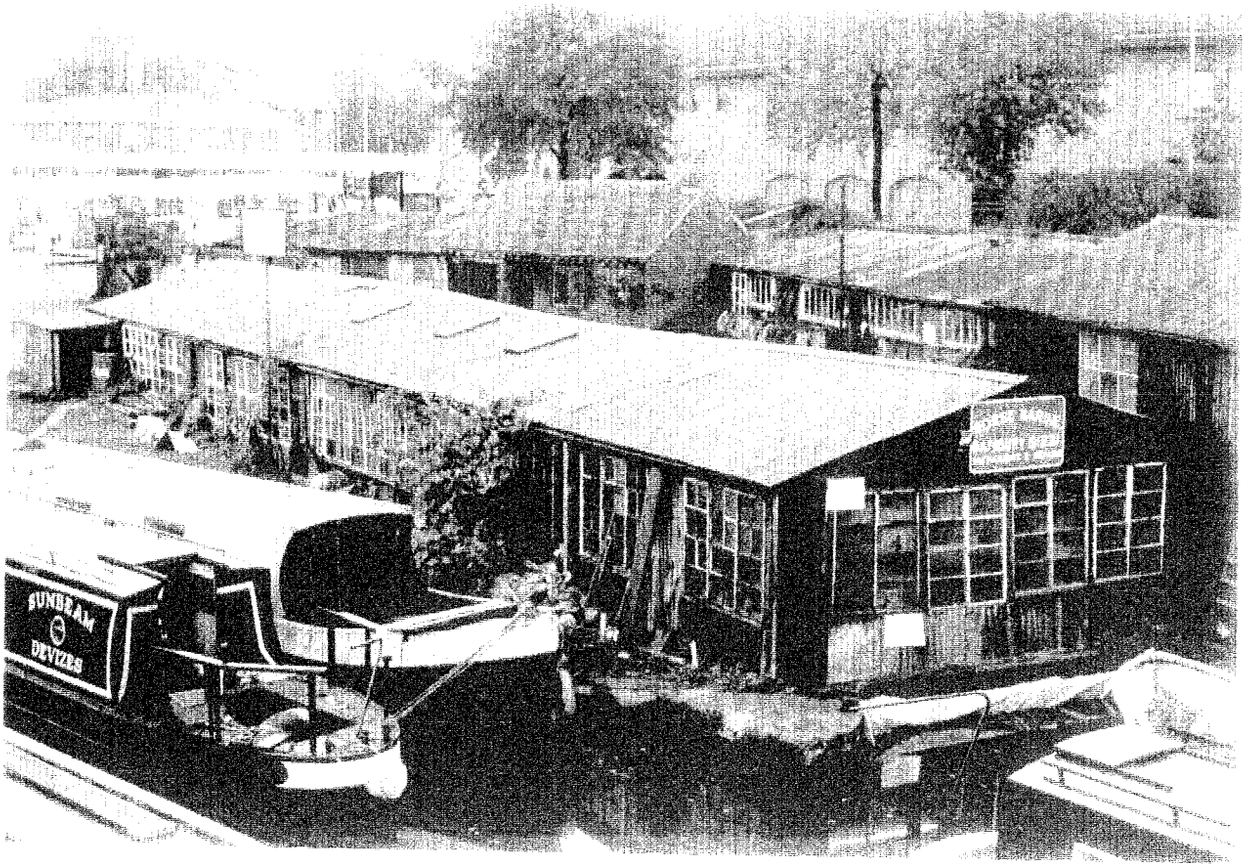


Plate 1: Overall View of Tooley's Boatyard (1995)

