Chapter 9

WHAT HAVE WE LEARNED?

A. INTRODUCTION

In 1999, the Advisory Council for Historic Preservation issued draft guidance on archaeological data recovery projects such as this one. They are undertaken under Section 106 of the National Historic Preservation Act of 1966 (as amended) as one way of resolving adverse effects on significant archaeological resources, following the procedures set out in 36CFR Part 800.6. The draft guidance stresses that data recovery plans and research designs should be "grounded in and related to priorities established in regional, state, and local historic preservation plans....and... academic interests.." The purpose of this chapter is to review the new information gained during the present study and to set it within its wider context.

During the identification and evaluation process for this project there was discussion of the possibility of delineating a historic district encompassing the various waterpower sites along this portion of Pike Creek and possibly including the Springer/Little Farm site because of some ownership and functional connections between the farm and the Woodward/Trump/Broadbent/Taylor Textile Mill Site.

Under 36CFR Part 60 (National Register of Historic Places), a District is defined as A geographically definable area, urban or rural, possessing a significant concentration, linkage or continuity of sites, buildings, structures, or objects united by past events or aesthetically by plan or physical development. "A district may also comprise individual elements separated geographically but linked by association or history." (60.3(d)).

The impression gained in the preliminary research of a connection between the Woodward/Trump/Broadbent/Taylor Textile Mill and the Springer/Little Farm was not confirmed by the detailed documentary investigations detailed in chapters 6 and 7. This disengagement of the two sites that were the primary objectives of the investigation weakened the historic coherence of the immediate Area of Potential Effect of the project.

More of a case can be made for the existence of a historic district linked by the waterpower systems along the Creek, and including associated buildings along the north side of Henderson Road on its eastern side. This coherence is perhaps best expressed in the 1876 Orphans Court survey of 1876 (reproduced in this report as Figure 6.6), and the presentation of the data in Figures 6.1 and 6.2.

The issues surrounding the identification, evaluation and management of waterpower sites ranged along Delaware rivers has been discussed by Bruff (1989) in relation to White Clay Creek. As Heite points out in this report, it is important to see individual mill sites as part of a broader system of interlinked enterprises sharing and competing for waterpower resources along these drainages.

The wealth of documentary data for the Pike Creek valley north and south of Henderson Road is not matched at this point by a comprehensive inventory of the archaeological and structural resources to which they relate. Preliminary survey was undertaken during the project to identify some elements of the waterpower landscape. This was particularly productive to the south where a section of the lower race, dam and ruins of one of the Wollaston mills

was identified. Remains of the two mills and the dams and raceways north of the road could not however be identified.

Given the constraints of the project, implicit in the nature of the highway undertaking, it was not possible to evaluate the numerous waterpower-related resources up- and downstream from Henderson Road. It does seem likely, however, that intensive survey, including some limited machine-assisted excavation at key locations, would establish the integrity of the main elements of a historic district along the Creek. The case for such district would be strengthened by the identification of Oliver Evans technology and alterations to the 1796 Phillips mill a short distance north of the bridge.

B. THE FARM

How has this project contributed to our knowledge of what has been called the "cultures of agriculture" in the Delaware Piedmont (Catts and De Cunzo 1999)? As pointed out in Chapter 1, section B, and more fully outlined in the Scope of Work (Appendix E), there is an extensive and constantly-increasing body of research on 19th century farmstead archaeology. In Delaware the magisterial overview by De Cunzo (1992) remains the fundamental resource for this topic, set within the framework provided by the historical archaeological management plan (De Cunzo and Catts 1990). Trends in Delaware in the remainder of the 1990's have been usefully summarized in Catts and De Cunzo 1999.

Catts and De Cunzo stress the fact that agricultural "places", meaning the totality of the farmstead including its fields and other spaces, are the essential building block of historical archaeology (1999:22). Reconstructing the "material world of place" remains a central part of the archaeological endeavor, even at a time in the development of the discipline when our confidence in our ability to "reconstruct" is increasingly called into question by post-processual thinking and deconstructionist viewpoints. The core of the Ward/Little Farmstead proved remarkably reconstructable, and we were able to picture it at different periods of time and draw contrasts and conclusions from those differences.

A second fundamental theme highlighted by Catts and De Cunzo is the need to try to comprehend the role played by the material world in communicating cultural and social meaning. Choices made by people are reflected in the material world they create, whether in the layout of their farm buildings, the architectural style of their houses, or the type of ceramics and other portable artifacts which they use. Spatial patterning of buildings and artifacts and their relationship to social and cultural attitudes, as expressed in documentary sources, have been discussed by Adams (1990). Increasingly sophisticated analytical techniques have been applied to artifact assemblages, particularly to ceramics, to extract information on wealth, social behavior, and even gender and ethnicity (e.g. Miller 1980, 1991; Yentsch 1991; Friedlander 1989).

