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ABSTRACT

The Water Supplies and Related Structures of Roman Britain

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Information is provided on the remains of aqueducts, wells, Roman baths, drains, pipes, springs and tanks, from 807 sites in Roman Britain (fortresses, forts, towns, small towns, settlements and villas). The introduction of running water supplies and baths had considerable social implications, for urban and rural communities. Aqueducts are the most intensively researched water-related structure of Roman date; evidence from Britain is presented in detail. Particular attention focuses on unresolved structural problems (Leicester, Lincoln). Wells were also important for water supply at all site types, especially for domestic use; possible religious aspects are also discussed. The layout of bath buildings is reviewed, and the provision of drains and sewers. Distributions of all the various water-related structures, based on the archaeological record, are evaluated. Several points emerge from this analysis, i.e. a number of settlements should be reclassified based on their possession of public baths or running water supplies.

Generally, these systems are poorly understood, partly through concentration of past fieldwork on monumental and domestic structures (areas outside buildings have rarely been investigated in detail). Britain's high annual rainfall has tended to diminish the importance attached by scholars to water-related features. There has been a general reluctance to discuss water supply and baths in studies of urban and villa development. These factors have tended to obscure their relevance both socially and technically, resulting in a lack of appreciation of the complexities surrounding water supply. An attempt is made to quantify the labour organisation and costs of well and aqueduct construction, to show the impressive scale of some Romano-British ventures.

It is concluded that water-related features are generally under-represented in the archaeological record, compared to the number of known sites. This can only be corrected by considerable additional fieldwork and re-evaluation of existing information.

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CHAPTER 1.

THE BACKGROUND: HISTORICAL CONTEXT OF WATER SUPPLY

1. INTRODUCTION

With the introduction of aqueducts to Rome in the late 4th century BC the Romans had developed a desire to have unpolluted water for drinking and domestic use. As the empire expanded, water supply was given a high priority wherever the Romans established themselves. The Roman army introduced into the new province of Roman Britain organized water supply at their fortresses and forts. Where towns and new settlements developed under Roman rule, organized water supplies were also introduced. Amongst the many remains of structures that have been found in Britain dating to the Romano-British period, aqueducts, wells and baths are common in the archaeological record. These were features which were either new to Britons following the conquest or which were constructed on a wider scale than hitherto.

Organization of water supply is of course fundamental to all human settlement but improvements on nature, especially when water engineering is involved, constitutes a characteristic of civilization. The improvement of water supply must be one of the basic means developed by man to enhance the quality of life. Baths and bathing derive their origin from the ability of man to bring water to their homes or to specially constructed public bathing facilities.

2. OBJECTIVES

In this thesis I shall bring together much of the available evidence from the archaeological record for Roman Britain on water-related features and discuss the possible impact they had on British society. The thesis is also about the mechanics of water provision and drainage, and their distribution at Romano-British sites. It also seeks to address the social and economic impact of water supply and its use. In the discussion I shall look at:

1. the sites where water-related structures have been found;
2. the type of water-related structures;
3. the inter-dependence of these structures upon each other;
4. the distributions of different water-related features at different categories of sites.

Arising out of this information some questions are relevant, such as:

- (a) how reliable are the data?
- (b) how representative are the data for all the Romano-British sites known from the archaeological record?
- (c) are current interpretations of some of the Romano-British aqueducts and wells acceptable?
- (d) how to reconcile older and more recent excavation reports on water-related structures such as aqueducts, baths and wells?
- (e) what is the relevance of water supply to a community?

This thesis will not give detailed descriptions of each site or structure associated with water supply, rather it will examine broader problems related to the water supply systems. I shall discuss the wider social implications associated with the provision of the facility, its administration, financial implications and maintenance. The site categories used in the database are legionary fortresses, forts, fortlets, and chartered towns (*municipia* and *coloniae*), *civitates*, small towns, settlements and villas. There are definitional problems with the latter three categories which I shall discuss in chapter 2. The categories of water-related structures recognized for the Romano-British period are aqueducts, baths, wells, waterpipes, drains, sewers, springs and tanks.

This thesis owes its genesis to a short research visit I made in 1993 to the Ashmolean library to collate information on the water-related structures of Roman Britain. I soon realized there was a much larger project to be done gathering widely scattered information from the existing archaeological record, and developing a new framework for its analysis. Three months research then turned into a three year project.

The hope is to have the database published in a gazetteer format to provide easy reference to the data set on the water-related structures of Roman Britain. Although the database is not claimed to be a complete collection of all available data on such structures, it is considered that most of the known ones have been included.

3. DATABASE

The database is effectively a large gazetteer of the data on the remains of water-related features at Romano-British sites I have been able to trace in the archaeological record. I have to date assembled a database of more than 800 archaeological sites from many records dating from the 17th to the 20th centuries. It is not claimed that all the available water-related sites have been processed. The structure of the database is discussed in detail in Chapter 2.

Problems arose over the definitions of some categories of sites and water-related features, such as:

1. *Site types* - for instance, how to categorize small towns, settlements and villas. Scholarship is generally not in agreement with the category of some sites, mainly because of definitional problems of those sites. I shall discuss some aspects of these problems in Chapter 2. For fortresses, forts and fortlets, there seems to be reasonable agreement. Large towns such as the four chartered towns of *coloniae* and two agreed *municipia* seem straightforward. Some *civitates* were larger than others, but these do not seem to present problems of category either. Since John Wachter's seminal book *The Towns of Roman Britain* appeared in 1974, there has been an intense debate on how to define settlements, towns, and particularly 'small towns'. In the papers from a 1992 conference on Romano-British small towns almost every author refers to the lack of acceptable definitions.¹ The authors analyse their development, morphology, function and the economic implications surrounding their activities in both the agricultural and non-agricultural fields, and what the social and religious implications were for the communities. Water supply does not seem to form part of the discussions of the development or morphology of the settlements. Burnham and Wachter, in the first five chapters of their book on 'small towns', discuss the above aspects of towns, but have little to report on water supply or wells. As an example, Neatham is shown to have had no less than eleven wells, but despite the fact that there were so many wells for the single community, there is negligible discussion on the water supply of the site (1990, 264-9, 272).

¹ Brown (ed.) 1995. It is striking how the nineteen authors of articles agree on the lack of a definition, but that they turn up with almost as many definitions as there are authors.

2. Data types:

2a. *Aqueducts*, for instance, were constructed in or with different materials and the archaeological record is not always clear what was the form of the aqueduct. Uncertainty often exists whether a stone channel was, in fact, the aqueduct or whether it only carried a wooden or some other pipe. Aqueducts usually originate from outside the most commonly excavated area of a site, providing obvious inequalities in the evidence.

2b. *Baths* varied tremendously in size, both at legionary forts, at forts, at towns, settlements and villas. The functions of small baths were different to those of public baths. Often the presence of baths is only inferred from token evidence.

2c. *Wells* were used for water supply, but also served as features for cult purposes. Sometimes they are referred to as shafts, and it is not always clear in what context, whether for water supply, ritual purposes, or for production of lime, or some other use. When wells have been excavated they have often been recorded primarily for the small finds found in them.

2d. *Drains* and *sewers* are often confused with each other.

2e. *Tanks* are sometimes only inferred from a base that has been identified.

These are problems which revealed themselves as the database was assembled. The definitions of categories of both sites and water-related features will be looked at in greater detail in Chapter 2, and where relevant, in the chapter for each site or feature type.

4. WATER SUPPLY

The different types of water-related features will be presented in a series of chapters: aqueducts and springs (Chapter 3), wells and rain water catchment (Chapter 4), baths, drains and sewers (Chapter 5).

4.1 Chronology.

Water supplies from antiquity came in a variety of forms. The earliest forms of water sources were likely to have been springs as there is a body of evidence relating to sacred springs. Later, people constructed wells, aqueducts, dams and the so-called dew-ponds. Man-made drainage and sewer systems are known from the classical period. In some settlements, and in towns, drainage and sewers formed part of a system to remove excess water from a continuously running water supply brought in by aqueducts and to remove human and animal waste products.

Man-made wells was also an early form of water supply, as for instance, in the book of Genesis² it is mentioned that Abraham dug wells (c. 3000 BC), or the religious wells from the Indus civilization³ about 2500 BC. Water was also piped by conduit from adits in the side of mountains for considerable distances from as early as the later Bronze Age.⁴ The palace-temples of the Bronze Age such as at Knossos, Phaistos and Mallia and the palace of Nestor, developed elaborate water supply and drainage distribution systems.⁵ At the Island of Samos, Herodotus informs us that a tunnel-aqueduct water supply was constructed through Mount Kastro during the reign of the tyrant Polycrates in the early part of the 6th century BC.⁶ In other instances tunnels were dug to allow water to be brought to a city by water carriers.

There are many remains of magnificent aqueducts built by the Greeks dating from the 7th to the 4th centuries BC (Crouch 1993, 43) and by the Romans (Winslow 1963, 171-6) dating from the 4th century BC through into the 4th century AD (Hodge 1992, 92). Many of these Greek and Roman remains have become national monuments in the modern countries where they are situated. Yet, modern scholarship gives scant discussion of water supply systems dating from the pre-Roman and Roman periods in Britain, probably because none of the Romano-British aqueducts incorporated large bridge structures as found elsewhere.

Water is a prime social need and the search for water supplies must have been of great importance to ancient communities, both during the prehistoric period and later. Food could be obtained from remote sources, but in antiquity water was obtained nearly always from local sources such as a nearby stream, a spring, or from a purposely sunk well (Clark 1944, 1; 1957, 152-8). There are several reported cases from the Bronze Age of spring-heads being specially adapted for ease of obtaining water and these would appear to have often developed as religious shrines. A possible Neolithic site was recently found at Abercynafon, Wales, by a local forest ranger.⁷

2 Genesis 21.15, 26.15, 21.18-21. Abraham had wells dug in the Negev desert and so did his son Isaac, who had reopened the wells which were destroyed by the Philistines.

3 Mackay 1935, 40-2, 55-8, 85.

4 Bromehead 1942, 183-96.

5 Mathioulakis 1966, 32.

6 Castleden 1994, 23.

7 Report prepared for the open day of the Clwyd Powys Archaeological Trust, in conjunction with other interested groups held during the summer of 1995. In a personal letter to me Dr. Caroline Earwood, the leader of the excavation team has indicated

Manley comments that prehistoric hillforts in Britain did not have a natural water supply, but that it was most likely that clay-lined ponds within the forts must have been used as cisterns to collect rainfall (1989, 121). Such a supply, he says, would have been supplemented by human or animal carriers with water transported from springs or rivers in pottery vessels or leather containers. Although this seems to be the most feasible explanation from studies of detailed excavation reports of hillforts, there are reports of wells and shafts from the pre-Roman period (see wells, chapter 4).

A number of hillforts around Britain have been identified as having Neolithic origins. Examples are at Crickley Hill (Dixon 1994), Gloucestershire (SO-32-927161 - on the Cotswold scarp), dating from the Neolithic to Bronze Age; Breiddin Hillfort (Musson 1991), Montgomeryshire (SJ-33-292114), with evidence of habitation from the Neolithic to Late Bronze Age, and Danebury (Cunliffe 1995, 91)⁸, Hampshire (SU-41-323376). Each of these sites had water supplies some distance away from the hillforts themselves and it seems certain that water was carried either from spring or pond or river sources. In the case of Breiddin Hillfort, the pond appeared to have become overgrown with flora over a long period and a cistern was constructed later during the Late Iron Age, probably between 300 and 200 BC (Musson 1991, 89). Some of these pre-Roman hillfort inhabitants migrated down to the valleys to work the land where water also was more abundant. By the time the Romans arrived there were already many established British settlements all over Britain.

At their third attempt in AD 43 the Romans obtained a foothold in South East England. There is a growing perception that far from seeing the invasion just as conquest, some of the southern tribes of Britain welcomed the invader for protection against aggressive neighbours. The Romans also introduced order and stability to the region, a local form of *Pax Romana*. They also introduced expertise in architecture and engineering construction of buildings, (especially baths), roads, bridges, aqueducts and wells. Among all the real or

that the findings will not be completed for a few years as they are having extensive dendrochronology tests done on wood recovered from the site. Letter to A Burgers from Dr Caroline Earwood, dated 5 February 1996. Another example is the Budsene spring on the Danish island of Moen which was enclosed in a hollow alder wood (Brøndsted 1958, 2.202). The figure shows the tree trunk which was inserted into the springhead, and also the relics which were deposited by worshippers of the spring goddess.

⁸ Dating from pottery indicators were from before the 4th century BC, but it is thought that habitation might have been from the Neolithic period, though the main activity dated to the 4th c BC and later.

supposed 'benefits' that the Romans brought to the Britons, the improvements in the provision of water must have ranked high. Yet water provision at Romano-British sites has not received the attention it warrants. Richmond (1968, 2.87) said that "in the literature it is one of the necessities of life so much taken for granted as to be little mentioned".

The native British must have been profoundly intrigued by the Roman baths which were constructed in the wake of the conquest. It would appear from recent literature that they came to accept bathing as a norm, because from about the mid 2nd century many British towns, settlements and villas seemed to have included bath complexes. The cult of the bath was probably one of the most significant non-political aspects of the so-called romanization of the Britons.

At some stage after the conquest the Britons were introduced to Roman features such as aqueducts for obtaining water for their towns and to bathing. Suddenly to be confronted with this foreign concept of having water virtually on-the-tap must have been something of a culture shock. The profound effect that the provision of running water for domestic use could have had on such prehistoric societies has been observed time and time again during modern colonization. Whether or not individual Britons had access themselves to such supplies, water supply was no doubt viewed as a symbol of Roman power. Both colonial powers, Britain and France, having occupied many African and Far Eastern countries for economic and political reasons during the late 19th and early 20th centuries, made attempts to improve the lot of the indigenous inhabitants of their new colonies. Provision of running water for these people was a prime facility that was introduced, often accompanied by celebrations on the part of the recipients.⁹ The same may well have applied to the indigenous British when they were provided with improved water supplies.

The Iron Age nucleated communities assimilated a new cultural awareness under Roman rule. New settlements developed as Roman style towns along main roads and military communication routes.¹⁰ The Romans built or encouraged the construction of houses, streets,

⁹ I was involved with a project through my firm working for a municipality in the Cape Province of South Africa, drilling for water in a remote rural area in order to provide drinking water to the African community. When the scheme was completed and communal water points laid on in the area, celebrations lasted for a week to thank the Inkosis for this wonderful gift.

¹⁰ Frances Condron provides an extensive bibliography in her PhD thesis, 1996, on the development of settlements and towns in Britain after the Roman invasion.

hospitals, granaries and roads. Drainage systems were also provided, sometimes in the form of elaborate sewers, as at legionary fortresses such as at York (Whitwell 1974, 4 and Fig.2.), Exeter (Bidwell 1980, 32 Fig.18) and Caerleon (Boon 1972, 25 and Fig.10) and at the Roman *colonia* at Lincoln (Wacher 1995, 138, and my Fig.3.9), and at Colchester. Impressive public buildings were erected - fora, temples, theatres - and abundant water provided - aqueducts, wells, baths and fountains.¹¹ Dams were also constructed in some locations.

The data collected in this thesis, although biased towards water-related structures, show that for four centuries from the conquest period onwards, the British landscape was transformed as fortresses, forts and chartered towns were built by the Romans, and the Britons transformed their settlements into towns and villas with these facilities, which improved the quality of life. For the Britons it was especially a stage of improvement from their own more primitive type wattle and daub huts. Although some of the earlier structures were built with timber, during the 2nd century most of those structures were replaced with stone-built buildings, both in forts, towns, other settlements and villas. The indigenous British had little or no prior experience of many of these facilities. It can only be guessed at how the Britons responded to these new living conditions and how improved availability of water supply impressed itself on the people.