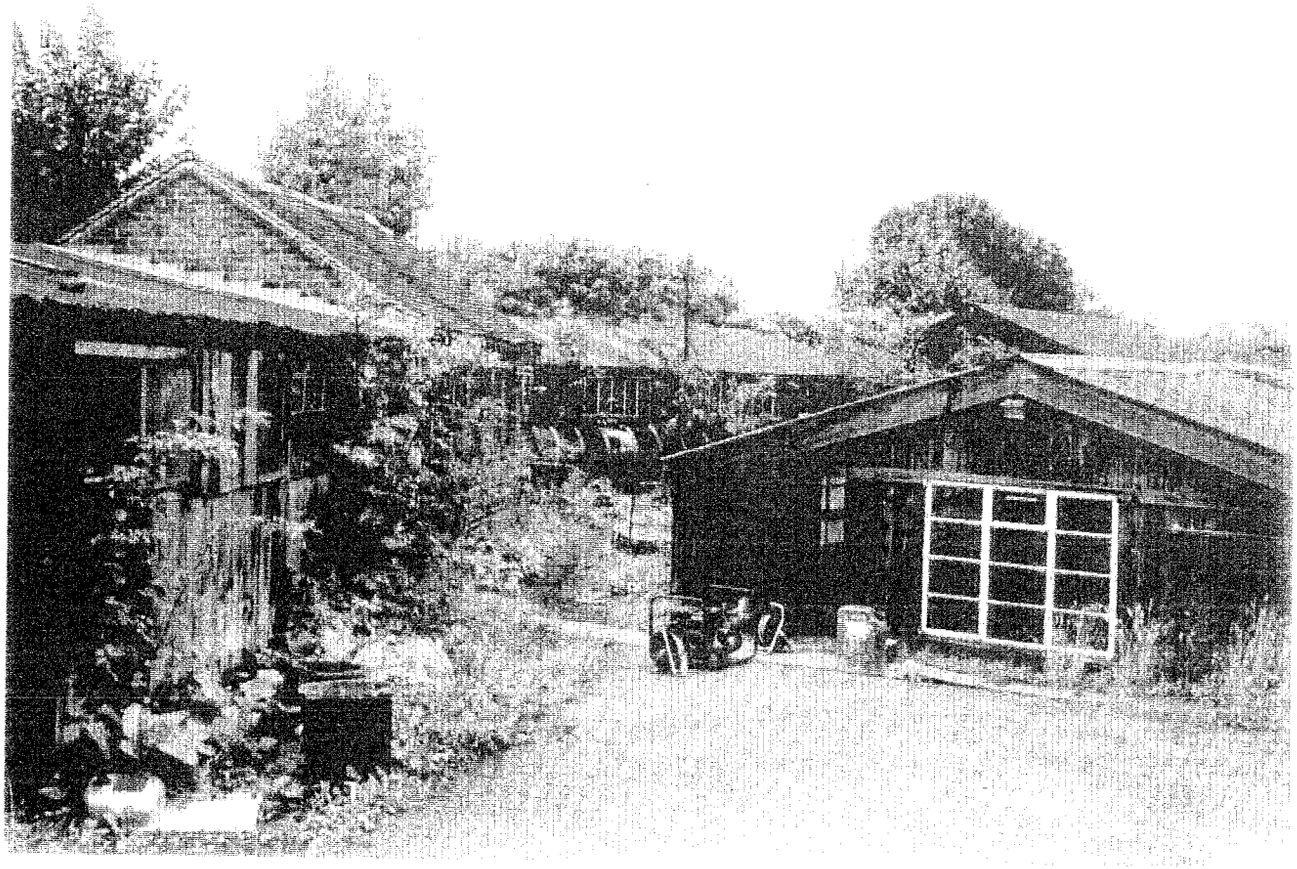


Plate 2: View North into the Yard

Plate 3: The Smithy

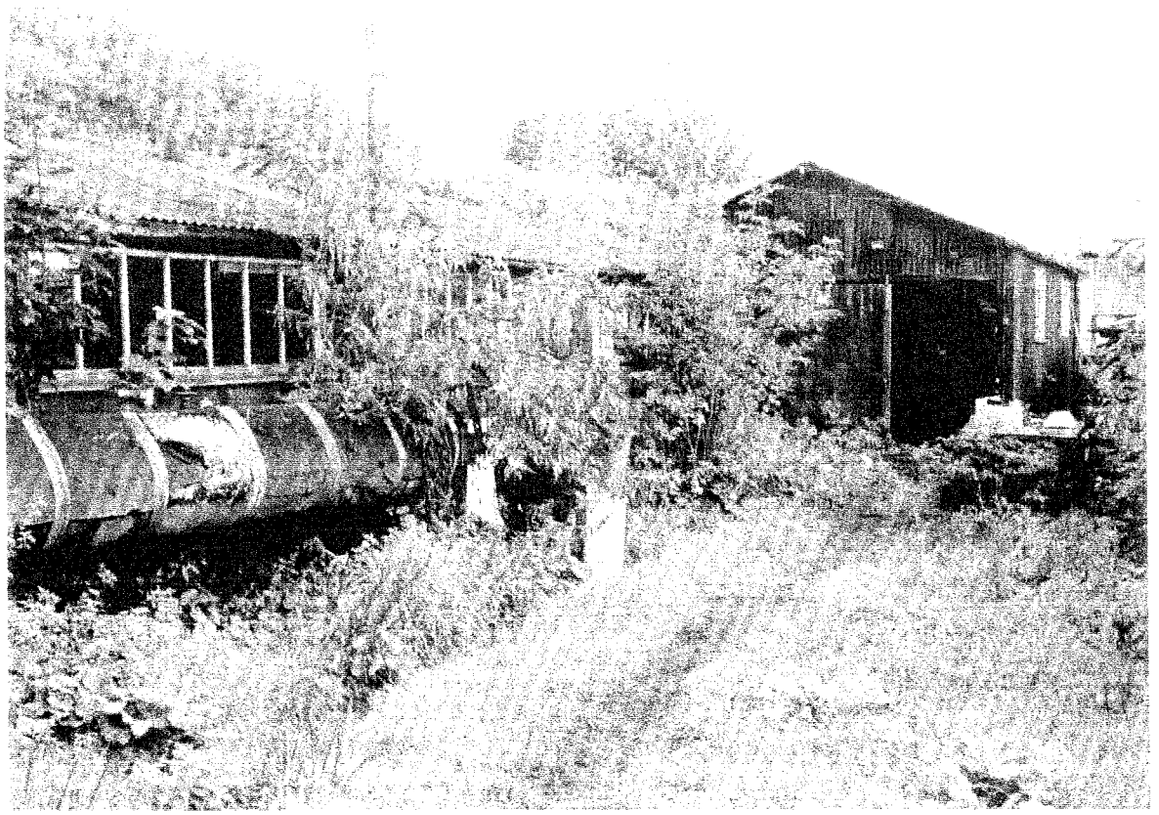


Plate 4: The Carpenter's Shop, Paint