Our analysis of the data from the farm enabled conclusions to be drawn about changing social attitudes through time at this place, and these can be added to the considerable body of data now available from other sites in Delaware, where is subject is probably better developed than in some other areas (cf. Perry 1991). Of particular interest is the apparently radical replanning of the agricultural complex in the mid 19th century, comprising both "transformation" and "new construction" (Catts and De Cunzo 1999:23).

A final major trend apparent in regional research over the last dozen years has been the protracted and somewhat introverted debate on the self-sufficiency of farms in the 18th and 19th century. This debate is well summarized in the discussion on the western Pennsylvania site of Schaeffer Farm (Bedell, Petraglia and Plummer 1994). There is now abundant evidence that farms in the 19th century Delaware Piedmont, as elsewhere in the mid Atlantic (e.g. Wacker and Clemens 1994) were in no sense self-sufficient and were never intended to be so.

For this study, a number of themes stand out. The overall impression gained from this study is that the Springer/Little Farm is a typical example of a small northern-tier Delaware farm. Archaeological and historical data from this site reinforce each other to striking degree. It is remarkable that a historically supportable model of the site's history could be derived solely from the archaeological evidence. More poorly documented sites can therefore be accurately characterized through intensive archaeological study.

1. The Springers

While the documentary evidence suggests that Jeremiah Springer was living in somewhat straightened circumstances, the archaeological evidence hints that he may have been more comfortable and better off than might be supposed. This possible contradiction between the two sets of data is an example of the constant interplay between the disciplines of history and archaeology, raising questions about the type of information each provides for the study of the documented past. A second deduction from the archaeological evidence is that the Springers were still eating some wild foods (e.g., turtles, clams and fish) for part of their food supply.

2. The Rebuilding of the Farm

Archaeological and historic evidence combine to show that something of a revolution took place on the farm in the 1850's and 1860's. The Springer family's log house, located close to the road, was taken down, and a new farmhouse built to the east on higher ground. At the same time that the new stone farm buildings were erected, a stone wall was erected along the road. The overall impression is of a new appreciation for appearance and stability, also during this time, the value of the farm doubled.

These trends are seen at other sites, too, and the Springer/Little Farm was following a common path at this time (Figure 9.1). The William Hawthorn Site in White Clay Creek Hundred underwent some reworking in the 1840's, during which time a new frame barn was built to replace a log structure, and the log farmhouse was apparently framed over and clapboarded to make it look as if it was a frame house. The tax value of this 111-acre farm increased by 166% between 1840 and 1852 (University of Delaware Center for Archaeological Research 1984). The 144-acre Ferguson/Weber Farmstead, also in White Clay Creek Hundred, saw the addition of a new frame house and frame barn to the existing farmstead of log house and frame barn in 1835-37. The value of this property increased by almost 150% in this period (University of Delaware Center for Archaeological Research 1983). Further south in New Castle County, the Buchanan/Savin Farmstead in Blackbird Hundred underwent major improvements in the 1850's. In 1852-1853, there was "an old frame dwelling and an outhouse", but by 1857 there were two tenant houses, a stable, a carriage house, and a meal, corn and tool house. The value here increased by almost 190% in the 1850-1860 period (University of Delaware Center for Archaeological Research 1994).

3. Houses

The size of the Springer's log house is not known, although the house that replaced it was quite small, with a first floor dimension of only 350 square feet for the stone foundation. Research undertaken for the study of the Cazier tenancy site in Pencader Hundred suggests that 19th century owner-occupied farmhouses in the mid-Atlantic region have a floor dimension of 490 square feet or greater (University of Delaware Center for Archaeological Research 1994:Table 24). On this basis, the farm house at the Springer/Little site seems anomalous. Is it a previously unsuspected tenant house? Is the stone foundation only a portion of the original house? There is a concrete pad area on the north side of the stone foundation, incorporating a well in its northeastern corner. If this reflects the mid-19th century footprint of the house, it would then be 660 square feet in size, which is still much smaller than the Hawthorn house but within the owner-occupier range. The question of house size and its relationship to ownership/tenancy status and farm size is evidently one that can be pursued further.