The provision of water supplies was an important aspect of the new material culture for the Britons. The data shows that many towns, settlements and villas acquired water supplies to support large communities. However, based on the archaeological record, there are still many sites which do not show any remains of these facilities. Can one conjecture from the data available that all or most of the forts, towns, settlements and villas actually had these water-related structures, but that they simply have not been found, or that they have been destroyed during the passage of time? From the excavation reports of many sites I gain the impression that many more excavated sites than are indicated in my database, in fact, did have water-related features. Comparing descriptions of sites (stratigraphy, materials, smallfinds) where no water-related features have been explicitly recorded with sites where they have, it seems likely that many of the former group could also have had aqueducts, wells and baths.

11 Wacher 1995, 2nd ed., (1974); Burnham & Wacher 1990; Brown (ed), 1995; Smith 1987.

4.2 Roman Britain.

In Britain, aqueducts were often of the leat type, a specially designed ditch dug along contours of uneven ground from a source to the delivery point. Examples are the leats at Dorchester (Dorset), Great Chesters, Winchester and Wroxeter. At Lanchester three aqueducts of the stone channel type served the fort, constructed along contours of the land between the source and fort. Elsewhere wooden pipes were used. At Chester (Hanson 1970, 185) and at Lincoln (*Lindum*) (Thompson 1954) earthenware pipe-lines were constructed as the water supplies. At York the suggestion is that it may have been supplied with a lead pipe encased in concrete (Hanson 1970, 192). Both wells and shallow tanks also were important water supplies during Romano-British times and they were probably the most important forms of water supply for most communities.

I think that much of the evidence pertaining to the ancient water supplies in Britain has become lost through a combination of lack of interest, natural decay and the activities of industrial and property development during and after the industrial revolution. Circumstantial evidence seems to indicate that water supply in the form of wells and aqueducts were much more common than present excavation evidence would suggest for forts, towns, settlements and villas.

5. DISTRIBUTION OF WATER-RELATED FEATURES

In Chapter 2 I shall define the types of sites and structures as I intend to use them in the thesis. In Chapters 3, 4 and 5 the evidence of the database will be presented giving the information on which an assessment can be made of the features and their distributions. Then in Chapter 6 I shall look at the distributions of both sites and the features found at them. The issues that will be addressed will be:

- a) the geographical distribution of site types;
- b) the distribution of features at different site types;
- c) the distribution of types of features within a site;
- d) the assessment of the evidence of a-c;
- e) the problem of who paid for the amenities which were provided to forts and to other communities;
- f) the aspirations of private benefactors and those who sought public office within a community.

To assess the evidence given in Chapters 3, 4 and 5 the issues listed above will be considered as will the associations between the site

types, their distributions and the different categories of water-related structures. The tables and distribution figures show that there are patterns in the distribution of site types across the country with water-related structures, but that at some sites where there is an expectation of particular features, they are absent. The question is, why? In particular, why would a site have an aqueduct, and/or wells, but no bath? Conversely, why will a site have a bath complex but no water supply? In part at least this must be due to *lacunae* in our archaeological knowledge, but some of the gaps may be genuine incongruities. The remains of some water-related features in older excavation reports, are often susceptible to new interpretations, for example the Dorchester Roman aqueduct. There are other instances, such as the problem of the water supply for the fort at Housesteads. Many indications within the fort suggest that it must have had a running water supply. Why is there not even the smallest physical evidence to indicate that there was such an aqueduct? Similarly, the aqueducts at both Chester and Lincoln leave many unanswered questions about how they functioned. Similarly there are divergent interpretations as to the functions of certain deep wells/shafts: were they dug as water supplies or for ritual purposes, or did they function as one and reverted to the other at a later date? Why did some settlements or villas (usually not large communities) have an unusually large number of wells, such as the settlement at Stonea Grange with 13 wells, the villas at Stanwick with 12 and Thetford with 10? At the small town of Tiddington 14 wells are recorded and the fort at Derby had 6 wells. These numbers are not the norm for recorded water-related features when compared with most of the other sites. I shall discuss these questions, but answers to them are not obvious.

An important question to consider is, why are there these disparate distributions amongst similar site types?

6. SOCIAL CONTEXTS

6.1 The Romanization debate.

The so-called romanization of conquered peoples by the Romans is complex. It is my belief that there was some intention by them to influence the material culture of the conquered people. It may have been more successful in Italy itself or even parts of Gaul, but whether romanization of the British was as successful is debatable. I do not want to enter into a profound discussion of the romanization process, but will consider in Chapter 7 Burnham's comment on the

subject of water provision of water related features in this regard (1995, 121). The native British experienced many new things under Roman rule - new ways of construction, changes in domestic architecture, the provision of major buildings such as fora, basilicas, amphitheatres and running water supplies. The perception of the power motive could not have escaped the Britons, but did it romanize them? Even before towns or villas were built many Britons would have come into contact with the new way the Romans built their forts and with the amenities they provided for themselves. I shall examine this aspect in relation to water supply and baths.

6.2. Organization and administration of water supplies.

There is no extant literature from antiquity to inform or guide us on the topic of water supply administration, or of any of the other public structures, in Britain.¹² It would appear that during the early 2nd century and the 3rd century the people of Britain experienced prosperity and wealth, and tremendous expenditure took place on construction of buildings, housing, water supplies, baths and other amenities. Places like Dorchester, Leicester, Lincoln, London, Silchester, Wroxeter, York, and many other British towns grew in population, and with the wealth that accompanied this growth, these centres embarked on extravagant building projects such as temples, fora, public baths and amphitheatres, and water supplies. How successful was this extravagance? Were the tribal authorities able to sustain this progress? How long did it last? Did urban development costs exceed the available wealth? To what extent was provision of running water a contributing factor? I shall look at these problems (in chapter 7) as they affected the water related features in Roman Britain.

For an understanding of the Roman approach to the decision-making processes for the construction of new amenities or how they were subsequently constructed and administered, it is necessary to look at how the Romans set about creating their major towns and also the *civitates* for the local tribes (in Chapters 2 & 7). This process seemed to have had its beginnings already before the invasions of Julius Caesar, with increasing trade between Britain and Gaul (Liveridge 1973, 3)¹³. An important question is whether there was an

12 The best ancient evidence relates to Rome: Vitruvius and Frontinus. Also, translation by Evans H B, 1994: *Water Distribution in Ancient Rome, The Evidence of Frontinus*, 13-52

13 Julius Caesar invaded Britain during 55 and 54 BC in two separate expeditions. A number of scholars have written on the subject, such as Bruun (1981), Ward-Perkins (1970, 1-19), MacMullen (1974), Duncan-Jones (1974 and 1990), and others.

intention to control spending by the *civitates*? The complex problem of who paid for public spending will be discussed in Chapter 7.

6.3. Cost and maintenance issues. Case studies.

There is no indication in the ancient literature for the costs of structures in Roman Britain. However there are some statistics of costs of structures from elsewhere in the Empire and, through two case studies, an aqueduct leat and a well, I shall arrive at some order of cost for such structures. Such studies have certain limitations as we have to make many assumptions about conditions existing in Britain at the time, of which we have no actual evidence. We can use some labour costs that are known for services such as agriculture or the army, and the quoted or estimated costs of structures from antiquity.

The performance of service structures is always problematic and their efficiency is generally directly proportional to their regular maintenance. This applies now as it must have done in antiquity. Funding for maintenance purposes in antiquity is difficult to assess, but that the need was there and provision made cannot be disputed. Pliny the Younger, in his letters to Trajan, several times draws the Emperor's attention to the need for the maintenance and repairs of structures that had deteriorated during service, or had gone wrong during construction, or after a period of negligence, and that additional funding would be required.¹⁴ From the archaeological evidence some assessment can be made of what maintenance was likely to have been carried out and will be discussed in Chapter 7.

6.4 Religious aspects.

Water in antiquity had far wider implications than its use for drinking, bathing and other domestic or industrial uses. Religious ritual also played an important part in the interaction with water supply, especially at spring sources. In Celtic religion the importance of water is indicated by the representation of river gods such as the Tyne river god found at Chesters and a sculpture of the Tamesis river god discovered at the *mithraeum* of London (Jones and

14 Gaius Plinius Caecilius Secundus, Pliny the Younger, AD 72?-113?: *Pliny, Letters and Panegyricus*, in two volumes, tr. by Betty Radice, Loeb Classical Library, 1972, (1969), letters 37, 38, 39, 40,41, 42, 61,62, 90,91, 98 & 99. All these letters refer to some technical problem related to water or construction and the finances for the projects. It would appear in the case of the province of Bithynia Trajan had given Pliny the authority to allocate funds for spending on construction projects without reference to a higher authority.

Mattingly 1990, 264). An important Celtic water-related goddess of the sacred well found at Carrawburgh, is that of the nymph *Coventina*, also found elsewhere in Britain (Allason-Jones & McKay 1985), another indication of the importance of water in the Celtic religion. There were a number of spring sources in Britain which were modified to include a well and were ornamented with temples and altars. Often these religious spring sites had a Celtic background, but, true to the Roman ethos, they romanized a number of these.

Springs, rivers and wells were associated with Celtic religious functions and became focal points for their cult practice and ritual long before the coming of Rome. The pre-Roman Celtic Britons appear to have adopted the concept of the sacred well similar to their Gallic counterparts. Together with its religious function, the well also would have served the purpose of providing the community with water and some of the early wells were probably dug by these early Britons.

Rivers were important because they were associated in Celtic tradition with fertility and with deities such as the divine mothers and sacred bulls. The Celtic mother-goddesses, who frequently also functioned in the role of war-goddesses and prognostication (foretelling the future), have wide association with water (Ross 1967, 20). There was a connection with fertility which could be likened to the life-giving powers of water and this was exemplified in the naming of rivers after goddesses. In Gaul there are several rivers so named, as for example the river Marne, which derived its name from 'Matrona', or 'Divine Mother', probably because at one time there was a cult legend associating the mother with the river (Ross 1967, 20). Ross reports that "in 1963, some 140 carvings of a cult nature in wood were recovered from the marshes at the source of the river Seine... This find adds weight both to the importance to the Celts of sanctuaries associated with the sources of rivers and to the association of the human head with sacred springs" (1967, n.2, p.21). Ross reports other cult object finds found in rivers and at springs. Some finds in rivers are images of deities which probably were related to the cult practices, but others are often ordinary items like swords and Celtic metal artifacts. Although Jane Webster indicates that one has to be careful in the interpretation of evidence of early finds used for cult practices (1996, 1, 5), there seems to be no reason wholly to abandon the conventional view of the religious associations of water in Celtic society.

In Britain a similar pattern is found in the naming of rivers after goddesses (Rivet and Smith 1979, 22-47, such as the river Dee, the "holy one", or Celtic *Deva* "the goddess" (22), the river Clyde after the Celtic *Clota* name the "washer, the strongly flowing one" (45), the Severn (*Sabrina*) (457), and both the Braint from Anglesey and the Brent of Middlesex from "*Brigantia*" a river goddess (278-9). The archaeological evidence for temples at sources of rivers in Britain is lacking, but Ross says that "the siting of the Lydney temple makes it clear that the wide estuary of the Severn (*Sabrina*) was of first importance, while the actual cult objects recovered from the temple to the god Nodons strengthens the connection between the cult and the water itself" (Ross 1967, 22). There are other shrines associated with aquatic cults in the region of the Severn estuary and adjacent areas (p.22).

There is other direct evidence for the cult of wells, pools and lakes in the British isles. From Europe the two prime examples for the veneration of lakes come from the La Tène phase of Celtic culture found in Lake Neuchâtel. Strabo, quoting Posidonius, reported "that the treasure found at Toulouse...and part in the sacred lakes...", seems to indicate that there was a practice of using the lake at Toulouse as a cult centre. (Strabo IV,I,13: Tierney, 262). Fox (1946) reports that Celtic metalwork was found in the small lake Llyn Cerrig Bach, in Anglesey, and that the manner in which it was deposited strongly suggests a ritual deposit (Ross 1967, 24). Fox (1958) also reports discovery of "the finest pieces of La Tène art in rivers, such as the Witham in Lincolnshire and the Thames...and the most likely reason for their presence here is...of the placing of precious objects in water for religious purposes" (Ross 1967, 24). On the evidence quoted above it seems clear that early religious practices were important in pre-Roman times, but in view of the comments by Webster it would seem that a new assessment of the original interpretations is necessary.

It would seem that the Celtic religion was highly developed amongst Britons at the time of the Roman conquest. The Romans, in the tradition of romanization, also influenced the Celtic religion, often naming the gods and goddesses of the Celts after their own.

7. CONCLUSION

In the chapters that are to follow I shall look closer at the aspects that have been presented above. I outline the methodology of collecting and collating the material. I shall discuss some problems, issues and questions that have emerged from my study of the archaeological data. A simplified presentation of the database material will be given. The main gazetteer database is incorporated in summary form in Appendix 2. An attempt will be made to establish patterns of water facilities and how much can be gleaned from the analysis of this data. The extent to which the provision of water facilities contributed to the romanization of the British and the success of that provision will be discussed. Finally, there will be a concluding section reviewing the analysis that has been presented with some comments on possible future research.

CHAPTER 2.

METHODOLOGY, DATABASE, ROMAN HYDRAULIC ENGINEERING IN ANCIENT TEXTS

1. GENERAL

After trying several databases, Microsoft ACCESS version 2.0 was adopted for creating a database and the other type tables to record the information on water-related structures from the archaeological record of Roman Britain.

2. PURPOSE OF THE DATABASE

There is no comprehensive gazetteer summarizing the available material on water-related structures for Roman Britain for easy reference.¹ For this reason I have produced a gazetteer database of information on water-related features at Romano-British sites.

The information used in the database covers archaeological remains reported in many sources and includes sites reported up to the end of 1995. An attempt has been made to cover most of the available reports on Roman water type structures, but inevitably some publications might have been overlooked. A primary motive for the research presented here has been the need to bring together information spread out in many publications. Also important in the study is the inter-relationship of the various features, and their significance in the romanization process, and in their social and religious contexts. The data can never be complete as new excavated sites are continually reported in the literature and a vast number of sites remains unpublished.

3. DATA COLLECTION

The most important previous work on water supply and drainage in Roman Britain is the unpublished thesis² of Julie Hanson, which summarizes data available up to 1970. She discussed in detail aspects of aqueduct types, the types of channel and piping used and some details about the sites. Her primary purpose was to look at the known

1 At the present time there is no comprehensive summary for the water supplies of the empire or even for the various provinces, though one may note the work of Gsell (1902) and Birebent (1962), both for Algeria in North Africa. Research is currently in progress to summarize information on water supplies for the Mediterranean area. The Germans have done some work in collation of water supplies through the Frontinus-Gesellschaft in three volumes *Die Wasserversorgung antiker Städte* edited by Garbrecht et al, 1986, 1987, 1988. For this reason I have produced a gazetteer type database of information on water supply features at Romano-British sites.

2 Hanson 1970, PhD Thesis, submitted to the University of London, Faculty of Arts.

aqueduct water supplies for military and town sites, and inevitably there are some omissions in her work and in the light of recent investigations and new excavations, her discussion of many sites requires updating. Not all the sites she discussed had remains of aqueducts, but because of other circumstantial evidence she conjectured that such sites may have had an aqueduct-type water supply.