Store and Machine Shop

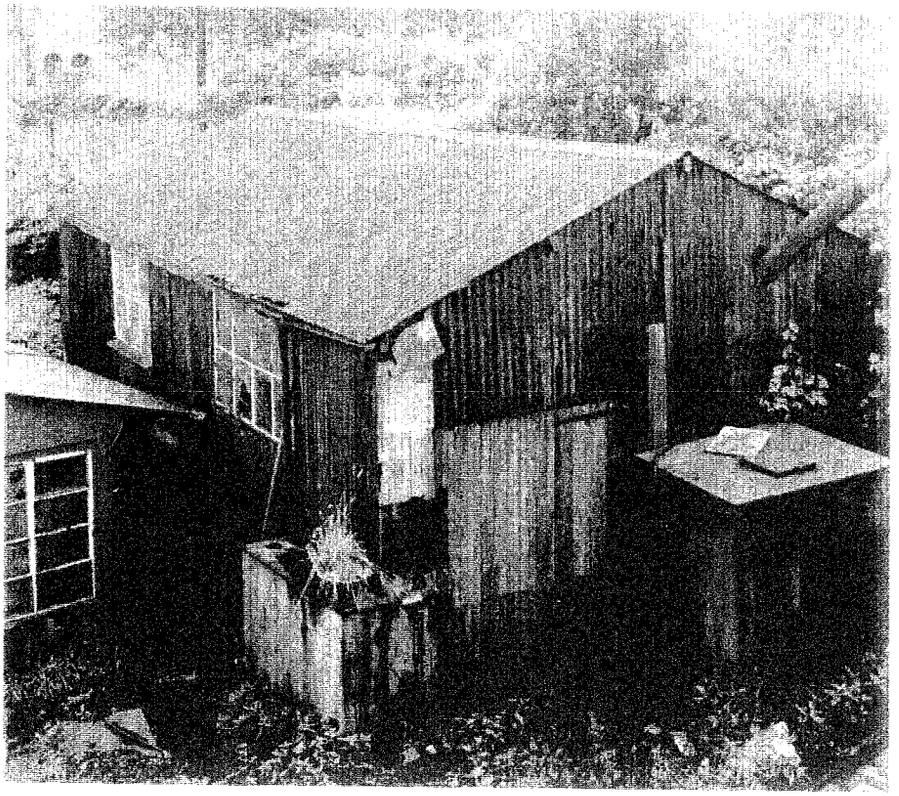


Plate 5: The Machine Shop

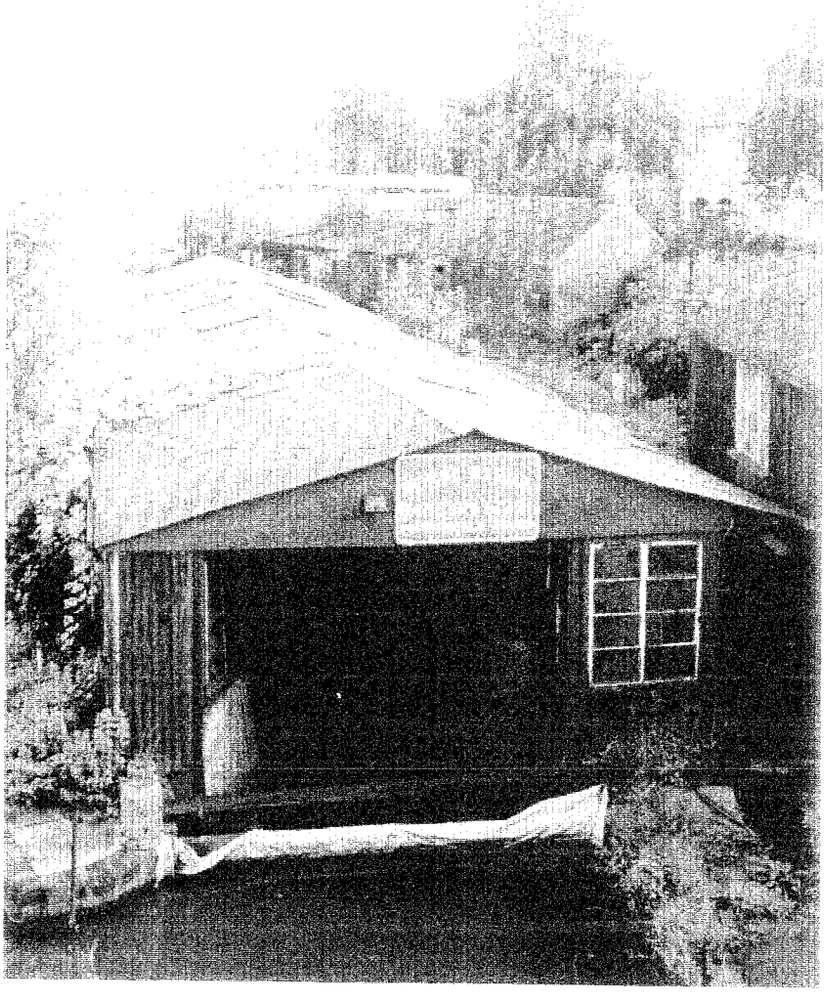


Plate 6: The Dry Dock