4. Artifact and Trash Disposal

Earlier 19th century artifacts were found in the pit believed to represent the pre 1850 log house of the Springers. How did they get there? The stratigraphic evidence from the barn area immediately to the west suggests that soils were removed from this location and dumped into the cellar hole of the log house before the barn was built. If this is the case, it points to the pattern of trash disposal in rear and side yards close to the house common in earlier 19th century and earlier sites. Such patterning was noted at the Hawthorn Site (University of Delaware Center for Archaeological Research 1984:178) and at the Ferguson Homestead (University of Delaware Center for Archaeological Research 1983:90). In all three cases, the later 19th century pattern was to dispose of trash further away from the house, a development which parallels the physical separation of the increasingly domestic space of the house from the work area of the farm. The reasons for these changes appear to lie in a complex set of aesthetic, cultural and sanitary attitudes which gained ground in the middle years of the 19th century.

C. MILLS AND WATERPOWER

While the archaeological evidence for the waterpower systems and structure of the textile mill was much less informative than had been hoped, the background historical research for the project produced a wealth of information. One particular discovery is the identification of the Phillips mill site north of the project area. This may be one of the first mills to be purpose built to accommodate Oliver Evans' new integrated grist milling technology in late 1790's. Several members of the Phillips family were subscribers to first edition of Evans' Young Mill-Wright and Miller's Guide in 1795 (Evans 1795 [1990].

The story of miller John Phillips, his relations with the Rice and Barker families, and his eventual ruin as a consequence of disputed land title, has compelling human interest and provides a glimpse into the complexities that resulted from the desire to harness the power of streams in areas already settled.

It is very clear that Pike Creek in the 19th century was a thoroughly managed watercourse which provided power to numerous industrial operations along its length. Attempting to study a single mill in such a setting proved both impractical and undesirable. The need to control and harness waterpower resulted in very complex property and tenurial

relationships, and an equally complex and constantly changing landscape of raceways, dams, sluices, tailraces and mill buildings. The almost complete physical disappearance of this landscape is striking, as is the lack of information on its archaeological survival beneath silt and debris and new bridges and new road alignments. The archaeology of Delaware Water Power will remain a challenge for some time to come.

The contextual background research for the mill also highlighted a number of wider issues to which attention is drawn here.

1. The Archaeology of Mill Sites: Methodological Implications and Key Considerations

As Crane et al. (2002) have recently re-emphasized, the archaeological study of mills can be a complex and sometimes unrewarding task. Certainly this study of the Woodward/Trump/Broadbent/Taylor mill site showed that the once complicated and massive structure and its associated waterpower systems simply could not be adequately studied by archaeological methods within the project limits. This was not only because the limits of construction only affected a portion of the site, but also because the waterpower structures lacked integrity and could not be understood in their surviving fragmentary form.

Several problems face any archaeologist planning to examine waterpowered mill sites, and indeed the validity of trying to study them through archaeology at all has been questioned (Morin and Friedlander 1988). The conservatism of waterpower technology has been cited by Crane et al. (2002:110) as one factor limiting the usefulness of archeological investigation, presumably because this does not help in the study of change through time, the so-called diachronic perspective, which motivates much archaeological research. Comparative studies of sites of the same period (a synchronic approach), are however less affected by this approach. More compelling is the observation that milling machinery was normally salvaged from sites that were abandoned, and therefore that key technological information may be missing from the sites.

The very size and complexity of mill sites does, however, mean that they may contain a range of archaeological resources of significance, and that sites lacking some features may retain others that can contribute to our understanding of these once ubiquitous and crucial elements of the early American landscape. The different elements of waterpowered sites will now be reviewed from an archaeological standpoint as a contribution to improving the archaeological response to their study.

It should be emphasized at the outset that the study of these structures absolutely requires the use of powerful earthmoving equipment in the hands of sensitive operators, guided by archaeologists who aware fully aware of the nature, complexity and probable appearance of the features likely to be encountered. Safety must be a primary concern in the deep, wet, and unstable excavations that result from investigation programs that aim to examine these sites comprehensively (Hunter Research Associates 1986).

Hand techniques such as shovel testing and excavation units are normally useless on these sites because of their scale and the frequently considerable depth of silt and fill with which the sites are covered. Some schools of thought in historical archaeology are so focused on the recovery and analysis of portable artifacts that the importance of obtaining large-scale exposure of the structural

components of sites like mills can be overlooked. One study in Delaware some years ago entailed the analysis of ceramics recovered by shovel testing from the upper levels of the fill of a deeply buried mill building. Hopefully, such inappropriate approaches will not be used in the future, since traditional material culture studies will add little to the understanding of these sites.