Stephens discussed sites with civic and military aqueducts in his two 1985 papers,³ but he did not go into the sort of detail that Hanson covered. Both authors in a few instances make comments on technical detail that require some re-interpretation, which I shall attempt to do in the sections of this thesis where it is appropriate.

The features discussed by Hanson and Stephens are summarized in Tables 2.1a and 2.1b as follows:

Table 2.1a: Water supply features cited by Hanson⁴

Total record entries:	76
Number of sites entered twice*:	-9
One site entered 3 times**:	-2
Actual number of sites:	65

* different periods, or once for fort and once for town.

** Corbridge i) Flavian, ii) Severan, iii) 4th century

Distribution of water supply features:

	AQ	BA ⁺	WP ⁺⁺	SP	TA
Military: (certain/conjectured)	29/13	13/-	22/2	6/1	8/-
Towns (+1 villa):	12/6	7/-	13/-	6/2	1/-
Total:	41/19	20/-	35/2	12/3	9/-

AQ = aqueduct; BA = baths; WP = waterpipe; SP = spring; TA = tank.

* 5 baths were reported as being external to the forts.

** 7 of the pipes shown by collar remains within forts were conjectured to indicate that forts had aqueducts.

Table 2.1b: Aqueduct features cited by Stephens⁵

Military:	55
Civil:	31
Total:	86

3 Stephens 1985a, 197-207; 1985b, 216-36.

4 Hanson 1970, 358-74.

5 Stephens 1985a, 197-207; 1985b, 216-36.

For comparison, I have recorded a total of 135 sites with aqueducts (see Chapter 6, Table 6.1). Neither of these two authors dealt with the wider range of archaeological sites with water-related features that have been reported on during the past 200 years.

I have collated information on water-related structures for 7 types of sites. Military sites are divided into fortresses, forts and fortlets. This evidence includes aqueducts (with a variety of conduit types), Roman baths, wells, and cisterns or tanks. The presence of baths would generally indicate the probable existence of a reasonably effective water supply, either of wells or aqueducts or a water source such as a spring or clean stream close to the site. Smaller baths, such as found in or near forts and in settlements and villas could have been provided with water from wells, or some other source, by soldiers or slaves carrying water to the baths. Baths are generally reported in detail in structural terms, but for some reason their water supply has not often been investigated or commented on.

In the next section, the typology of water-related features and the typology of sites are defined for the purpose of this thesis.

4. DATABASE RECORDING

The procedure used for compiling the database was to record information obtained from the libraries for each site on index cards with as many bibliographic references as possible, and then to transfer it to a computer database.

The types of sites are given in the records of the 'site type' field⁶. The database consists of fourteen fields as follows:

Field one: site name

Field two: site type

Field three: Roman name (where known)

Field four: eastings, and

Field five: northings, in International Grid format

Field six: location, in National Grid format

Fields seven to fourteen give the following eight data types:
aqueduct, bath, well, drain, pipe, spring, tank and sewer.

⁶ The database table was originally headed by fifteen fields of which the last eight represents the actual typological features data. The 7th field was the 'Reference' memo field, but the large size of each memo record made it impractical to handle within a database, and was transferred as a table to Appendix 2.

The initial two fields provide the site name and category of site (for simplicity I defined nine types: fortress, fort, fortlet, *colonia*, *municipium*, *civitas* capital, small town, settlement and villa). Field three gives a Roman name for the site name where it is known. The fourth and fifth fields give the location of each site in the International Grid format in terms of the 'easting' and 'northing' coordinates based on 100km (100,000m) grids. The sixth field provides the location for each recorded site using the Ordnance Survey National Grid system for Britain, with the two-letter notation for each 100 square kilometre grid area. Fields seven to fourteen give the water-related features of the database which represent the archaeological remains discussed in the text. Query tables have also been produced based on the database table which gives the location of sites in the International Grid format based on eastings and northings for 100km square grids. Plots have been produced showing locations of sites for specific water-related feature types based on the International Grid pattern. The database is presented in this thesis as a series of specialized tables because the format is too wide for all the fields to be given together in a single table. These are divided into three basic divisions:

- a) a single table (Appendix 1) gives all the data for the eight types of water-related features;
- b) the reference memo field is now given as a separate table with each record headed by the site name (Appendix 2);
- c) site names and types with their locations and the category of feature under discussion, (Appendix 3);

One of the problems with the typological data was to decide what to include without making it completely unwieldy. Originally it was my intention to include the dates of the various structures in the fields for each type of structure, but as the dates of so few of the structures are known it was decided not to include it at this point. Inclusion of a date field adjacent to each structural type would have doubled the number of fields and would have made printing of meaningful tables a difficult task. Date information is usually given in the references of Appendix 2. The typology of water-related features does not include agricultural drainage features and Fen-type drainage.⁷

⁷ Areas such as Wentlooge Level (Gwent) show Roman expertise in this type of hydraulic engineering. On Wentlooge Level, the Romans used many drains to lower the water table in order to reclaim land which was affected not only by surface flooding, but also by erosive attack from usually violent sea waves. At Romney Great Wharf alone more than

All reference material will be in Harvard format and details will be given in the bibliography. I have added pertinent notes about some of the water-related features for information and to clarify aspects about them. Also, the three references *CSIR* and *TIBRS* and *TIRCGLL*⁸ always are given at the end of a reference record where they apply. It is also to be noted that many of the references in the database and the bibliography are dated in the last and previous centuries. These authors give descriptions of structures which they have actually seen or had first hand knowledge of and many of which may have disappeared since. For many water-related features the older references are the only ones that I could trace. However, early archaeological reports often did not give sufficient details for the precise location of sites or for features such as wells or aqueducts at particular sites. Nevertheless the reports can provide visual testimony of the existence of specific structures at sites where the evidence is now lost.

The database provides a reasonably extensive sample of water-related structures for the Romano-British period (Appendix 1). Many references are included in the table of Appendix 2, and I have endeavoured to make these as complete as possible. Where the literature mentions that, for example, wells were found at a site, they are indicated in the field as W1+. Where the specific number is given it would be indicated.

The inclusion of structures such as baths or piping or drains is assumed to indicate the presence of some form of water supply by implication. Large public baths would most likely have required some form of constant running water supply such as an aqueduct. Baths in some forts, villas or homes may have been small enough for them to have been filled by water carriers. Many of the sites listed in the database show only a bath or a drain or piping, without also showing a water supply. It is to be inferred that such sites had some form of a water supply source. A number of these may have had running water supplies of which the structures are now no longer visible, or they

forty drainage ditches have been found and also protective dikes to protect the land from the sea. *Britannia* 17, 1986, 91-117; 19, 1988, 191-2; 25, 1994, 175-211.

8 *CSIR: Corpus Signorum Imperii: Great Britain* (Oxford).

TIBRS: Tabula Imperii Romani: Britannia Septentrionalis.

TIRCGL: Tabula Imperii Romani: Condate-Glevum-Londinium-Lutetia.

may have been filled from water in a tank or cistern, or water carried from a well or spring.

Many sites mentioned in the literature have yielded items such as hypocaust tiles, which could have originated from the hypocaust of a bath, but since rooms other than baths were also heated, it cannot be assumed every such tile would indicate the presence of a bath. Although some such isolated tiles could have been part of a bath complex, I have not included such sites in the database unless some additional information indicates that it is warranted to assume that the site had a bath.

It is also likely that many Roman settlements and towns had wells which have not been found or recorded during archaeological investigations. This could equally apply to other water-related structures. Many archaeological excavations, especially of the last 30 years of rescue archaeology, remain unpublished and this necessarily affects the completeness of the data set available for my thesis. Where available, the more recent excavation reports, such as at Colchester (Crummy 1984 Report 3 and 1992 Report 6) and Caerleon (Zienkiewicz, et al, 1986), are more thorough in their descriptions of features such as water supplies.

The database of archaeological sites used in this thesis is thus by no means a complete gazetteer, representing a sample of excavated Roman period sites which has provided evidence of water-related structures. The reason for this limitation is that there is a dearth of information about such structures at many other Romano-British sites. For instance, study of the Nene valley, south-eastern England, or the Cotswolds area, areas where there were numerous Roman period settlements, reveals many details of water supply for some sites, but there are many more which have shown none. This seems to apply throughout Britain. The 'missing' information was either not recorded during excavations, because they had been completely destroyed beforehand or the excavators were not particularly looking for that category of structure, or of course, the site might genuinely not have had water-related structures. One is led to the tentative conclusion that the fairly extensive sample of sites in the database could be a reasonable indicator that many, if not most, of the remaining sites must have had access to water supplies that were quantitatively or qualitatively different from the traditional supplies used at the pre-Roman British settlements.

What are the chances that the sites that had no record of having had water structures, did in fact have them? I am conscious of my lack of archaeological experience and of the problems involved during excavation of sites. However I find myself asking whether archaeologists have paid enough attention to those factors that allow a community to thrive. There were so many factors which influenced the location of settlements, whether it was to establish a fort, a town or a villa. One constant factor must have been: could they subsist at those sites, and for this the two prime requirements were food and water. Defence was also important, but under Roman rule defence was of less significance to the 'new' Briton and for them their livelihoods and commercial prosperity became the motivating forces.

Since water was vital to existence it can be assumed that they gave it some priority in their planning. Scanning some of the standard works on Roman Britain it is difficult to find the word 'water' mentioned and even more so 'water supply'. This seems to indicate some reluctance concerning this important social requirement and one which would surely have demanded early attention when establishing a household or a community. When reports do mention a well, for instance, it might be merely to describe the small finds found in it, with less concern about identifying the length of time the well may have been in use. That the well in itself was of importance to that site in its own right is usually ignored. This, it can be argued, may account for the fact that many sites have been reported on and no water-related structures recorded. It may also be because interest in water or the technical aspects of what made a site viable as a place to live at was outside the ken or interest of the investigating archaeologist. It is possible that little attention has been given to the details of the remains of aqueducts or wells in Britain precisely because of the relative abundance of water in this country, leading scholars to underestimate the significance of water supply. An abundance of water in nature is not the same as a sufficiency on site.

5. TYPOLOGY OF WATER-RELATED FEATURES

The database presents information on 807 archaeological sites and data records of eight water-related features: aqueducts, baths, wells, drains, pipes, tanks, springs and sewers. A brief definition is given of each feature as it will be used in this thesis.

1. **An aqueduct** is any type of conduit which conveys water from a source to a distribution tank (*castellum divisorium*).
2. **Baths**, a place for bathing. From the 1st century BC they were generally heated by a hypocaust system which warmed the floors from underneath and walls built with flue pipes to heat the rooms, and almost invariably had a hot room (*caldarium*), a tepid room (*trepidarium*) and a cold room with plunge baths (*frigidarium*).
3. **Wells** were shafts sunk into a water-bearing layer (aquifer) of permeable rock, gravel or sand, or to below the top of the water table where ground is permanently saturated.
4. **Drains** consisted of ditches, stone- and wood-lined channels, and occasionally pipes, to convey rainwater, water from baths, waste material from kitchens and latrines, and stormwater along streets, away from the buildings on a site.
5. **Pipes** were made of wood, lead, ceramic materials and stone.
6. **Tanks** were receptacles in which water was stored, usually constructed with stone and lined with mortar. It is likely that there were also many wooden tanks, but these are less visible archaeologically.
7. **Springs** were sources of water which issued from the ground fed by an aquifer in the form of a perched water table, usually along the slopes of hills or mountains.
8. **Sewers** were stone-built structures, generally arched and usually underground, which were conduits into which drains discharged waste materials from kitchens, latrines, baths, and also rain water from stormwater drains.

Each one of these features had particular characteristics, which were often dependent on where they were situated on a site, and also on the materials from which they were manufactured. A brief discussion of each feature will be given below.

5.1 Aqueducts

These consisted of the following types:

- 1a. *Leats*: open ditches cut into soil or rock.
- 1b. *Stone channels*: usually lined with clay or lime-based mortar to render them impermeable to seepage; on more elaborate aqueducts the channel (*specus*) is usually an arched structure tall enough for cleaning purposes, popular in the rest of the Empire; sometimes they are covered with ashlar slabs. Another issue concerns whether a stone channel was open, as at Lanchester, or covered.
- 1c. *Wooden pipes*: usually bound, with iron rings at joints. Wooden pipes varied in length from about 1m to 3.5m, with bores of about 50mm to 90mm diameter. The outside of one end was tapered so that it could fit into an enlarged opening at the thick end of an adjacent pipe, which was bound with an iron collar. These iron collars are often the only remains which indicates the line of such wooden pipes. Roger Wilson discusses the wide use of wooden pipes as aqueducts, and in particular refers to them also being used in inverted siphons (1996, 22).
- 1d. *Lead pipes*: were either round, triangular, oval or pear shaped (see Chapter 3, Fig.3.2); they were mostly used in an aqueduct system where inverted siphons were necessary, or in intra-site distribution systems.
- 1e. *Ceramic pipes*: were made from terracotta (earthenware) and were either cased in concrete, or uncased. They were hollow, conically-shaped, with a small diameter end which could fit into the large end of the adjacent pipe. The sizes varied considerably, depending on the expected amount of water to be delivered. At Lincoln the diameter of the large end of the earthenware pipe was about 140mm reducing to about 90mm at the smaller end. Ceramic distribution pipes found at Wroxeter were about 70mm at the large end and 35-40mm at the small end. Pipe lengths varied from about a half metre (as at Chester), to one metre (as at Lincoln). Joints were sealed with a specially prepared lime mortar.
- 1f. *Stone pipes*: made from bored-out stone were used in several places in the eastern part of the Empire, but are rarely attested in Britain.

In the database I have used the classification aqueduct and the symbol AQ to indicate it at a site, and where possible have indicated in the field column what the aqueduct feature consisted of, but this was not always possible. Aqueducts are more fully discussed in

Chapter 3 and a case-study of the Dorchester aqueduct is analyzed in Chapter 7.

5.2 Roman baths

Baths developed a standard pattern consisting of the hypocaust system for heating, which provided graded temperatures to generally two heated rooms (1b above) and the larger baths also included a dry-heat sweating room (*sudatorium*). Within each one of the first two hot rooms there were pools fed with hot water from tanks associated with the heating system (Nielsen 1990, 14-8). There were also many other rooms used for dressing, scraping, massaging and other activities in the larger bath complexes. The public baths of towns usually had a basilica attached to them, where exercise activities were available, and where food and other commercial products could be obtained, which at the same time provided a social community centre associated with the baths. There were also private baths which were run as commercial enterprises, particularly in places like Rome, Pompeii and Ostia (Nielsen 1990, 122-7). It is not known if there were any commercially run private baths in Britain. Baths varied tremendously in size across Britain and the large ones usually were architecturally very elaborate structures. At fortresses, baths were usually large as they would have been used by large numbers of soldiers (Zienkiewicz 1986). A number of towns also had large baths such as Leicester and Wroxeter. The smaller baths in settlements and villas often consisted of two or three rooms only, as at the villa of Cosgrove (App.2), with three rooms for a *caldarium*, a *tepidarium* and a *frigidarium* with a small plunge bath attached (Quinnell 1991, 8-11). In Chapter 6 I shall discuss the status of some settlements with baths. Some other villas had quite elaborate baths such as at Northleigh and Rockbourne (App.2). I have not given a classification of Roman baths (designated as BA) in the database table, but in the text (Chapter 5) have discussed their classification and where appropriate, referred to their sizes and other attributes. Baths have been comprehensively treated in the literature, mostly baths outside Britain.⁹

5.3 Wells

These were an important source of water for all site types. They were dug into both soil and soft fractured rock, and, where necessary, were lined to prevent internal collapse of the walls. Water-bearing rock, usually limestone and sandstone formations, is widely spread

⁹ Manderscheid 1981, 1983, 1988; Nielsen 1990; Yegül 1992.

over Britain. Wells varied in diameter from about 1m to 2.5m, and also were made in square format, particularly when they were steined (lined) with wooden planks. Some wells were steined with used barrels, and also with masonry or brick. Wells could be as shallow as 2m when they were sunk in gravel or sand layers close to the surface (as at London and Silchester) (App.2), and others could be as deep as 30m and more. Some wells were also used for cult purposes and in the literature there sometimes is confusion between shafts used only for religious purposes and wells used primarily as a source of water. Clarke (1996) discusses the overlap between these two functions, with particular reference to Newstead.