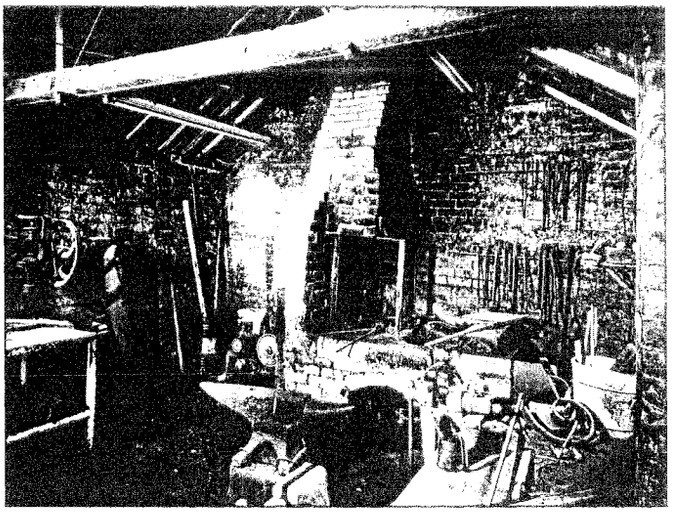


Plate I

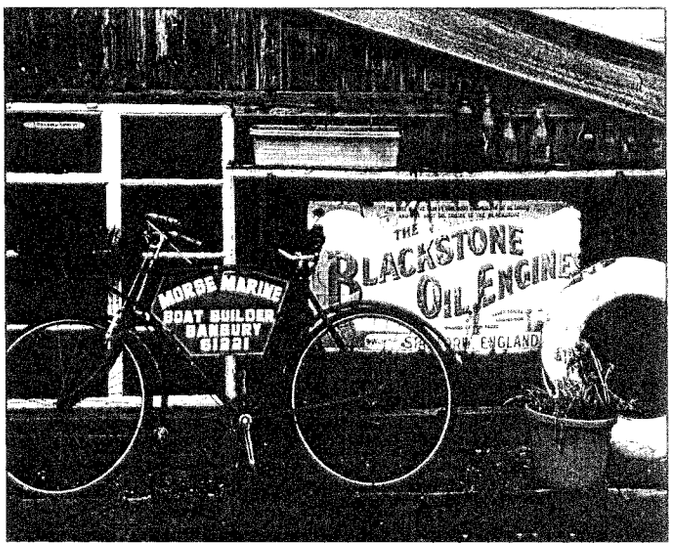


Plate II

Plate III

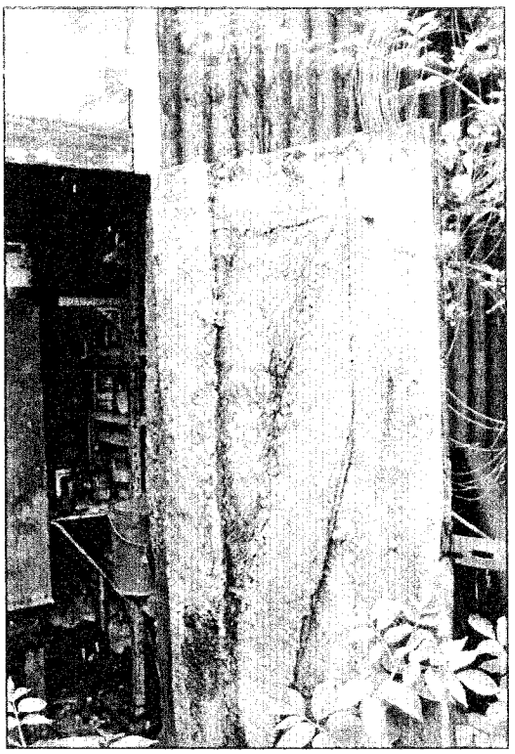


Plate IV

Plate V