In addition to skill with earthmoving machinery, the archaeologist studying mill sites requires considerable skill in "reading" the cultural and natural landscape. Familiarity with the historic maps of the area and their conventions is a key component of this, as is a general understanding of changes in hydrology that have taken place over the last three centuries and the associated changes in sedimentation and flow that have resulted. The locations of mills can be extremely hard to identify in the modern landscape because of these changes, and an awareness of the past history of the site, particularly post-abandonment, is essential.

A final methodological consideration must be the importance of obtaining accurate elevation data of all elements of the waterpower and other components of the site. This will enable a range of calculations to be undertaken to calculate the energy utilization of the mill site. A methodology for using this type of information in conjunction with GIS technology is set out in Crane et al. 2002: chapter 8

The key component of all mill sites, whatever their specific function (gristmill, sawmill, fulling mill etc) is the mill seat, the actual building in which the waterpower was harnessed to the processing machinery. Delineating the footprint of the mill seat should be a primary objective of any archaeological study because this will provide an indication of the scale of the operation and its relationship to the waterpower. Additionally, the mill seat footprint is likely, if the site was in use for more than a few years, to show evidence of alteration and enlargement to take advantage of technological improvements (Hunter 1999:156-173), comments by Crane et al. (2002) noted above notwithstanding.

The key archaeological context in the mill seat is the wheel-pit. This may be within or outside the building footprint, although in areas like the mid-Atlantic where winters can be severe they are normally inside to protect the wheel mechanism from freezing. In either case it is important because its depth means that it is likely to remain waterlogged, preserving not only pieces of wooden machinery and other tools (dropped and only recoverable by the mill workers at considerable inconvenience and risk), but also paleoenvironmental evidence relating to the local environment and possibly also to the materials being processed. This can be particularly true of processes creating a lot of organic debris, such as sawmills (Stilgoe 1982:317-318). Location and evaluation of wheel-pits should be a high priority for archaeological evaluations of mill sites.

The wheel-pit is additionally the feature most likely to show evidence for major technological change in the portions of mills surviving as below-ground archaeological sites. Changes to the wheel-pit may reflect changes in the power coming to the wheel, improvements to the wheel itself, or changes to the powertrain or processes within the building. Most typical is the conversion from a traditional vertical wheel to more efficient turbine systems in the mid and later 19th century, requiring removal of the wheel and reconfiguration of the pit. Regional examples of such conversions have been documented at Prallsville, New Jersey (Hunter Research, Inc. 1991:5.12 - 5.19) and Mahwah, New Jersey (Hunter Research Associates 1986:5.42-5.45)

Raceways are another major component of these sites. The headrace, bringing a reliable flow of water to the wheel, required careful construction

and is capable of yielding a great deal of hydrological information when studies in concert with other elements of the complex (Crane et al. 2002 110-111). Particularly important sections of headraces are the intake from the supplying source (river or lake) and the approach to the wheel. At both places penstocks and other features for controlling the flow of water are likely to be present, and these can also provide important information on the overall hydropower system.

Tailraces tend to be less elaborate that headraces, and were chiefly designed to remove slack water from the vicinity of the wheel as quickly as possible and to avoid ponding back of water into the wheelpit. They are of much more limited structural interest, but may indirectly provide information on the overall hydrology of the system.

Dams may come in a range of forms. The traditional concept of a dam is a solid continuous embankment across a valley, blocking the flow of a stream and creating a pond or lake. Structures of this type do exist but also common are various wing or diversion dams which served to channel water from a river or stream into the raceways system without completely impeding the flow. This was important on many rivers where there were multiple rights and users involved. Dams often included various overflows, sluices and spillways to reduce the risk of flooding and overtopping of the dams. At some sites multiple dams may be present as power needs increased through time or, as at Pike Creek, because of multiple mills and mill owners on short stretches of drainages.

There are two major regulatory and procedural considerations in cultural resource studies of mills. One is establishing a meaningful boundary for the mill site, and the second is determining if a site meets the eligibility standards for inclusion in the National Register of Historic Places. Both will be briefly touched upon here.

Site boundaries can be particularly difficult to establish because of the landscape changes mentioned earlier, and the lack of data on the below-ground preservation of raceways and other features of which there is no sign on the surface. In general, it is recommended that boundaries be drawn to encompass all features once known to exist unless there is clear evidence that they have been destroyed. Wherever possible, physical confirmation of features should be established through survey and testing.

In terms of National Register eligibility of mill sites surviving as archaeological resources, a flexible approach should be adopted. Mill sites, like any other historic resource, may be eligible under any or all of the four criteria defined in Federal Regulation 36CFR 60.4, and in many cases only detailed research on a case-by-case-basis will establish this. These observations are however chiefly confined to consideration under criterion D: sites “that have yielded, or may be likely to yield, information important in... history”.