Wells generally have not been studied as a special construction feature except in a few cases, such as the Wilsford shaft (30m) (App.2) and the wells/shafts at Rushmore (40m and 51m) (App.2) and the details of some selected wells relating to their lining as a means of protection against collapse, as at London, Lancaster and Scole (App.2). Mostly they have been discussed in the archaeological record for the contents of their finds, or their importance to cult practices. I shall look at selected aspects of wells such as their construction features including lining (Chapter 4) and their social and religious significance (Chapter 7). Wells are not sub-classified in the database.

5.4 Drains

Drains varied tremendously typologically, having been constructed as open soil type ditches, pipes of various kinds and channels in stone, some open and others covered.¹⁰ Many excavation reports show drains of several kinds for some town sites. At forts they generally seem to be timber or stone-lined. It would appear that drains were often allowed to deteriorate, or were blocked up as new development took place at sites. Baths usually had an elaborate drainage system such as at the baths of Leicester (Chapter 3, 94), (App.2). Many towns had systems of drainage from private homes which discharged into larger drains or directly into sewers such as at Lincoln or York (App.2). They have not been classified in the database (shown as DR).

5.5 Pipes

These were used in aqueduct systems, water distribution systems within urban areas and occasionally in drainage systems. Wooden pipes

¹⁰ In the literature drains are sometimes referred to as culverts, a term in modern terminology implying a drain passing underneath a structure.

were used more often than either lead or earthenware pipes, whether as aqueducts (as at Cirencester, Caistor-by-Norwich, Carpow and Fendoch), or in distribution systems (found at Caerwent, Colchester, Gloucester, London, Silchester, Verulamium and Wroxeter) (Hanson 1970, 419). Wood was cheaper and more accessible than either lead or materials for ceramic pipes, and they were easily repaired. Where inverted siphons were necessary either lead or earthenware pipes were used and they were usually encased in concrete when used for that purpose, though wooden pipes are recorded as having been used as inverted siphons (see Chapter 3, section 3.4), as at Caerwent (Hanson 1970, 85) and as recently found at Gosbecks near Colchester (Wilson 1996, 22). This is an unusual use of wooden pipes, probably working only under quite low pressures, and as repairs to wooden pipes at Caerwent shows, they were prone to burst under pressure (Hanson 1970, 85). There seem to have been no standard wooden pipe diameters or lengths, these depending probably on the boring equipment and lengths of trees available to a pipemaker. Iron collars used at the joints of wooden pipes were found at many sites but surprisingly were not used much at military sites as at Birrens, Brough-on-Humber, Fendoch, Pen Llystyn and South Shields, although they were used at the legionary fortresses of Caerleon and Carpow (Hanson 1970, 421). Pipes are indicated in the database as WP.

Lead pipes were mainly used in distribution systems in Roman Britain. A lead pipe inverted siphon was used in a portion of the earthenware aqueduct at Chester (Stephens 1986, 60) (App.2). Lead was also used in pipelines as at Caerleon, Corbridge (an 18.5m length was recovered), Inchtuthil and York (App.2). Hanson suggests that lead may have been used more readily at military sites because the cost of expensive lead was paid for by the State, whereas towns had to finance their use of materials from their own funds, so would therefore have used the cheaper wooden pipes rather than lead or earthenware pipes (Hanson 1970, 419).

The use of earthenware pipes as aqueducts in Roman Britain is recorded only for Chester and Lincoln, whereas they were used widely in distribution systems at many sites. When they were used as a rising main in an aqueduct as at Lincoln, they had to be encased in concrete in order to withstand the water pressure. Their diameters varied over their lengths for different sites from about 30-50mm (Wroxeter) to 90-140mm (Lincoln) (Hanson, 1970, 423-4) and 130-170mm (Chester), (Stephens 1986, 60), and their lengths from about 0.3m to

0.7m. The military supply depot at Holt was a probable supplier of earthenware pipes to Chester fortress and probably also to the *colonia* at Lincoln (Hanson 1970, 423). Pipes have been classified in certain instances in the database.

5.6 Tanks

Tanks were widely used in all categories of sites to store water. Many excavation reports have recorded tanks, some of which were filled with rainwater run off from roofs and others were placed where it was most convenient to fill them, or at places from which water could be conveniently drawn from them. They varied in size depending on whether they stored water from an aqueduct supply such as the tank at the north wall of the *colonia* at Lincoln, or were a source inside a building for internal use. An elevated tank is postulated for the bath at Leicester (Wacher 1995, 350, Fig.10) but there is uncertainty as to how it was filled. Similarly, an elevated tank is proposed for the hypothesized inverted siphon of the aqueduct at Lincoln (Thompson 1954, 117). Usually tanks were at floor level in buildings and of modest size (capacity about 1.5m³ to 3m³). In private homes they usually were below floor level in a convenient place where they can receive water from rooftops. Tanks are not classified, even in the existing literature, because so little of the upper part of tanks has survived.

5.7 Springs

These were the preferred source of water for aqueducts, though sometimes aqueducts tapped the headwaters of streams. It must have been a constant worry whether a spring would supply sufficient water all year round. At Winchester it is reported that several springs were tapped at Itchen Stoke. A puzzling situation existed at Caerleon where there was a spring within the fort which seemed not to have been utilized as a water supply, but that a 'culvert' was used to remove the water from the site (Hanson 1970, 179). Although there were springs along the route of the aqueducts for the Lanchester fort, the northern aqueduct was extended further west, where two dams were built across a stream to provide the source of water. Springs are not classified (shown as SP).

5.8 Sewers

Sewers are some of the best preserved structures from the Roman period, primarily because they were always constructed below ground level. As new construction took place over demolished buildings they

became covered to greater depths. The remains of twenty sewers have been recorded in the database, of which half are from military sites. Sewers were used in Roman times for the removal of foul waste, stormwater or excess water from a running water supply. They were usually wide and high slab-covered structures such as at Lincoln (Wacher 1993, 46, 138) and arched structures such as at York (Whitwell 1976, 1-55), to be discussed in Chapter 5. They are not classified in the database (shown as SE).

The table of Appendix 1 gives all the data for the 807 sites showing the distribution of the water-related features, and shows the incompleteness of the information about the type of structures that one would expect to find at sites. For instance at a site that has a bath one would expect to have some form of water supply. If the bath is large the expectation would be that it was serviced by a running water supply, such as at Caerleon or Wroxeter. However it often happens that a town may have a public bath, but no water supply of any kind has as yet been found, as at High Wycombe. I shall be discussing this anomalous aspect in greater detail in Chapter 6.

6. TYPOLOGY OF SITES

The term 'site' in modern archaeology, it is suggested, must be avoided because it is considered an "artificial concept invented in the present with no meaning in the past" (Greene 1995, 53). However, Greene suggests that archaeologists should continue to use the term as a "descriptive label for a place where... artifacts and/or features occurs" (ibid. 53).¹¹ It may be a problem to refer to a region, or the route of an aqueduct as a site, but usually such features are not referred to as sites. Aqueducts are referred to by the site name of the town or other site they serve. A 'site' in this thesis is taken to be a place where people lived, such as a fort, a town, a settlement or a villa.

The nine site types used in the database are given on p.19 and below follows a brief statement about each type.

¹¹ There is no doubt some logic behind the reasoning why the term 'site' as a notion should not be used, but if qualified with a name that gives the location of a supposed site it provides a practical means of referring to a locality. The word site comes under the category of generic words like 'love', 'war' or 'object', each of which have been analyzed etymologically and philosophically, without specific acceptable definitions. Yet they are read, in spite of Duneell's statement that "site, as an archaeological concept, has no role to play in the discipline...In spite of the technical problems its abandonment will cause, the concept of archaeological sites should be discarded" (1992, 36-7, quoted at Greene 1995, 53).

6.1. Forts.

In the database tables I have used three categories of forts namely fortresses (legionary), forts (auxiliary/cavalry), and fortlets. These categories are based on the functions they served. All three types varied considerably in size, even within each category. Their function and size were determined by the number of soldiers that each housed during its active existence. I have not included military camps as a category, because they did not have permanent status, and did not generally have permanent water supply features, water most likely being obtained from springs or clear small rivers.¹²

1. *Fortresses* were of two kinds: legionary (c. 20-25ha) and vexillation (c. 6-12ha). The legionary forces were the protectors of the frontiers of the Empire and their fortresses had to house as many as 5,000 to 6,000 military personnel. The legions were composed of Roman citizen soldiers; vexillation fortresses may have housed mixed brigades of legionary and auxiliary troops. Wilson lists ten legionary fortresses and twelve vexillation fortresses (1980, 92-3), but the military disposition of fortresses and forts was very fluid through the conquest period (c.AD 43-68), the Flavian (AD 70-96), the Trajanic-Hadrianic (AD 97-138) and the Antonine periods (c.AD 142-63). Often both fortresses and forts were deployed during these periods to serve particular military needs, so that they may not all have been occupied at the same time. Jones and Mattingly (1990, 88-101) show in a series of maps (Map 4.23, 4.24, 4.31, 4.32) the complicated changes of disposition of military sites over that period of about 120 years, indicating that it can be misleading to mention all the known military sites for the period from AD 43 to AD 168. In the database I have listed nine legionary and four vexillation fortresses with water-related structures, without taking into account their period of deployment. In Table 6.2 where I have given the summarized information for all site and feature types, I have classed all military sites together as forts, for the purpose of analysis.

2. *Forts* are continually being added to the list of known remains as new ones are discovered. The areas of auxiliary forts were generally about 1 to 5ha in extent, depending on many factors, and they were usually manned by auxiliary infantry and cavalry units, consisting of between 500 to 1000 soldiers. Towards the later first century unit

¹² However, some anomalous, semi-permanent structures were erected during the construction of major sites, as with the officer's compound at Inchtuthil. (Pitts and St Joseph 1985, 215).

numbers at some forts were increased to about double the former unit size (Breeze 1983, 15). Their duties were in general to keep lines of communication open and preserve the peace in conquered territory. During the 3rd century the north of Britain was relatively peaceful (Welsby 1982, 8), but in the south-east of Britain there were indications of trouble from the European continent and this resulted in the construction of the so-called forts of the Saxon Shore (Johnson 1979). These forts differed in some respects from the type of forts described above, but I have not listed them separately. They have been listed as ordinary auxiliary/cavalry forts. Holt is listed as a fort, but was actually a supply base to other forts of special products such as pottery tiles and ceramic pipes.

3. *Fortlets* were usually small forts (generally less than 0.5ha) and manned with a detachment of about a centuria. They were often used as outposts for the purpose of protecting an installation such as a bridge, river crossing, or a road (Breeze 1983, 43). Milecastles I have referred to as fortlets. In the database 10 fortlets are listed which had water-related features.

Many of these military installations were not permanent, and some could be abandoned for a period and, when military circumstances required it, be re-established at a later date.

6.2. *Coloniae, municipia and civitas capitals.*

Coloniae, municipia and *civitas* capitals seem reasonably well defined as large urban centres or major towns, each serving specific functions within the province. The three initial *coloniae* were built for the specific purpose of housing large populations of discharged soldiers, as at Colchester, Gloucester and Lincoln. York, on the other hand, was raised to that status in the early 3rd century during Severus' reign (Salway 1993, 391-2). The water-related structures for *coloniae* were usually an integral part of their planning at the inception of their development. The *coloniae* would have been established with the approval of the Emperor and the colony would have been governed by a council known as an *ordo* with a constitution modelled on that of republican Rome. Officers would have been elected by the council as executive magistrates, who would have been responsible for the planning of the city's development including its water supply (Frere 1974, 206).

When the word 'town' is used in this thesis it has meaning only in the broadest sense applied to major towns. Distinctions are drawn between chartered towns (the *coloniae* and *municipia*) and non-chartered towns (the *civitas* capitals) and more particularly between the latter and 'small towns'. Verulamium is the only town in Roman Britain for which there is evidence that it was granted a charter as a *municipium* (Wacher 1993, 18). The status of Roman London seems to be uncertain; however, I have designated it a chartered town in that as the provincial capital it was almost certainly promoted either to municipal or *colonia* status (Frere 1987, 193).

1. *Coloniae* were chartered towns specially created for retired army veterans and their families. These towns had a certain amount of autonomy in their administration and were able to raise capital for their development, including construction of public buildings, baths and water supplies. In Britain the four *coloniae* were at Colchester, Gloucester, Lincoln and later York. All four initially started as fortresses.

2. *Municipia* were often pre-existing towns that were promoted to Roman municipal status, also with some form of self-government, but they did not have the full administrative powers vested in the *coloniae* (Frere 1967, 200). Verulamium was a *municipium* (probably from the AD 50s) and London may have achieved that status soon after the Boudician revolt in AD 60 (Frere 1967, 93-4). However, London is a problem with regards to its status. Morris argues that it was created as a wholly Roman town not associated with a tribal centre, with early Roman citizens already living on the site (1982, 104). It was not a *colonia* or a *civitas* and its probable status from its inception, c. AD 48, "was the rarity, a *municipium civium Romanorum*, a Roman citizen borough" (104).¹³ Clearly London must have had some status more than that of a mere settlement or ordinary town, especially considering its importance as the capital of the Province and as a major commercial centre and as a major harbour.

¹³ Morris 1982, suggests that Leicester was also a *municipium*, based on "The diploma of M. Ulpus Novantico (CIL xvi, 160), a Coritanian/Corieltavian auxilliary soldier, gives his origo as Ratis, not Coritanus, implying that Leicester had risen from the status of *civitas* to that of *municipium* by AD 106. For the contrary view see Frere 1978, pp.235-6" (Morris 1982, 71, n.31 p.354). Frere's view is that since Novantico "was already a Roman citizen as a result of a special grant in the field...", it has no bearing on the status of Leicester. This is an historical opinion, but one cannot but wonder why so few towns in Britain had *municipium* status.

There may have been other towns with higher status, particularly because of "their evidence of intense romanization", such as Canterbury, Leicester, Wroxeter and probably Cirencester, but there is uncertainty about it (Frere 1967, 206).

3. *Civitates* were based on the pre-existing tribal territories which centred around newly created *civitas* capitals. They did not have the same self-governing powers of the chartered towns, but they did function on the model of Roman towns with an *ordo* who elected magistrates responsible for the running of the *civitas* (Millett 1990, 7, 66).

The *civitates* in Roman Britain were centres of local government based on 17 tribal areas. These tribal areas were the artificial partitioning of *Britannia* by Rome in order to facilitate government and regularize relations with the different British tribes.

Millett lists 16 *civitas* capitals (1990, 106, Table 5.1; 154-6, Table 6.5), which is three less than the number of tribal areas which he shows in Fig.16, (p.67). The two tribal areas, the Ordovices and the Degeangli in Wales, do not seem to have had *civitas* capitals, nor does he refer to the *civitas* capital of the Trinovantes.