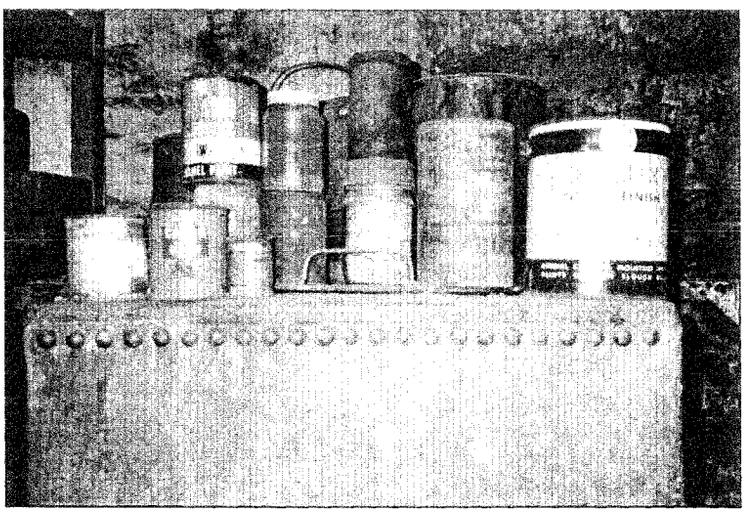


Plate VI

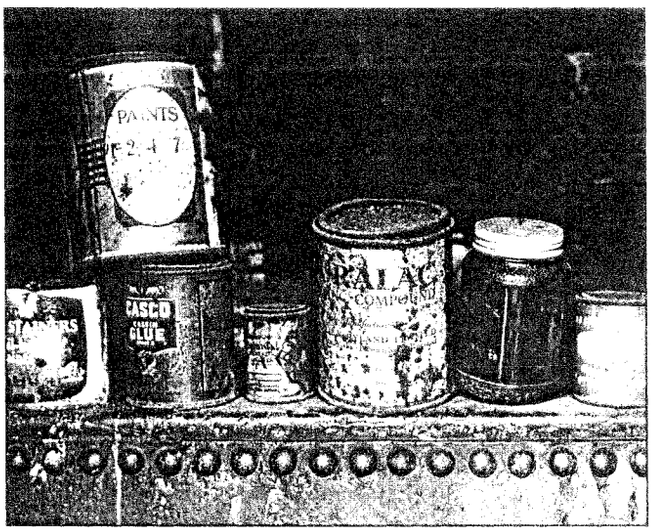


Plate VII

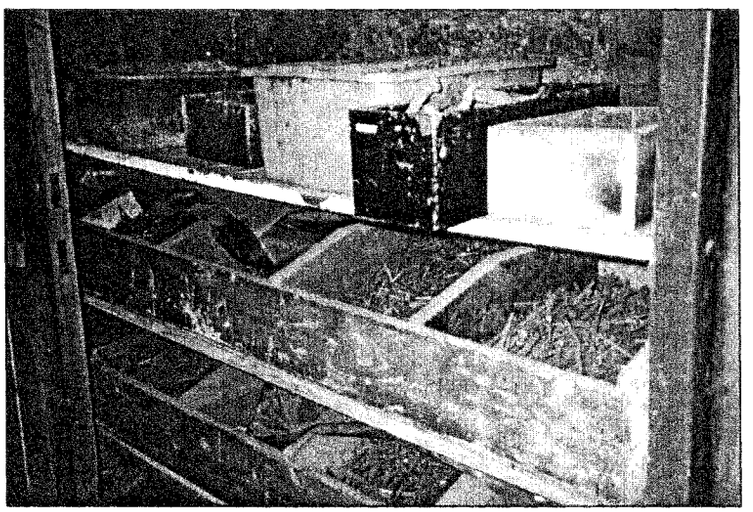


Plate VIII