Ideally, a mill site will possess all the main structural elements discussed above, each have a good degree of integrity. Such sites will generally meet criterion D quite readily, and should also be carefully evaluated under criterion C (having “distinctive characteristics of a type, period, or method of construction”. The argument here, however, is that individual elements of a mill site may be eligible in their own right, even if other components are destroyed or lack integrity. A particularly well-preserved dam, for example, could be significant for the technology it reflects, even if the raceways and mill seat have been destroyed. The innovations

developed by Oliver Evans and his collaborator Thomas Ellicott at the end of the 18th century may be taken as a case study for this argument.

2. The Archaeological implications of Oliver Evans' Milling System.

Oliver Evans was instrumental in transforming grist milling from a labor-intensive and essentially pre-industrial craft into a more integrated and automated process that prefigured later 19th century industrial production lines (Ferguson 1980:13-28). The crucial concept in Evans' design was that the grain was moved automatically from one step in the milling process to the next without the need for intermediate manual bagging, transfer, or hauling as had previously been the case in traditional mills. It became possible to unload unprocessed grain directly into a mill and to receive it as flour without any manual labor being required other than the maintenance of the equipment and the waterpower system. It was this automation of the movement of the material, rather than technical improvements to the actual milling process, that was revolutionary.

Evans' system integrated several devices to produce this result. Vertical movement of the grain, meal and flour was accomplished by the use of bucket elevators, perfected by Evans. A time consuming process, the manual spreading out of the meal on the upper mill floor to dry and cool after grinding, was automated by the ingenious "hopper boy". This device received the ground meal from the millstones via a bucket elevator, and by means of a rotating arm spread, stirred, and turned the meal before raking it back into a hopper from which it fell into the "bolter" where it was sifted into fine flour, middlings and chaff.

A third major innovation, developed by the Ellicotts of Maryland, was the horizontal screw conveyor. This tool enabled grain and meal to be transported horizontally from one part of the mill to another (for example from beneath the millstones to a bucket conveyor). Two other devices later improved on this system, but by 1790 Evans had a working integrated system that made use of all these devices. He demonstrated the system by means of a model in Wilmington, and after that it began to be widely adopted.

The introduction of Evans' system required a substantial reworking of the interior of mill buildings, and probably the complete rebuilding of many smaller ones to accommodate the bucket and horizontal screw conveyors. The capital investment for this would also have been substantial, but the huge increase in efficiency was a strong incentive.

Identifying the introduction of Evans' system should be a priority in the archaeological study of grist mills that were established earlier in the 18th century and continued in use in the 19th. Did all mills adopt the system? Do the ones that did not have common characteristics of size, location, ownership or other factors? Can structural alterations to mill buildings be directly related to Evans improvements? At this point it appears that no concerted attempt has been made to study these questions, at least in the Mid-Atlantic (Ned Heite, personal communication January 23, 2003).

One way to approach the question is by examining the materials published by Evans and Ellicott (Evans 1795 [1990]). Although he did not specifically address the spatial requirements of the Evans system, Ellicott wrote and illustrated a plan for a gristmill that may perhaps be taken as representative of the sort of building he considered appropriate for accommodating it.