Table 2.2: *Civitas* capitals.

<i>Civitas</i> capitals	Tribe	Modern town
<i>Calleva Atrebatum</i>	Atrebates	Silchester
<i>Caesaromagus</i> (or attached to <i>Camulodunum</i>)	Trinovantes	Chelmsford (or Colchester)
<i>Corinium Dobunnorum</i>	Dobunni	Cirencester
<i>Durovernum Cantiacorum</i>	Cantiaci	Canterbury
<i>Isca Dumnoniorum</i>	Dumnonii	Exeter
<i>Isurium Brigantium</i>	Brigantes	Aldborough
<i>Noviomagus Reginorum</i>	Regini or Regni	Chichester
<i>Ratae Corieltauvorum</i>	Corieltauvi	Leicester
<i>Venta Belgarum</i>	Belgae	Winchester
<i>Venta Icenorum</i>	Iceni	Caistor-by-Norwich
<i>Venta Silurum</i>	Silures	Caerwent
<i>Verulamium</i>	Catuvellauni	St. Albans
<i>Viroconium Cornoviorum</i>	Cornovii	Wroxeter
Suggested <i>civitas</i> capitals		
<i>Durnovaria</i>	Durotriges	Dorchester (and Ilchester)
<i>Luguvalium</i>	Carvettii	Carlisle
<i>Moridunum</i>	Demetae	Carmarthen
<i>Petuaria</i>	Parisi	Brough-on-Humber

Civitates perigrinae had a similar constitution to that of the *coloniae* but without *quaestors* and *servi Augustales*. The elected magistrates serving in local government could acquire Roman citizenship if the town received a charter. The prestige of these positions attracted some wealthy members of the community to participate in local government and so to enhance their power and wealth.

They would have been responsible for the collection of taxes for the state, but also for the planning of the development of the town and raising the funding for buildings. It was expected that they would become generous benefactors to city development projects. By the middle of the 3rd century it became a problem to find enough wealthy persons to take on these duties because they were expected to give ever more donations (Frere 1974, 207).

They seem to have been released from military control becoming self-governing *civitates peregrinae* (Wacher 1993, 21) and had their own constitutions modelled on the Roman type of towns elsewhere in the Empire (Salway 1993, 391). Based on the evidence only 11 *civitas* capitals have been directly attested and 3 further sites are also suggested (Table 2.2). The *civitas* of the *Catuvellauni* was probably administered from the *municipium* of Verulamium. The suggestion is that the *Trinovantes* were administered from *Caesaromagus* (Chelmsford) or Colchester, but opinion seems to differ on this (Wacher 1995, 207). The formation of the *civitates* is complex (Haselgrove 1984, 31-43), but generally was based on prior Roman experience in Gaul. In Britain, the *civitas* territories generally had a loose relation with earlier 'tribal' boundaries (Haselgrove 1989, 34; Birley 1988 11, 24ff).

6.3. Small towns, settlements and villas.

I have used the following simple approach in my database for the listing of lesser settlement sites: 1) small towns, 2) settlements, and 3) villas.

6.3.1. *Small towns* were 'settlements' that developed the characteristics of urban centres with some order in their layout and probably had some kind of industry or centres of attraction such as temples for cult practices. However, the definition of a small town

is contentious with little agreement amongst scholars. Burnham (1995a, 7-17) gives a detailed analysis of settlements and what attributes they should have in order to acquire the status of a small town. I have used Burnham's list of 97 small towns (1986, 186-7, Fig.1) to identify the small towns mentioned in my database.

Small towns are problematic and scholars still disagree on certain aspects of definition. I generally accept Barry Burnham's definition of small towns (1995a, 7-17). Frances Condrón has synthesized Burnham's approach (Burnham 1995a, 7-17) to the classification of small towns and suggested some modifications (Condrón 1996, 57-8). However even here things are not straightforward. In his early work (1986) Burnham listed some 97 sites, but in later work he has cited in texts variously 52 sites (1987, 187), and 60 (1988) and 54 (Burnham and Wachter 1990, 2). Rodwell and Rowley (1975, 3) list 78 sites, and Millett (1990, 154-6) lists 117 'small towns' but complicates the issue by including the four *coloniae*, 16 *civitates* and a *municipium* with Burnham's listed 97 sites. Whether from this it is to be assumed there are as many as, or only, 97 small town sites I have not been able to confirm. However, where the sites collated by me coincide with any of Burnham's lists, I have used the title of 'small town'. Other nucleated sites I have called 'settlements' unless they are specifically known by a different category such as *civitates* or *municipia*.

6.3.2. *The term settlement*, as it will be used in this thesis, denotes minor nucleated sites, where small groups of families lived with no apparent indication of urbanization. Such settlements would have been hamlets and small villages consisting of a few farmsteads, but not operating as a unit with an organized urban structure. Often they would be near forts, towns or villas, but seemed to have had an independent existence. They could have been farmers, but also had other economic interests such as pottery and iron workings. Some 'settlements' dating from the Iron Age developed during the Romano-British period into villas or towns, such as Boreham or Somerfield Keynes.

Ultimately, Eleanor Scott says, everyone must decide for themselves what is the distinction between a settlement and a villa (Scott 1993, viii).¹⁴ It is not always easy to know how to interpret a site if the

¹⁴ Scott gives a detailed analysis of the problems of analyzing the classification of villas, indicating some of the confusion created by scholars when particular attention

original excavator did not provide sufficient information, which of course may not have been available at the time of excavation. Even the name 'town' which has become synonymous with settlements in Roman Britain as 'fortified places with a civilian character' (Wacher 1993, 19), can create confusion when it is applied to some specific sites. The confusion about settlement classification is compounded as shown in the *Britannia* index (1995, 184-5) where many settlement sites are listed, of which 17 are included in Burnham's list of small towns (1986, 187). Hingley (1989, 2-3) acknowledges the historical framework for the archaeological evidence of settlements, small towns and villas, but he stresses the dissatisfaction and criticism with this approach in recent times.¹⁵

Frances Condrón (1995, 103) seems to have provided a sensible approach to the question when she says that "The use of the term 'small town' here is taken as a modern label applied by archaeologists to the identified sites, rather than a meaningful description of the settlements themselves". This seems to be a crucial issue in the debate: when archaeologists describe the remains of buildings on a site there is seldom discussion on what made that site function as a dynamic entity in which people lived. It is a difficult problem because we rarely have any knowledge of who lived in the buildings, but when there are public buildings and services, the site cannot easily be considered as a simple settlement. For the most part these are larger than simple farmsteads and typically it is these larger and more complex rural settlements which have yielded information for water-related features. The existence of such features presupposes an infrastructure controlled by some group of individuals, and probably by the more affluent and powerful members of the community.¹⁶ I have listed as settlements in the database any nucleated sites which are not classed as towns of any type mentioned above, or as villas.

is not paid to the parameters used to categorize a villa site. This may of course be due to problems with the limited data of remains found on the ground, but it is not always the only problem. The problem of categorizing villas applies equally well to other site types. She quotes Millett's approach to the term 'villa' (1990, 91-2), which I will in general accept.

15 Hingley 1989, 2-3, cites Burnham & Johnson 1979; M Jones and D Miles 1979; Reece 1982 and Cunliffe 1984 who is critical of the historical approach. Since 1989 a number of scholars have reconsidered the basic approach and assumptions to settlement classification.

16 Burnham 1993, 99-110; Condrón 1995, 103-18; Rodwell & Rowley (eds.), 1975. The authors of the articles mention the disagreement over details of some aspects of definitions of small towns and by implication also on settlements, which are of necessity discussed by them.

6.3.3. Villas and non-villa rural settlement.

There seems to be general agreement on what constituted a villa, although there are variations within this category, which I will mention where it is important in the treatment of their water-related structures. I have not distinguished between different types of villas, whether they were of 'corridor' or 'courtyard' villas, or of any other type. Although they varied in their layouts, this did not seem to have any bearing on the type of water supply they used. There are problems with interpretation however, as pointed out by Jones and Mattingly. To quote one example, although the Lydney example is recorded as a villa, the abnormally large size of the baths would suggest that the site might have been 'a bigger enterprise than normal for a villa' (1993, 193). This type of situation is likely to be common and could be usefully researched, but it was beyond the scope of this thesis to investigate whether the sites could be differently classified.

Usually the excavation reports refer only to the site comprising the structures within the villa's built-up area. Actually the villa consisted of the home, out-buildings and the surrounding land which form the villa estate (Hingley 1989, 100-9, 121-3). When it comes to the other occupied areas, that is Hingley's non-villa settlements, the situation is very complicated, particularly within the context of his discussion of 'settlement' economics.

These non-villa settlements were the simple homes of people who did not become 'highly romanized' and therefore the buildings do not show the characteristics of Roman type buildings, that is, the linear features associated with Roman construction or being built with stone. Hingley refers to these widely spread settlements over the province as ranging from 'extensive village-type communities to single upland farmsteads' (1989, 23). The farmstead settlements are not confined only to the uplands. Non-villa settlements are often associated with villas and Hingley (1989, 100-9, 121-3) indicates some relationship between them and the villas. On the other hand many non-villa settlements were not associated with villas or other nearby communities and Hingley (1989, 100-9, 127-8) speculates that these could have been the homes of absent landlords. He also suggests that there may have been families living in simple settlements but also had some contacts with more sophisticated urban communities (Hingley 1989, 24-25). It seems to me that the exact form of dependency between different kinds of estates in these rural areas is not

clearly established. How the 212 settlements I have recorded in my database will fit into Hingley's classification I have not examined, but whatever the type of non-villa settlement, 20 had some form of an aqueduct, 49 had baths and 135 had wells. It would seem that there is a need to investigate these so-called settlements in relation to the small town and villa categories. In Chapter 6 I shall discuss the classification of 41 settlement sites and reappraise their present status.

Hingley (1989, 133-44) also refers to more isolated non-villa communities not seemingly associated with any other community. These were probably the poorest classes who occupied and were the owners of land traditionally inherited from generation to generation from before the conquest. In the absence of definitive evidence of the relationship between different communities, it seems unnecessarily restrictive to assume that a non-villa type settlement had to belong to some more established estate, villa or urban centre. My primary interest in these sites is whether they possessed water-related features and how their presence affected the status of the so-called settlement. It is therefore not possible to adopt Hingley's criteria for what constitutes a settlement for the purposes of this thesis. I have simply grouped all the sites which are not forts, major towns, small towns or villas as settlements in the records of the database. The dispersed minor dwellings that dominate the Romano-British landscape are certainly drastically under-represented in my database, but they have also tended to be far less explored archaeologically, with academic priorities more focussed on upper levels of the settlement hierarchy.

7. SITES WITH SPECIAL FUNCTIONS AND STATUS

Some sites were difficult to classify because of limited information in the literature about their status. A number of sites seem to owe their existence to some industrial activity. For instance it would seem that the settlements like that at Alice Holt, Hants., and Cantley, West Yorkshire (see App.2), owe their existence to the very extensive potteries that developed during the late 2nd and 3rd centuries. The case is similar for mining sites of Roman date, many of which continued on from the Iron Age period. The gold mine at Dolaucothi (App.2) and the lead mine at Linley (App.2), were both dependent on aqueducts for water supply. There are many Roman iron mining and iron working sites but only at Lydney (App.2) have I been able to trace an aqueduct. Beauport Park (App.2) is referred to in

the literature as an iron mine¹⁷ or processing site, which could be classified as a settlement (or even a villa). It is situated in the iron-rich area of the Weald in Sussex and boasts a bath-house¹⁸ built during the 1st century (abandoned in the mid 3rd century), but no indication of what water source it may have had. Walton-le-Dale (App.2) had two wells and was classed as a settlement, and is described also as having the function as a military supply base. This does not fall within my criteria of what a settlement is.

8. SITES WITH NO WATER-RELATED FEATURES

From a first glance at the limited information on some sites I formed the opinion that they might have had water features. But on closer reading of several references for those sites I came to the conclusion that no water-related features were actually reported. These sites are referred to in the database as '*falsus*' sites, because it is likely that other people may form the same impression as I did that water-related features have been found. That is not to say that they did not in their hey-day have these features, but merely to put on record the fact that they have not yet been found - contrary to the impression one can form.

Many reports of sites incorrectly imply that they did have water-related structures, especially baths. For instance in describing the features of a site with a bath, usually the bath had an hypocaust, drains, special kinds of tiles and *tibuli*, mosaics and often painted walls.

A number of sites are described in the literature referring to such type of finds, and the expectation would be that the sites may have had baths, but none have been found. Similarly from descriptions of certain sites the expectation is that they may have had other water-related features, but again none have been found as yet.

17 *Britannia* 10, 1979, 139-56; 19, 1988, 217-74.

18 *Britannia* 19, 1988, 217-74.

Examples of sites without water-related features are given in Table 2.3.

Table 2.3: Sites without water-related features.

Site name:	Site type:
Ardoch	fort (large)
Limestone Corner	fort
Neath	fort
Whickham	fort
Coldharbour	settlement
Brantingham	villa
Frampton	villa
Kingscote	villa
<i>Sites not included in database¹⁹:</i>	
Brancaster	fort
Bowness-on-Solway	fort
Lidgate	villa

The sites mentioned in the table have the typical characteristics of other similarly classified sites, but no water-related features have been found yet. The following three sites (not included in the database), would seem to have all the requirements to have had water-related structures. Brancaster in Norfolk, a fort (3.1ha) with a 'large civil settlement' (23ha), (EAA 23, 1985) has no reported water-related features. Bowness-on-Solway (refs), the terminal fort on Hadrian's Wall, a largish fort (c. 2.77ha) and with a large civil settlement, has no reported water-related structures. In the light of evidence for elaborate baths and water supplies to some of the other forts associated with Hadrian's Wall it is surprising that this site has not yielded any evidence of their existence. Lidgate in Suffolk, a large winged corridor type villa with 20 or more rooms, has no reported water-related structure (*Antiquity* 45, 1971, 224-5). One can add further examples, Kingscote (App.2) in Gloucestershire, is a villa, referred to in at least ten volumes of *Britannia*, but with no mention of water-related features, and the villa is situated in a county where they were usually well provided with a bath and water supply system. Frampton (App.2), a villa in Dorset is another site where the expectation would be for some water-related features to have been part of the complex, but none have been found. This negative list is extensive, especially when one considers the 2000 or

19 Brancaster: *Antiq. J.* 1936, 444ff; EAA 23, 1985; JRS 67, 1977, 157-8. Bowness-on-Solway: Lidgate: *Antiquity* 45, 1971, 224-5; *Britannia* 3, 1972, 330-1; 5, 1974, 258.

more reported villas and many more settlements of various kinds. Some may have been too poor to afford such luxuries, but there seems to be too large a number without those features. They may of course not have been found yet or have been irretrievably destroyed. In general therefore, when the reported archaeological evidence of sites with and without water-related features for Roman Britain is compared, the evidence seems to indicate that many more sites had water-related structures than have been reported.

8.1. Problems of the archaeological data.

The partial list given above of sites where water supply features would be expected but none have been found, stresses the problem of some archaeological data. There are some detailed reports on aqueducts and wells, but very few in comparison with the number of sites that have been excavated and which would obviously have had some sort of a water supply. The reports of the Colchester (App.2) excavations pay particular attention to water supply and other water-related structures.²⁰ For many sites it would appear that amateur archaeologists were the excavators most interested in aqueducts or wells.