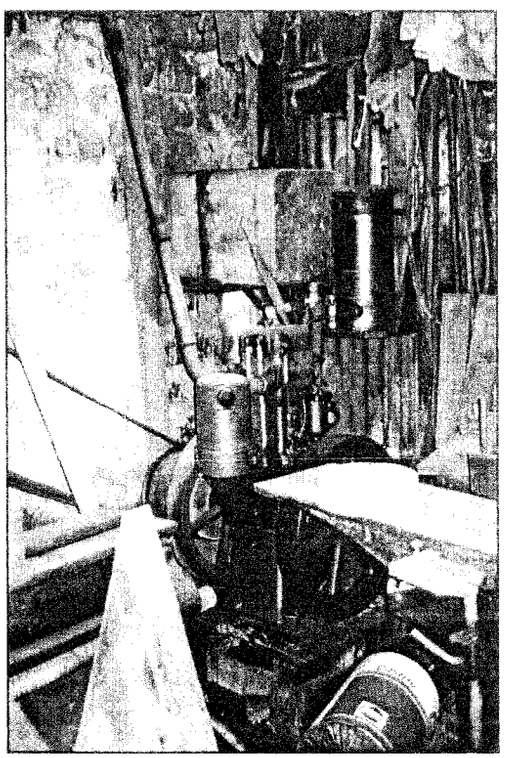


Plate IX

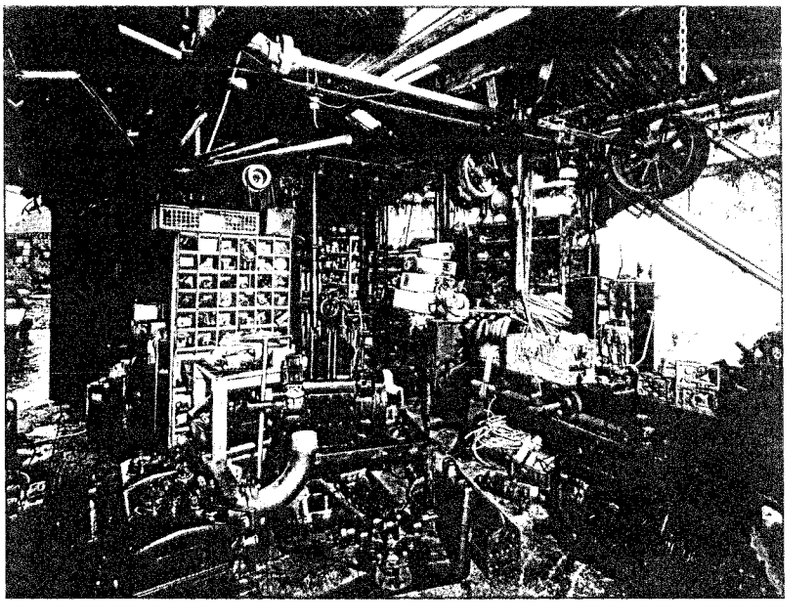


Plate X

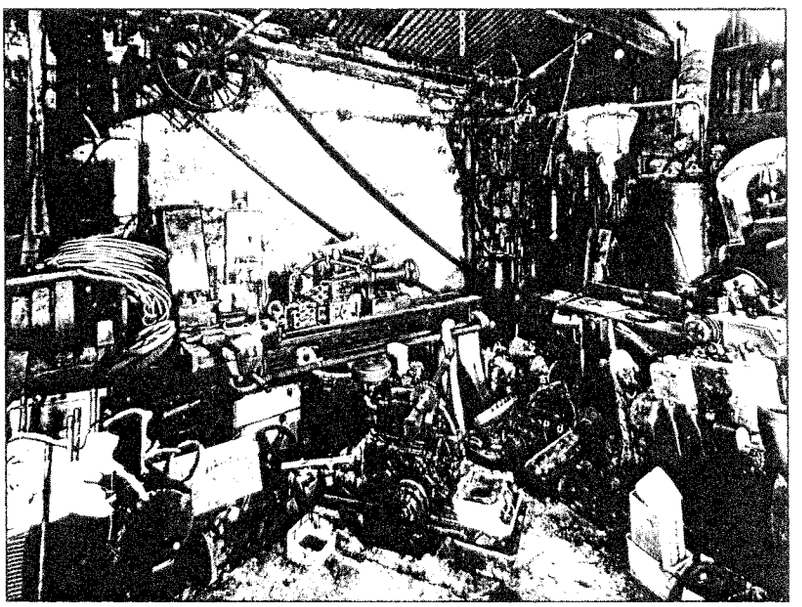


Plate XI

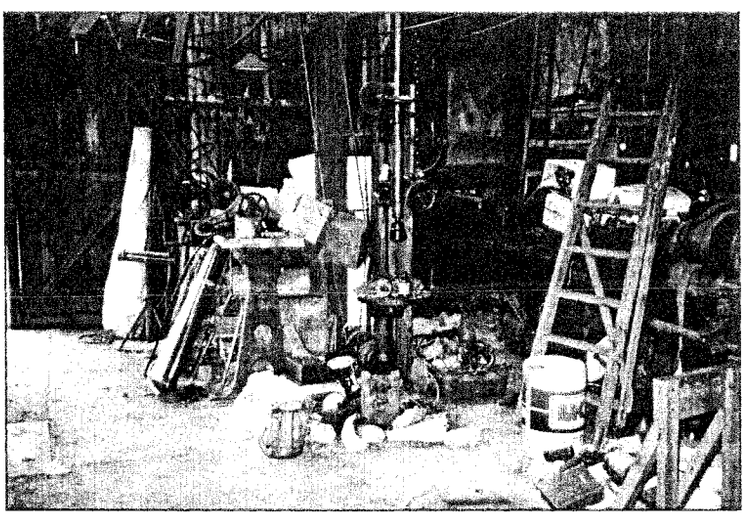