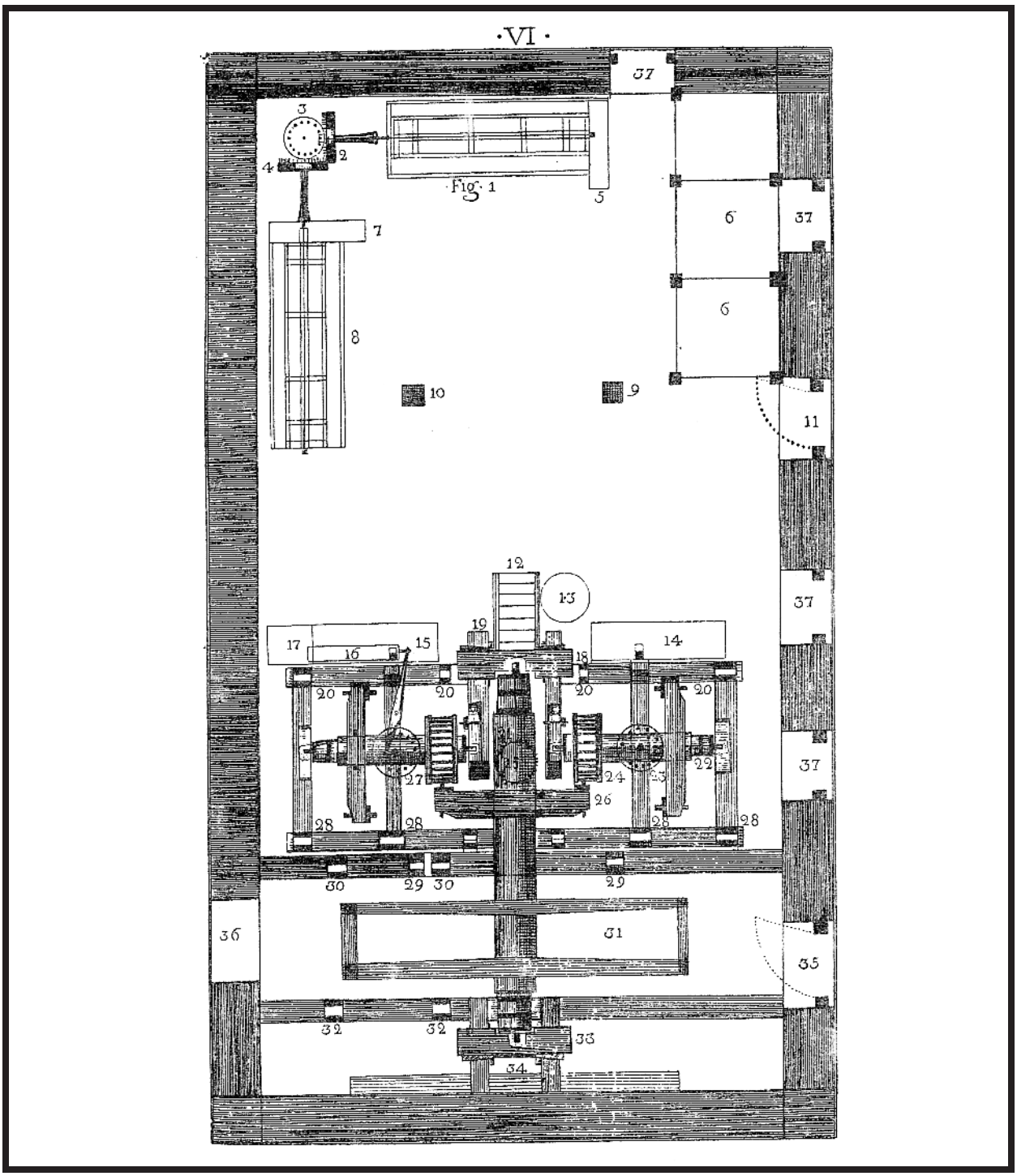

Figure 9.2. “Ground Plan of Mill” by Thomas Ellicott, 1795.