Historically, archaeological investigations started as a result of the interest antiquarians (Aubrey, Camden, Leland, Stukeley) had in the past. These antiquarians had no particular background in archaeological excavations and indeed their initial interest was almost entirely confined to recording what they observed of remains or heard about what others have noticed. Gradually a better approach developed and by the second half of the nineteenth century antiquarians like Pitt Rivers and others in Europe, had developed methodical approaches to excavation of remains. Greene states that "the requirements of 'scientific' excavation were finally met when Pitt Rivers approached recording...with a clear perception of the significance of stratification..." (1995, 62). He quotes the excavation of Corbridge as one of the sites where the "aims and techniques of archaeology" were developed into the modern scientific science that archaeology has become (1995, 69-76). Leonard Woolley commented that the early 20th century excavation work at Corbridge would have scandalized any British archaeologist of today (Greene 1995, 70). The remains of the aqueduct at Corbridge are still visible within the confines of the excavated site, but its course outside the

20 Crummy 1984, Report No.3; 1992, Report No.6.

main site is not well reported. From my study of the reports on the remains of water-related features it seems that there was a limited interest in these features during early archaeological work and it was more by chance observation that features like leats were reported when they were still visible during the 17th to early 20th centuries. Most of the physical evidence of leat-type features seem to have been irretrievably lost as a consequence of intensive ploughing and is not easily identified even on aerial photographs. The exceptions are the leats at Dorchester, Great Chesters, possibly Winchester and the leat at Wroxeter (App.2). At all four of these sites the courses of the leats are known only along certain sections, the rest being completely destroyed by agricultural activities.

The number of known archaeological sites where water supplies and baths have been found is surprisingly small in comparison with the number of sites where it would be expected that such features should have existed. Eleanor Scott reported in 1993 well over two thousand villas (though, of which, many entries are likely to be other types of settlement). Nonetheless the villas with a proven water supply in my database amounts to only about 5% of these postulated 2000 villas. This seems to be an anomaly and can be attributed to several different factors.

1. wells have often not been found because of the limited area of excavation at many of the sites;
2. wells may have been covered with so much overburden that ordinary physical excavation techniques have not uncovered them;
3. excavators working before archaeology became a strict science during this century have not been interested in wells unless small finds were found in them;
4. wells have collapsed or been irretrievably destroyed;
5. where leats were the water supply system these have most likely been destroyed by continued cultivation on former estates;
6. where water supply consisted of water-mains in the forms of wooden, lead or earthenware pipes, they have been robbed out, weathered or destroyed over the centuries, particularly during the Anglo-Saxon and Medieval periods;
7. tanks would have suffered the same fate as water pipes.

To what extent tanks were a significant factor in the water supply of sites is difficult to say. It would have been expected that at the less romanized types of sites, such as farmsteads, round houses,

etc., where there is no apparent evidence of wells or aqueducts, that at least tanks may have been an obvious source of water supply filled by rainwater or water brought in from another source to fill them. This aspect will be commented on in Chapter 6.

Although the volume of the archaeological record is large for Roman Britain, there is nevertheless a limited amount of evidence on water-related features. Much of archaeology in Roman Britain is presently devoted to rescue archaeology and this severely limits the area over which excavations are carried out. For many sites excavation reports still need to be published and this also limits the available information. For many other places in the Empire more inscriptional and literary evidence is available, which complements the archaeological evidence. Probably the most significant reason for the lack of information for Roman Britain, not only for water-related features, is the poor evidence from ancient literary sources. Recently valuable evidence has become available from the many writing tablets found at Vindolanda, (Bowman 1994a, 1994b), but they appear to be concerned with accounts, materials and the army, and are not likely to provide new evidence about what was built in Britain during the Roman period. Four inscriptions (RIB 430, 1060, 1049 and 1463 - discussed in Chapter 3) are the only epigraphic evidence that refer to water supply in Roman Britain.

Directly related with water supplies are the ancient water supply sources: springs, (rivers) and dams. Floods were also a problem the ancients had to consider. I discuss these briefly below.

9.1. Floods.

We have limited knowledge of flood control measures in antiquity. However several ancient authors refer to the flooding of Rome by the Tiber river during periods of high rainfall. Livy reports that in 193 BC storms were the cause of flooding of the lower city (Livy 35.9.2; 35.21.5). During 60 BC serious floods destroyed the *pons sublicius*, the wooden bridge over the Tiber river, and also in 54 BC and 23 BC when the *pons sublicius* was again destroyed (53.20; 53.33). In 22 BC the floods created a food crisis in Rome, resulting in Augustus appointing a *praefecti frumenti dandi* (Dio 54.1; 54.14; 54.17). Suetonius mentions continued flooding in spite of precautionary measures (Sue., Aug. 30.1; 37; 40). He reports further floods in AD 36 (58.26.5) and in AD 69 the reconstructed *pons sublicius* collapsed again due to flooding by the Tiber (Tac. Hist. 1.86; Suet. Otho 8.3). Pliny the Younger tells of

considerable damage due to flooding of the Anio and Tiber rivers, despite Trajan's efforts at flood control (Ep. 8.17). Further major floods are mentioned during Marcus Aurelius' reign (AD 217) and again in AD 374 (*Sha. M. Ant. Aurelius* 8; Dio 79.25; *Ep. de Caes.* 32.3; Ammianus 29.6.17-18). Olivia Robinson discusses the administration and officers who were appointed by different emperors to deal with the flood problems in Rome (1992, 3, 85-9).

In modern times agencies concerned with water hydrology generally provide some flood control facilities to prevent severe flood damage. These often take the form of major dams in major catchment areas, but even these are not always adequate for very severe floods. The Romans usually constructed dams as a source for the supply of water to an aqueduct. There does not seem to be evidence that they constructed dams for flood control.

The reason why flood control dams were not built by the ancients, was that the reservoir walls had to be very high in order to impound sufficient water to be effective as a control measure against floods.²¹ The ancients did not have the understanding of the problem, nor the knowledge to construct such high dam walls to contain large volumes of water. We therefore cannot be sure that they did construct dams for the purpose of flood control. However, Hodge suggests that dams may under certain circumstances have been constructed with flood control in mind (Hodge 1990, 86), but it seems to me doubtful. The Proserpina dam at Merida, Spain, had a capacity of 10 million m³, (with a wall height of 12m) which was large by Roman standards, and could well have served as a flood control reservoir, but is small compared to modern flood control dams, such as the High Aswan dam in Egypt, or the Kariba dam in Zimbabwe (both in excess of 10,000 million m³). Hodge lists 13 Roman dams dating from the first century BC to AD 284 (1992, 82). They mainly served as sources of water supply for aqueducts and he suggests that some may also have been intended for flood control structures, and others as irrigation dams and for soil retention control, a technique practiced by the Nabataeans (Smith 1971, 21-2), and also in North Africa (Hodge 1990, 86). The few dams that have been suggested for Roman Britain now would be classed as weirs across streams to form the intake of an aqueduct.

One can only wonder how often flood disasters affected the water supply systems in antiquity. The floods of February 1995 reported in Britain

²¹ Many large dams that have been built this century both for water supply and flood control have wall heights of the order of 100m.

and continental Europe along rivers such as the Clad, the Clyde, the Tyne, the Rhine, the Seine and the Danube, had their counterparts in antiquity. The forts along the Rhine and Danube must have been particularly at risk. This would possibly have applied to many of the settlements along rivers such as the Nene, Trent, Severn and Thames, and others, where there were high concentrations of settlements. Ramm (1971, 181) refers to floods which caused the silting up of a Roman wharf at Hungate near York as a result of flooding during the late 3rd and mid 4th century AD. On his Fig.28 (p.180) he shows flood levels along the banks of the river Foss. Richardson (1959, 56), who excavated the Hungate area, shows the levels of silting of more than a metre (Fig.3) that occurred during the Roman period into the Medieval period as a result of flooding (1959, 56). Flooding also seemed to have occurred during the late 5th to early 6th centuries on the Hatfield Moors and also in the Humber area during the Dark Ages (Ramm 1971, 183). No doubt similar floods took place elsewhere in Britain during Roman times, which probably resulted in erosion and instability of the embankments of leat aqueducts, but we have no record of specific instances of such damage. No study of flood damage to structures seems to have been carried out for the Romano-British period. What, may be asked, was the impact on Roman water supply systems and how did the communities and the Roman authorities deal with the potentially devastating effects of such floods? It would seem that, from Ramm's report, nothing was done to repair the flood damage at the wharf in York and this could have been the situation at many places in Britain. Usually flood damage is of such proportions that for the period under discussion it would have been easier to start anew elsewhere rather than repair the damage. When facilities like leats were severely damaged they were most likely abandoned. It is likely that baths which were dependent on such running water supplies may then also have stopped operating.

Archaeological evidence indicates that some water supply systems suddenly stopped operating. It is not clear whether they failed because of some form of local instability in the structure, or because of some natural disaster such as floods or earthquakes. The latter may have applied to regions of earthquake activity, but this was not a likely cause in Britain. So some water supplies in Britain could have become inoperative as a result of flooding, which could have triggered embankment failures (called slope failures in soil mechanics terms), and also caused silting up of the conduit, erosion of embankments, cracking as a result of desiccation during periods of drought. Negligence in cleaning out silted aqueduct channels could be the start of incipient

failure conditions as water would have overflowed the sides causing erosion of the embankments. Hodge (1992, 124) reports on the mounds of silt removed from aqueducts such as the Anio Novus and from the settling tank of the Aqua Virgo, indicating that maintenance was a regular practice. For a city like Rome with specific departments responsible for such work it would have been a normal practice, but in Roman Britain the local town administrations may not have had specific maintenance units to do regular maintenance. However, we do not know what the maintenance practice was in Roman Britain for any of the urban centres.

10. LITERATURE AND ARCHAEOLOGY

Archaeological information is generally recorded in journals, excavation reports, or magazines (such as the now discontinued 'Gentleman's Magazine'), and books, which are often specific to particular counties or even parishes. Much of this literature is available only in some of the country's specialized copyright libraries, or in the county and parish records and the National Monuments Record office at Swindon and their several regional sites. In recent years some specialized books on water supplies and aqueducts in particular have become available, of which the most detailed general books are those of Trevor Hodge (1992) for Roman aqueducts and Dora Crouch (1993) for Greek aqueducts. Neither pretend to be exhaustive, but Hodge's book is likely to remain a standard work for some time. Other books on water supply have been written by technical people, such as Robins (1946), Bromehead (1942) and Smith (1971, 1976), usually engineers who covered the history of water supplies from antiquity to the present. Scholars such as Bruun (1991), Birebent (1962), Gsell (1902) and Landels (1978), describe specific aspects of water supplies. Two pioneer books on the remains of the aqueducts of Rome are by Thomas Ashby (1935) and Esther van Deman (1934). Much specialist literature has recently become available on excavations of water-related structures at sites around the Roman Empire, but there has been no comparable literature on the water supplies of Roman Britain.

Trevor Hodge's book is a treatise on Roman Aqueducts and Water Supply (1992) covering the Empire with some reference to Britain on topics such as wells and lead pipes, but only in passing on the actual aqueduct/leats. Hodge makes an important comment: "The real argument comes from the fact that the Roman aqueducts were not built to provide drinking water, nor to promote hygiene. Nearly all Roman cities grew up depending for their water on wells or cisterns in the

individual houses, and some cities (such as London) got through their entire history without having had an aqueduct at all. In most, when the aqueduct arrived, it came belatedly and only as a result of imperial or other munificence (or a concerted municipal effort), long after the city had grown up and already existed without one for decades, even centuries, in apparent health and prosperity" (p.5). I am not sure that this is the whole story, but it has some element of truth in it and I shall return to it in Chapter 3. His treatment of the subject is wide ranging, providing much detail on the technicalities of construction of aqueducts and their administration, and of water supply and distribution in general at Rome and elsewhere in the Empire. He has also provided some information on the calculation of water-flow in channels and the type of distribution systems used by the Romans. His bibliography is particularly useful in that it is divided under headings of the type of subject that is covered by water supply systems and a geographical survey of Roman aqueducts throughout the Empire.

The most recent information on aqueducts and water supply in the English language is given by Roger Wilson (1996, 5-29), providing an overview of the state of current knowledge. In his review of the existing literature he stresses many areas where there are major deficiencies in detailed knowledge, in particular the dating of some of the well-known aqueducts (12-18), such as the aqueduct from Uzès to Nîmes with the famous Pont du Gard bridge and the very long Carthage aqueduct. Dating information is also not available for many of the water-related structures in Roman Britain. Wilson's comment on the lack of information on villa aqueducts "because the line of the conduit has not been traced outside the excavated area of the villa" (p.25) is particularly significant, because I believe that also applies to other site types in Britain. Although Wilson points out that aqueduct studies have advanced considerably in the last decade (p.26), it seems to me that not much new information has become available on Roman aqueducts in Britain during the same period.

Similarly Dora Crouch has produced a study on *Water Management in Ancient Greek Cities* (1993) with an excellent discussion on karst formations and of limestone geology in general over the Mediterranean basin. It was in these type of formations that people looked for their water supplies from pre-classical times. Crouch describes some important sites in detail, which give a good insight into how the development of water supplies was planned and constructed by the

Greeks, and how they were managed. However she is not too clear on some technical detail.

Long before engineers seriously studied the history of early water supply archaeologists had already discovered many remains of the ancient evidence dating from the Bronze Age through to the aqueducts of the Roman and later periods. Classicists and ancient history scholars tried to interpret the two perplexing major literary texts on Roman hydraulic technology, Vitruvius (late 1st c. BC) and Frontinus (AD 90s), with amplifications by Faventinus (c. 4th c.) and Palladius (c. 5th c.), (Plommer 1973, 1-2). One of the problems with the studies by scholars from the different disciplines is that classicists, historians and archaeologists often do not understand the hydraulic principles involved and the architects and engineers are not familiar with the language of literary sources and archaeological evidence. This problem is compounded by the fact that neither of the first two ancient authors was clear on some of the technical aspects they discussed, thus making it difficult now to understand the exact meaning of some of their statements.

11. ROMAN HYDRAULIC ENGINEERING: THE ANCIENT TEXTS

In order to understand the development of Romano-British aqueducts and other structures, it seems appropriate to briefly discuss aspects of the complexity of ancient technology, and in particular Roman engineering, hydrological knowledge, surveying, and the training of engineers and architects.

The modern study of ancient technology and specifically Roman engineering, has come from classicists²², ancient historians, archaeologists, architects and engineers²³. The interests of the latter two groups are usually concerned with the history of the technology relating to the construction of ancient structures, and in particular ancient engineering. About the Roman engineers and their engineering knowledge we know nothing, except for the remains of how they applied it. Aqueducts are one such manifestation, which includes the simple aqueduct leat used on a wide scale on different types of sites in Roman Britain. But, even for leats, we can only conjecture how they went about surveying and constructing them. No records have survived to indicate if the engineers had drawn plans, recorded survey data or how they planned

22 Examples in the English language literature are: Blake 1959; Landels 1978; White 1984. There are others and also in other languages.

23 Hauck 1988; Isaac 1958; Smith 1971, 1976, 1990, 1991; Sprague 1978; and many others.

the quantity of materials needed for the construction of structures, which Vitruvius assures us they must have done. Parts of the *Forma Urbis Romae* have been found (Grewe 1985, 14), but few detailed plans for the construction of structures in that or other ancient cities seem to be extant. The collected work of ancient surveying manuals, the *Corpus Agrimensorum*, published information by Roman surveyors and how they set out certain land survey projects, but they did not describe how engineering surveying was actually carried out.