Plate XII

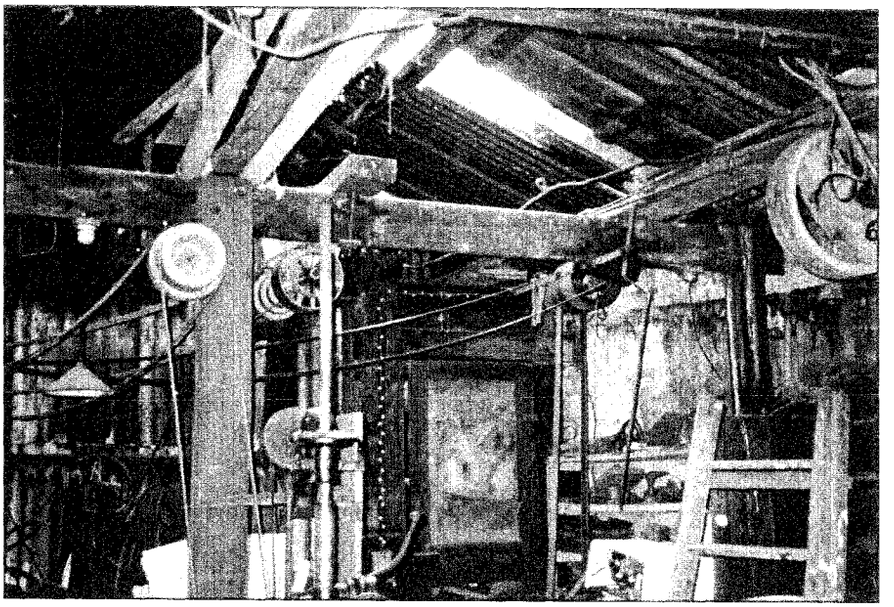


Plate XIII

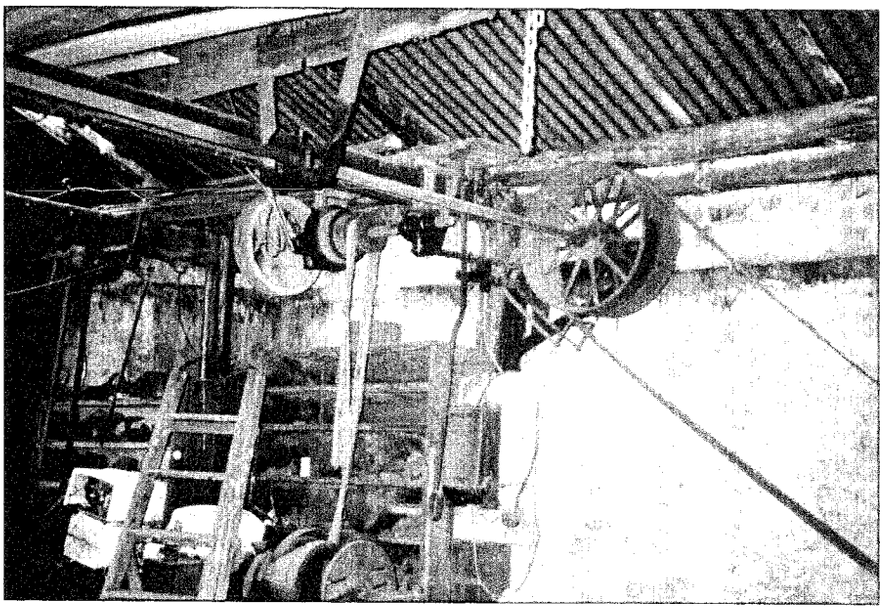


Plate XIV

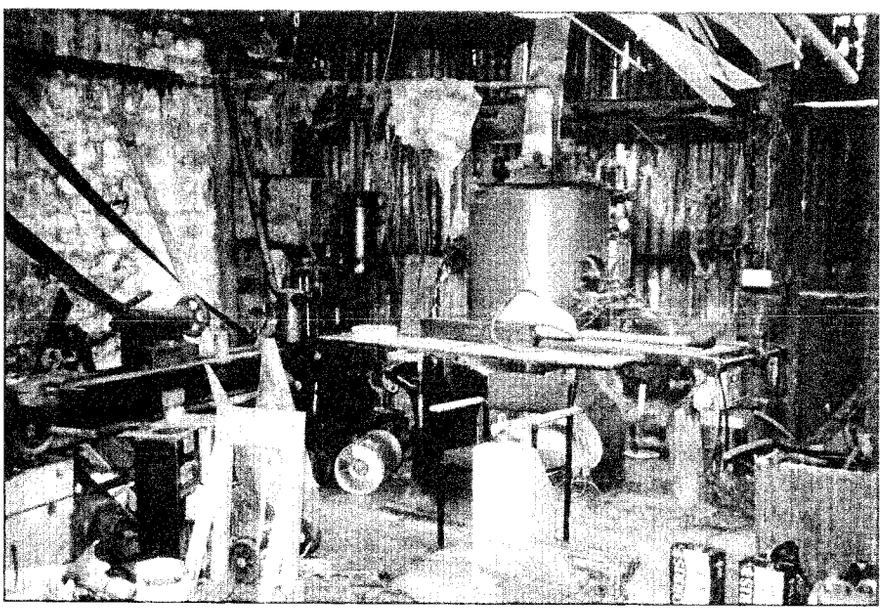