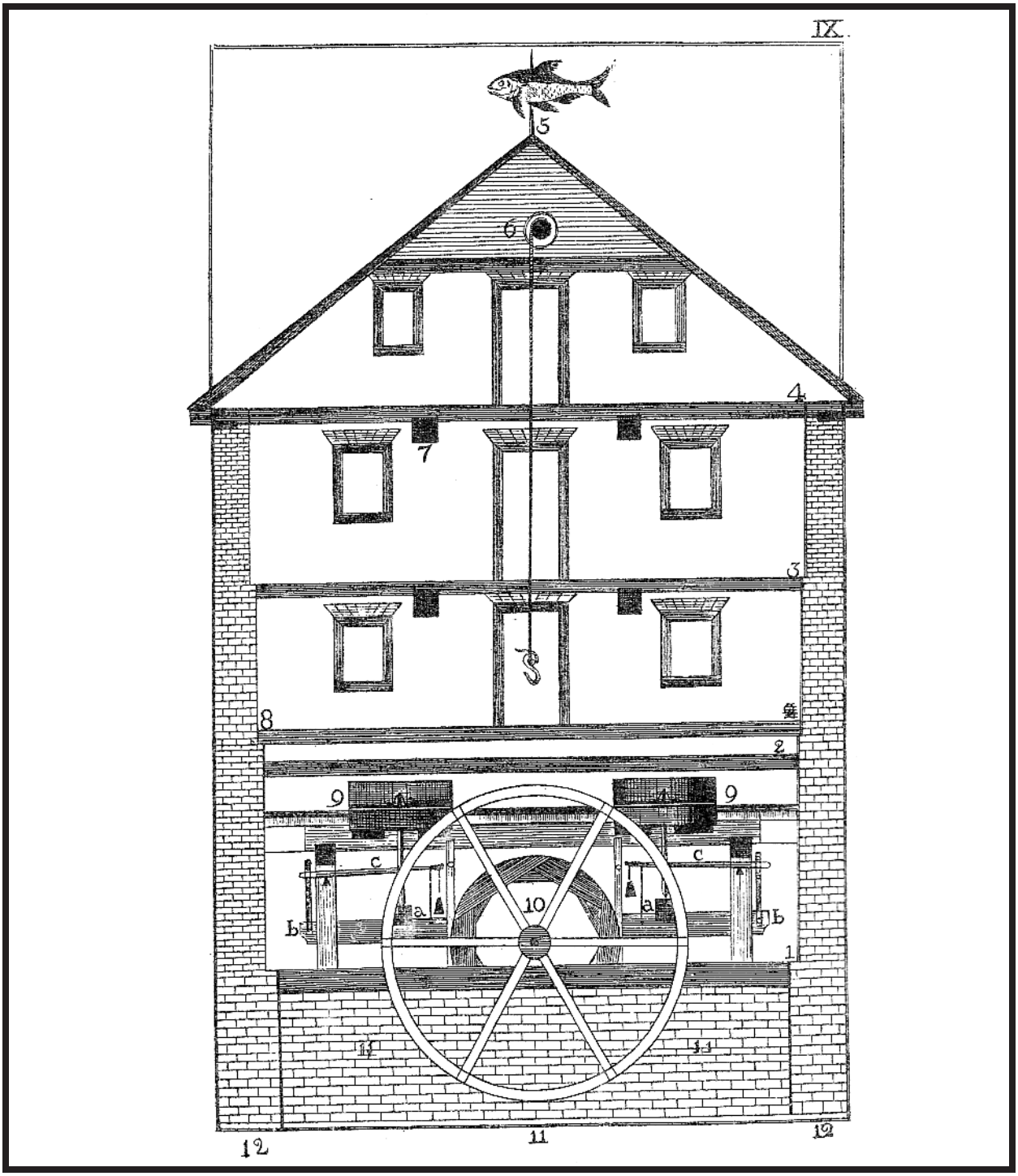

Figure 9.3. "Outside View of the Water End of a Mill-House" by Thomas Ellicott, 1795.