The development of the physics of hydraulics related to the practical applications of water in motion as applied to ancient water supplies were of particular interest to the engineering profession during the nineteenth century. This theoretical interest developed out of the planning of healthier and more abundant water supply which became imperative as the populations of the major cities of Europe and America strained existing supplies (Smith, 1976b, 93). The example of the extensive aqueduct system of Rome became a model for the supply of clean water for modern aqueducts over long distances from the cities. Thus interest in the technology of ancient water supplies was brought into focus, particularly Roman hydraulic technology and the applications of the technologies that preceded it.

We do not have detailed information on Roman engineering practices. Vitruvius, in his book on architecture and engineering,²⁴ comments on a number of aspects relating to these topics, but in a general way.²⁵ He makes it clear that the architect/engineer produced a plan (*ichnographia*) to show the elevation (*orthographia*), "the vertical image of the front, and a figure slightly tinted to show the lines of the future work..." (1.2.2). Clearly it must have been the practice, even before his time, to produce plans for the design and construction of structures, especially by the Greeks from whose sources he draws much of his information. It is a salutary experience to read what Vitruvius has to say about professionalism and how one needs to acquire that all-round liberal background which makes an individual a rounded person in order

24 Vitruvius, 1st c. BC, *De Architectura*, Books 1-10.

25 Vitruvius comments on what was expected from architects and engineers while practising their professions. Most technical training was obtained while men served in the army, he himself being army trained. He gave his views on what the educational background of architects and engineers should be. He gives criteria for an architect/engineer's liberal educational background in order to understand the technical, social and spiritual implications of his profession (1.1.3) and the need to appreciate the social issues in practicing his profession and his responsibility as an advisor and designer to his client (6, Pref.6). He emphasizes the need to rely on the experience of others (7, Pref.6) and gives his reasons for producing a manual on architecture and engineering techniques (7, Pref.18).

to practice his particular expertise successfully, in spite of the problematical technical knowledge he sometimes gives.

Although he acknowledged that flow in a channel was related to the size of a conduit and to the rate of flow, Frontinus only quantified the volume of flow of water in terms of size of a conduit. It is important to take into consideration flow rate, size of conduit and friction during flow to arrive at an empirical formulation for volume of flow. Similarly Vitruvius gave a vague explanation for the operation and construction of the so-called inverted siphon (he does not give it a name). He comments on the function of the horizontal part of the conduit at the bottom of a valley, the venter, and also on water as it flows down hill and the supposed swelling of the water as it is forced up the opposite slope. He says "stand-pipes are to be made in the bend, by which the force of the air may be relaxed" (8.6.5-6), which is unnecessary for the system to work. These misconceptions by those authors have been misinterpreted from as far back as the 16th century. Modern engineering scholars have tried to make some sense of what Vitruvius was trying to say in terms of the physics involved, both with regards to the standard siphon and the incorrectly named inverted siphon.

The physics and mathematics of a liquid flowing in an a U-tube configuration are well understood, but the Romans did not have the theoretical background to base their designs of inverted siphons on such knowledge. Roman engineering was primarily empirically based. By trial and error, and from the knowledge they gained from other societies, they were able to produce complex engineering structures and perfected the use of inverted siphons. Unfortunately no written evidence or drawings are extant from antiquity indicating how this knowledge was adapted for the improved constructions. Hodge (1992, 428, n.43) lists 18 aqueducts with attested so-called inverted siphons, correctly referred to as pipe pressure systems. The inclusion of the Lincoln aqueduct in this list as having such a pressure system is premature, since the existence of a pressure system in the aqueduct has not yet been proved, although it has been suggested. There is circumstantial evidence that points to the possibility that it was feasible, but nothing certain.

Another area where the Roman engineers (and other civilizations before them) had an imprecise understanding of a specific technology concerned the way calcined lime, when combined with certain admixtures, hardened into the strong cementing agent used in concrete. It is only during this

century that the chemistry of lime-based hydraulic cement has become, to date, partially understood, and empirical application is still important in concrete technology today. A recent TV film on the construction of the Colosseum in Rome showed a lack of understanding of the part 'pozzolana' soil, derived from volcanic action, had on the development of hardening of calcined lime used as a cementing agent. Vitruvius refers to a "kind of powder which, by nature, produces wonderful results", found in the neighbourhood of Baiae and Mount Vesuvius (2.6.1). The Romans by empirical observation in the harbour works of Misenum, and a break water at Puteoli, found that concrete made with lime admixed with pozzolana was stronger than concrete that had only clean sand mixed with the lime. It is this improved concrete quality which allowed Roman engineers to build the amazing domed roof of the Pantheon (Smith 1976a, 49), the dome for the Bath of Mercury in Baiae (McKay 1978, 48-9), and vaulted roofs for many structures, and the cores of masonry dams.

Other aspects of ancient and Roman construction are similarly poorly understood. NAF Smith, a civil engineer, has written a penetrating article on the "Problems of Design and Analysis" as it relates to ancient engineering and especially to Roman aqueduct bridge design and construction. He suggests that, since for maintenance purposes, the cross-section of the aqueduct had to be large enough to accommodate workmen, "in that case a size based on flow may not have been the issue at all" (1991, 122). Considering the variety of aqueduct channel sizes it seems to be a fair comment on the ultimate design approach of Roman engineers to channel sizes. This practical non-technical approach did not necessarily apply to the actual bridge design, for which strength parameters would have been important to consider. How these were arrived at would be most interesting to know.

There has been a lack of recent studies on water supply as it applies to the different site types, which may have created a certain amount of misunderstanding of its importance to Romano-British archaeology, and needs urgent research to bring into focus the relevance of water supplies in Roman Britain.

I shall treat the eight types of water-related features in detail in the following three chapters, followed in Chapter 6 by their distribution in Britain.

CHAPTER 3.

WATER SUPPLIES: 1) AQUEDUCTS, SPRINGS AND DAMS

1. WATER SUPPLY SOURCES

Location of suitable water sources was one of the important duties of the Roman engineer wherever a military site was to be established. The Romans had a long tradition of searching for water sources for the aqueducts they built all over the Empire. The sources of water supply used by them consisted of:

1. water from springs, streams and dams; transferred in aqueducts in the form of various kinds of stone channels, leats, wooden and earthenware pipes;
2. rainwater, stored in a variety of cisterns/tanks, pottery vessels, water buckets and other containers;
3. groundwater, recovered by sinking wells into perched aquifers or into the watertable of water bearing gravels, sands and rock formations.

One of the purposes of my thesis is to examine the evidence from the archaeological record confirming that all three methods were used in Roman Britain. For this reason, it was necessary to collate the evidence in gazetteer format in order to discover what type of water supply or water structures were used at different kinds of sites. Many of the aqueducts were in the form of leats dug as an earth channel in soil or rock. There are no apparent high bridge structures from the Romano-British period that carried the channel of an aqueduct over deep valleys as are found in so many other parts of the Empire.

Many settlements and towns in the Empire had only wells as water supplies. As the population grew in the different parts of the Empire, in particular in urban areas, greater volumes of water were required, especially to serve the public facilities such as fountains from where the general public could draw water. Large volumes of water also were required for public baths as the ritual of daily bathing became an integral part of romanized social custom and for this the aqueduct was the obvious solution. Running water was also needed for the flushing of public latrines, sewers and the streets of towns, usually obtained from the excess over-flow from fountains. Even with the large number of slaves available to use as water carriers it was not possible to rely on wells alone as a water supply in large volumes, mainly because in many areas they were not able to yield sufficient quantities of water, whereas aqueducts delivered large volumes. Springs were the preferred source of water for aqueducts and dams were often built in the vicinity

of springs to ensure that unpolluted water reached the cities (see Section 3).

2. SPRINGS

Vitruvius, in Chapter 1 Book 8, gave advice on how to locate a water source if springs were not obviously visible. The engineer had to lie flat on the ground and looking at the horizon would see in the distance, if the circumstances were right, where vapours rose from the ground, indicating a source of underground water. If he then dug there he would encounter a water source.¹ This is a misinterpretation of a natural phenomenon, because the apparent vapour so observed is merely the mirage of heat radiation creating turbulent air flow upwards from the warm ground. He does qualify this procedure with advice on the type of trees and plant growth which could also indicate that there were underground streams in the vicinity. Vitruvius made comments on springs and the quality of water derived from them, which were a mixture of practical advice and often interspersed with comments which have no physical truth. His views on many technological aspects, often unsound, particularly related to water engineering, seemed to have influenced technical thinking until about the 18th century.

Springs emerge at the surface of sloping ground as water flows by seepage from a perched water table or aquifer, which is relatively easily observable. From great antiquity such springs have been the source of water supplies for humans and animals. In time, cults developed round such springs, probably because their source seemed to indicate a supernatural origin and the supply was without limit. The practical value of such clean water sources was realised very early and a number of ancient communities obtained water from springs channeled along conduits to their cities. When the water of the Tiber became polluted during the 4th century BC, the consul Appius Claudius of Rome built the first aqueduct in 312 BC, 16km long and all underground, with its source from springs about 9km east of the city (Winslow 1963, 171). A number of the other aqueducts to Rome had their sources as springs.

For Roman Britain there are a number of sites where the water source is from springs, for example, the aqueduct to Winchester had as its source several springs near Itchen Stoke (Fasham & Whinney 1991, 5-11); the villa of Chedworth had a spring water source and so did the palatial

¹ A woodcut illustration from an edition of Vitruvius published in 1522 in Florence illustrates his conception of how a spring source could be detected (Bromehead 1922, 145).

villa of Fishbourne (*Britannia* 25, 1994, 289). In the database 47 sites are listed as having spring water sources in Roman Britain and there are likely to be more not yet identified.

3. DAMS

Often dams were built below springs, or across streams to ensure a constant supply of clean water to an aqueduct. The dams also functioned as a means to control the flow into the aqueduct, such as the second dam (masonry and concrete, 49m high) at Subiaco, constructed under Nero to serve his pleasure resort, and from Trajan's time used as a source for the Aqua Anio Novus (Smith 1970, 58-68). Several aqueducts in Spain also had dams as their supply source, notably the dams at Alcantrilla (Toledo) and Proserpina (Merida), both so-called masonry dams, and at Cornalvo (Merida), an earth dam. These dams, built across streams, had fairly large capacities: the Proserpina with a capacity of 10 million m³ of water. This is a large dam for its low height of 12m. Hodge lists 13 Roman dams built during the 2nd and 3rd centuries AD (1992, 82). Schnitter (1987) records many dams from antiquity which served as water supplies to cities, of which a number were built by the Romans.

Roman dam building probably represents the acme of their empirical hydraulic engineering knowledge. They may not have had an understanding of the theory involved in the design of masonry and earth dams, but their perception of basic hydraulic principles allowed them to construct a variety of dam types. The stability of dam walls is subject to low factors of safety, which the Romans compensated for by building the down stream sections at slopes as flat as 1:3 to 1:5. If one considers the spectacular and tragic failures of some modern dams, it is even more to the credit of the Roman engineers who built their long-lasting dams. No doubt they had failures too, but the Subiaco dam only failed in 1305 (Smith, 1970, 65) after 12 centuries of service. The Prosperina dam, with a down stream slope of 1:5, is reported as still being in use today (Hodge 1992, 89). The dams at the source of the Lanchester aqueduct are said to have been almost intact during the early 19th century (Steer 1938, 210-34), but now hardly visible.

For Britain I have been able to trace only two dams which served as the source of water for aqueducts. These were built as sources of supply for one of the aqueducts to the fort at Lanchester (Steer 1938, 210-34; Reed & Austin 1976, 214, 216, Fig. 36) (App.2). The lower dam (A) was built over a small stream that had a spring as its source. About 0.25km higher up the slope there was another spring at which a dam (B) was

constructed, which discharged into the lower dam. It is not known how the system worked between the two dams, but it is possible that the supply from the lower spring into its dam did not supply sufficient water, so it was decided to complement the supply with an additional upper dam.

It has been suggested that the Saughy Rigg Washpool was the source for the Great Chesters aqueduct (App.2), but it is not certain (Mackay 1990, 285)². I saw no evidence of a likely place at this position where the aqueduct could have obtained water from the river or evidence of dam remains when I visited the site, nor could I see any indication of the source on the relevant aerial photographs held at RCHM(E) archives at Swindon. Putnam has suggested that the Dorchester aqueduct may have had as its source of supply a 4m high dam, which was built across the Steppes Bottom stream near Littlewood, (Putnam & Hewitt 1996, 1, Fig. 2, interim report). There may have been other Roman dams in Britain which have now completely disappeared.

4. ROMAN SURVEYING

In my judgement, one of the most significant feats of Roman surveying and construction is that of the aqueduct from *Ucetia* (Uzes), the source, to Nîmes and that beautiful aqueduct bridge structure, the Pont du Gard. From the surveying point of view, a standard of levelling was achieved that would do a modern surveyor proud, providing a route through rough and mountainous country with a fall of 17 metres in 51km, that is, a fall of one third of a metre (1 foot) in 1 km (Hauck 1988, 78-84). This quality and skill of surveying, done with the crudest of instruments, can only be appreciated if one has tried to do surveying over similar distances. Many of the other Roman aqueducts of Gaul (Nîmes, 51km; Cahors '*Divona*', 31km), Germany (Köln, 95km), Spain (5 major aqueducts), North Africa (Carthage, 132km) and several in the eastern part of the Empire, attest to the skills of the Roman surveyors. This skill in precision surveying had special significance for Roman Britain as demonstrated by the examples of the Dorchester, Great Chesters and Winchester leat aqueducts because of the small difference in elevations between the source and delivery points.

These surveying skills were important aspects of Roman technology brought to Britain, whether surveying of fort, town, building, aqueduct,

² Bruce 1884, 225-8, Pl.xvi; *JRS* 35, 1945, 80-1. There is uncertainty about the source, a suggestion being that a dam was constructed at Saughy Rigg Washpool, but no evidence of it has been found.

road route, or agricultural plots. The army had a corps of surveyors (*agrimensores*, land surveyors, and *libratores*, surveyor levellers using water-levels such as the *chorobate* and cross-pieces) controlled by a *mentor* (Dilke 1971, 51). Most of the ancient writings on surveying were based on accounts by Vitruvius, Hero and the *Corpus Agrimensorum*, which described surveying for agricultural and land purposes, and not for engineering, for which little research has been done (Smith 1990, 59-61). The Roman surveyor (*librator*) achieved a surprising degree of accuracy in surveying with the most crude and elementary instruments, the *groma* and *chorobate* and probably also the use of Hero's *dioptra*. By the middle of the 1st century the *dioptra* had probably improved sufficiently for more accurate measurements to be made of slopes than with the simple *chorobate* or with the A-frame (Mathews 13(1) 1970, 9). The *groma* is a device with which linear sightings can be made along right angle directions; the *chorobate* is an awkward levelling device and the *dioptra* can do both leveling and angle measurements including angles less than right angles. Smith believes that the A-frame levelling device (Fig. 3.1) should not be ruled out as having been used by the Roman surveyors in establishing relative levels for aqueduct routes (Smith 1990, 61).

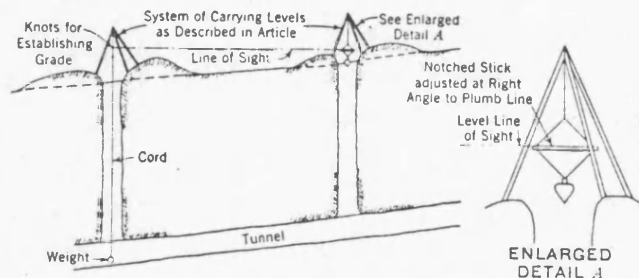


Fig. 3.1: Levelling with an A-frame level, (Butler 1933, 73, Fig. 5).