Plate XV

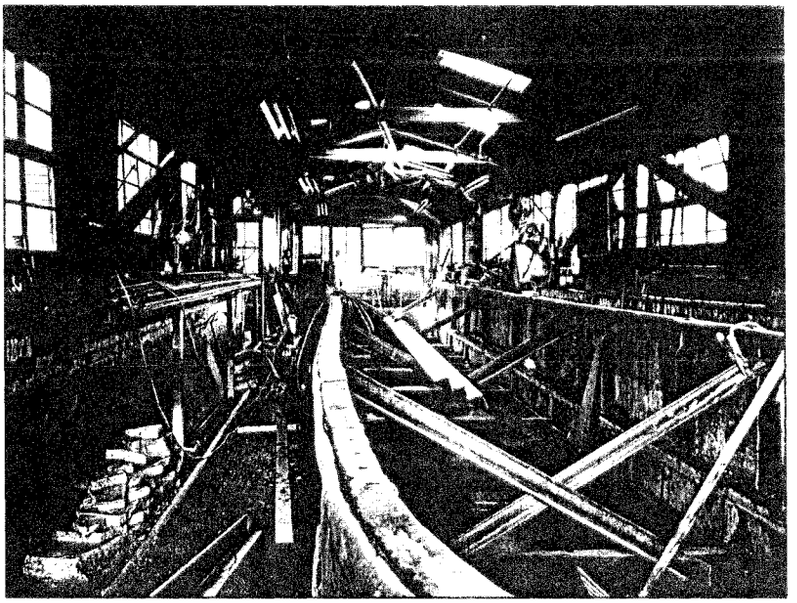


Plate XVI

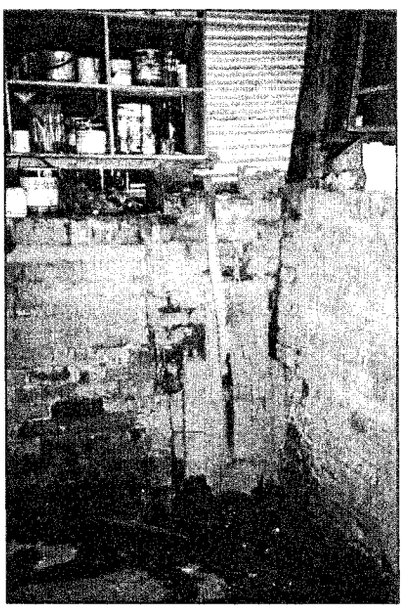


Plate XVII

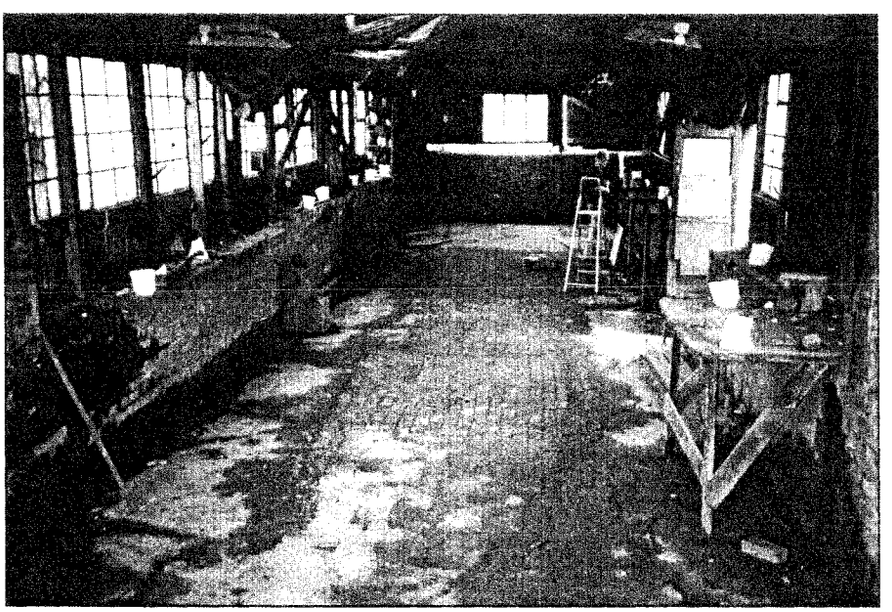


Plate XVIII