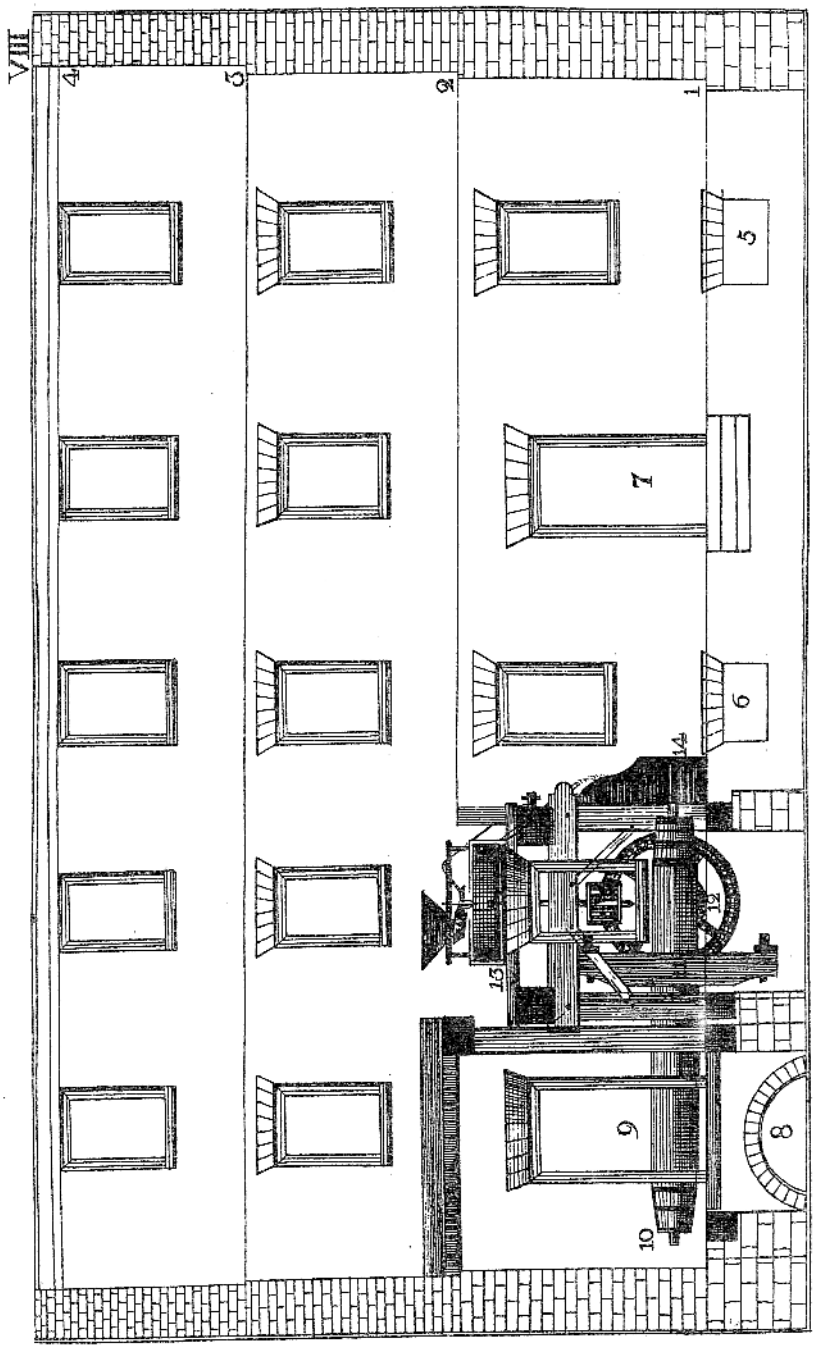

Figure 9.4. "Lower Side of a Stone Mill-House 3 Stories High" by Thomas Ellicott, 1795.

Three of Ellicott's plates are reproduced here as Figures 9.2 through 9.4. These plates illustrate a mill building 32 by 55 feet in plan that Ellicott uses as an example to illustrate the process of designing and building a new mill. It was clearly unusual at this time to produce formal drawings (draughts) of planned mills. Ellicott notes that "*some are of opinion that draughts are useless pictures of things, serving only to please the fancy", but goes on to explain that "The great use of draughting mills &c. to build by, is by conveying our ideas more plain, than is possible to be done by writing or words, which may be misconstrued or forgotten; but a draught, well drawn, speaks for itself...*"

Ellicott's text and drawings do not explicitly indicate that his sample mill in designed for Evans' equipment, the popularity of Evans' innovations would seem to make this an implicit assumption.

Given the requirements of the Evans system, and Ellicott's general guidance, what are the implications for the archaeological study of water-powered gristmills? Clearly a familiarity with surviving and restored mills incorporating Evans technology, and working models such as the one at the Hagley Museum (illustrated in Ferguson 1980:27) is an important part of the process of learning to identify these introductions

For mills already known to be in existence before c. 1790 and continuing into the 19th century, a number of features may be anticipated:

1. Expansion of the footprint of the building, implying a significant rebuilding to incorporate new machinery.
2. Alterations to existing openings for the loading of grain from the exterior. The presence of such openings would imply that bucket elevators were present in the interior to carry the grain up to the rolling screens at the top of the building.
3. Seating arrangements for horizontal screw conveyors, particularly below the millstones, but possibly in other areas of the building as well.

4. General indications of interior reorganization, insertion of new seatings or mountings into pre-existing masonry etc.

New buildings of around 1800 are predicted to be significantly larger than their predecessors, perhaps of the order of magnitude of Ellicott's example of about 1750 square feet. Surviving masonry or interior framing should also be carefully examined for the presence of mountings or seatings for the signature bucket elevators and screw conveyors of Evans' system. Archaeological research designs for mills of the early 19th century should take into account these possible impacts of Evans' innovations on interior layouts and overall structure.

3. The Archaeology of Textile Mills

This study has highlighted the fact that the main industrialized textile processes of spinning and weaving could be placed into multi story open buildings where machinery could be moved around relatively easily in response to changing technology or the particular processes involved. The main archaeologically recoverable features of these structures will typically be those related to the power train, rather than to the specific processes involved. This suggests that research designs for sites of this kind should focus on the archaeological investigation of the power system, and place emphasis on the documentary study of the processes and products.

4. Hay Farms and Cooperage

The study has also highlighted the importance of ancillary activities which took place at milling and other rural industrial sites. The production of barrels (cooperage) appears to have been an important process at many sites, but has been little studied. The same may be true for the hay-producing operations needed to sustain the large numbers of horses which rural industries needed to transport their goods to emerging urban markets.

5. The Vulcanized Fiber Industry

Mill Creek Hundred was the world center of this industry, which produced a significant forerunner of the many synthetic materials developed in the 20th century. Historic contexts for industrial history and archaeology should study the physical remains and historical documentation for this industry with a view to establishing guidelines for preserving important sites relating to it.