However, Roman surveyors were not infallible. A prime example of 'How Not to Build an Aqueduct' discussed by Nicholas Horsfall, is the Saldae aqueduct in Algeria which was intended to bring water from the spring of El Anseur, 21km away. A Roman engineer, Nonius Datus had made the original plan, and carried out the initial survey. But it took a long time, something like 15 years, from the start of the project (c AD 137) until water eventually flowed. When construction had progressed for some short distance, the contractors realised they had a problem constructing the aqueduct over the valley of El Hanai'at. Datus' services were again called for and the aqueduct was placed on arches along the valley. But progress was slow and he was required elsewhere. He was recalled again

four years later, because it turned out that the two units who were constructing the aqueduct worked from both the source end and from Saldae at the same time. One of the construction sections included a long tunnel of 428 metres and the two units did not meet in the centre. In his words "It was apparent that the digging had strayed from the line, so much so that the upper tunnel (source end) turned right, to the South, and likewise the lower tunnel turned North, to its right. So the two ends were out of line and had gone astray". Nonius Datus had recorded this information on an inscription found at *Lambaesis* (modern Lambese), dated to pre-AD 153. Datus was recalled to survey a connecting link, which was eventually successfully constructed for delivery of water to the city (Horsfall 1987, 40-1).

One wonders how many mistakes like that occurred in antiquity. I suspect that the aqueduct at Lincoln did not function as it was originally planned to operate. Examination of the interior of the earthenware pipe encased in Roman concrete does not show the encrustation of sinter as do many pipes and channels which operated in similar limestone environments, which could imply that water did not in fact flow in the pipe for any length of time. There are other uncertainties about this aqueduct, in particular its source of water and the delivery of water from the source to the town (see section 9.3, p.87).

5. TYPOLOGY OF WATER SUPPLY CONDUITS AND STRUCTURES

Specially constructed artificial aqueducts are very characteristic of the Roman approach to water supply. Aqueducts that were used specifically for irrigation water supplies, as in parts of North Africa for instance, contributed to the local economy. However, the same cannot be assumed for aqueducts used as purely domestic water supply and there does not seem to be any evidence to support this possibility. Their contribution to society seems to have been of the same order as that of temples, Roman baths or the larger and richer villas found all over the empire. None of these structures directly generated wealth for the communities where they were situated. However all three were *indicators* of wealth and power - whether of the State, of the community or of individuals. Each type served specific functions within the communities where they were located: temples for religious and cult practices, baths for bathing and as public social centres, and the great villas for the pleasure of their wealthy owners.

There do not appear to be aqueducts constructed specifically for irrigation purposes in Roman Britain. Because of the over-abundance of

water in Britain in some low-lying areas, such as the Fens and at Wentlooge in Wales, channels were constructed for draining of water-logged areas. Some aqueducts were constructed for industrial use such as those at Dolaucothi where three leat aqueducts were constructed for the purpose of hydraulic mining (Jones, *et al*, 1962, 71-84). On a lesser scale, at the pottery works of Cantley (Doncaster) two very short aqueducts provided water for the manufacturing process, which indicated an economic use of water. At Holt, where the army at Chester had pottery and tilery works, the aqueduct may also have served some economic purpose. The small town of Wilderspool had a pottery industry, but it is not certain that water from its aqueduct was used in the industry.

Across the empire there were many Roman aqueducts, often involving high and aesthetically beautiful bridge structures, that served two very important functions. Firstly, they conveyed one of the necessities of life, water; secondly, they were an expression of the ability (power) of Romans to create such impressive structures. However, aqueducts were not a necessity for survival. People would have been able to get water, albeit with some effort, from other sources. Although there were alternative water supplies, people developed many different kinds of facility for comfort and pleasure, and these, in part at least, depended on the construction of aqueducts to make running water available.

In Britain there are none of the magnificent arched bridge remains carrying the aqueduct conduits to urban centres. The Romans utilized various forms of aqueduct conduit that are also found in other parts of the Empire. Where there were no problems with valley crossings which could not be effectively circumnavigated by following contours, the preferred method was to use simple leat channels, ditches dug into soil and rock forming the water conduit. Other conduit types are listed below.

5.1. Typology of conduits.

5.1.1. Leats.

Leats are open ditches dug in soil with sloping sides. It would seem that when the channels had to be deeper than one metre, the general slope of the walls was about 45 degrees, which in certain circumstances would have been too steep a slope and may have been unstable. Evidence has been found of slumping of the sides of the leat at Dorchester (Dorset) where it was in a high side-cut.

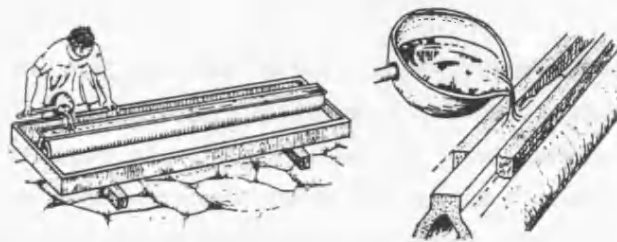
5.1.2. *Stone channels.*

These are of two kinds. The first kind is channels cut in rock in order to maintain the desired flow grade of a leat. They usually followed directly along the line of the leat where it traversed rock, as at Dorchester. The second kind are channels made from dressed stone cut for the purpose of forming channels with two vertical sides and a floor. These channels could either be sealed with a lime-based mortar to render them impermeable to leakage, or be the carrier of some form of pipe. Remains of both these channel types are found at several sites in Britain. The remains of three aqueduct channels were still intact as late as the mid 19th century, originally built to provide water for the fort at Lanchester, but have subsequently been destroyed by opencast coal mining (Steer 1938). Vitruvius advises that such a channelled aqueduct should be "arched over to protect it from the sun" (VIII.vi.1). No mention is made of protection for health reasons. Many stone channel aqueducts were below ground level, firstly, for protection against pollution, and secondly, to ensure that the supply could not easily be cut off by an enemy.

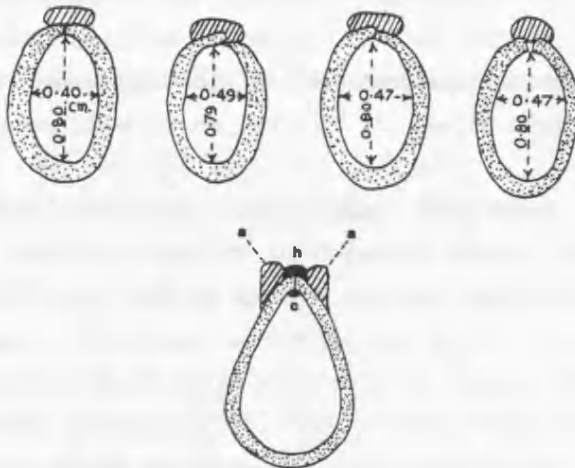
5.1.3. *Pipe lines.*

Pipes consist of four types: a) wooden, b) ceramic (terracotta), c) lead, and d) stone pipes.

a) *Wooden pipelines* are usually indicated by the remains of iron rings or collars which have been found *in situ*, mainly within the confines of the enclosure of sites. In Britain, the wooden pipes were as a rule carried in a channel of stone, but not invariably so. The iron collars associated with wooden pipes vary in size from different sites. More than 20 collars were found at Wroxeter with a diameter of about 63mm and pipe lengths of the order of between 1.5m to 1.8m (Atkinson 1942, 121-6), whereas at Silchester and Verulamium the collars were of the order of 110-155mm in diameter (*Archaeologia* 55, 1896(2), 422-4). Although evidence for wooden pipelines were found at some forts such as at Birrens, Fendoch, Pen Llysten and South Shields, no iron collars have been traced (Hanson 1970, 421). Instead two pipes were fitted together and the join then "solidly packed with clay" to prevent leakage (*Arch. J.* 125, 1968, 125). Collars were found at the legionary fortress sites of Caerleon and Carpow.



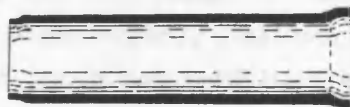
a) pouring lead and forming the joint



b) cross-section of Roman lead pipes and soldered seam



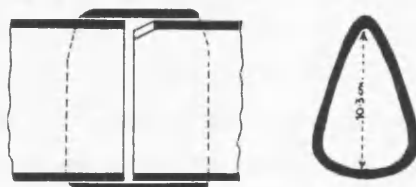
c) forming pipe and showing soldered and lap joints



(a)



(b)



(c)

d) methods of jointing pipes to each other

Fig. 3.2: Construction of lead pipes and making of joints (Hodge 1992, 309 Fig. 215, 312 Figs. 216 & 217, 314 Fig. 219).

b) In Roman Britain the major *ceramic pipe* aqueduct is that of the Lincoln *colonia*, at least part of which was encased in concrete. It is not clear whether the pipe was buried when constructed. When discovered it was below modern ground level. It seems to have traversed ground from the vicinity of the Roaring Meg for about 2km to a tank in the north of the upper part of the *colonia*, into which it is speculated it would have discharged, but the route of the last half kilometre of the aqueduct has not yet been traced. An earthenware pipe is also reported for the fortress at Chester as part of its water supply (Stephens 1986, 60).

c) Remains of Roman *lead piping* have been found at several sites in Britain for distribution of domestic water, such as at Bath, Lincoln and York. At York, during excavations at Wellington Row, a 180mm diameter (external), 18m long lead pipe was found, "which seemed to have carried water across the bridge and down the centre of the widened road" (Wacher 1995, 175; *Britannia* 21, 1990, 325). This is the largest known Roman lead pipe found in Britain. Lead piping was extensively used elsewhere in inverted siphons, and for this use the thickness of the pipe has been reported as being from 19 to 25mm. Several techniques of forming lead pipes were developed and an elaborate technique of soldering the joint was one method of sealing the pipe, this being the main procedure used for inverted siphon pipes. Pipes were also formed on a circular mandrel, then bending the two edges of lengths of pipe over on themselves and forcing the edges tightly against each other making a lap joint. This type of joint would not have been able to take the internal pressure of inverted siphons. Other joints were also made for specific purposes. Sketches of lead pipe making and forming of joints are shown above (Fig. 3.2, p.60).

d) *Stone piping* were used mainly in the eastern Empire such as at Patara and Aspendos (Grewe 1985, 76, 80-81). Piping bored in stone must have been extremely costly to produce in terms of both time and money. It was not used in Britain as far as I can ascertain.

5.2. Tunnels.

Tunneling was not used in Britain as it was in the rest of the Empire. Tunnels were constructed through both soils and rock, of which the Köln aqueduct is an example. There is the famous tunnel of Eupalinos on Samos island (Rihl & Tucker 1995, 403-31), and the tunnel section described by the Roman army engineer who left an inscription describing the problems with the tunnel section of the aqueduct at Saldae (Horsfall

1987). The aqueduct from Vers to Cahors in France had a short length constructed as an arched channel in a soil tunnel (de Garros, 1989).

5.3. Bridge structures and arcades.

There are many famous remains of aqueducts carried on stone bridge structures and arcades, and they are some of the most magnificent stone constructions produced by the Romans. Long arcades with elaborate arches over land and as bridges over rivers and roads are found all over the Empire, some of the most conspicuous being those at Aspendos, Carthage, Köln, Pont du Gard, Segovia, and Rome's own contribution of many remains. The channel (*specus*) is carried on top of the masonry structure and was always covered, either by an arched roof or ashlar slabs. Usually channels were large enough for a person to walk in so that repairs and maintenance could be carried out.

Four minor bridge structures have been suggested: at Beckfoot fort, at Henk Bridge on the Great Chesters aqueduct, the bridge that carried the aqueduct into Exeter, and the controversial bridge structure suggested for the Lincoln aqueduct. Thompson reported foundation slabs (1954, 114-7, Fig.3) for piers which most probably would have carried a substructure for that portion of the aqueduct. At Beckfoot, Joseph Robinson reported in 1880 the discovery of "a very curious structure" and "leading out of this space was a hewn channel, apparently intended for water". Collingwood thought "it to have been the end of an aqueduct leading into the fort at that corner", (Collingwood 1936, 38, 76-84, Fig.1). From the 1:25,000 OS map of the area it would appear that the aqueduct would have had to be carried on a raised structure to enter the fort as Collingwood suggests, but the evidence is inconclusive. In a new survey of the Great Chesters aqueduct by the RCHM(E), it is suggested that at the crossing of the valley at Benks Bridge, which is about 6m below the course of the aqueduct, a bridge would have been necessary to carry the aqueduct across the valley and the river. It is likely to have been of wood construction, but its length and actual height is not known and no surface remains survive (*Britannia* 21, 1990, 288). The aqueduct originally serving the fortress and later the town at Exeter, was carried on an elevated timber bridge structure where it entered the town defences, but it is not clear how long this structure was (*Britannia* 14, 1983, 322). Perhaps there are other sites where aqueducts have been suggested which would have required bridge structures, but this would need special investigation to confirm it.

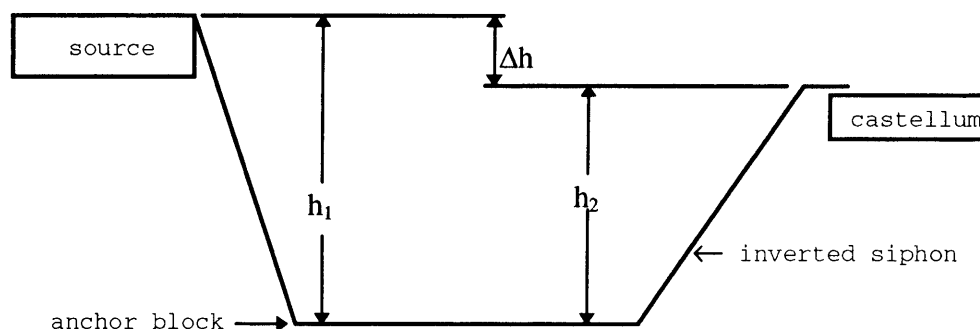
5.4. Inverted siphons.

This is a most unfortunate name for the type of aqueduct which conveys water from a high point on one side of a valley to the opposite bank. Such an aqueduct is correctly classified as a pressure system for which the elevation of the down stream side of the pipeline has to be lower by a small amount in relation to the level of the upstream end (Fig. 3.3). The difference in height need not be great, but in practice will depend largely on the resistance to flow in the pipe. The Roman engineers did not have the knowledge to calculate exactly the flow in pipes or channels, or the necessary difference in level to allow flow to take place. They are likely to have relied on their experience and observations of existing inverted siphons to decide on an effective difference in level. The actual pipes for inverted siphons were usually made of lead, but there are some where stone piping was used, such as at Aspendos (Ward-Perkins 1955, 119, Fig.2). One of the main problems would have been to prevent leaking at joints of a pipeline at the bottom of a valley because of the high pressure which is generated, anything from 5 to 20 atmospheres, depending on the height between the delivery aqueduct and the pipe in the valley. Pipes used in inverted siphons appear always to have been encased in concrete. The Lincoln aqueduct must have operated as a pressure system³, with an inverted siphon because the upward slope of the pipe, but evidence for the source end of the aqueduct has not been found to confirm this. Suggestions have been made by Thompson, Wachter and Lewis for possible sources, but so far no source has been identified. Since the earthenware pipe encased in concrete has been traced near the Roaring Meg, the postulated piers at the Roaring Meg could have supported a low bridge structure as proposed by Wachter (see Fig. 3.7b) carrying the pipes southwards towards the town. However, such an interpretation is dependent on identifying its actual water source. The purpose of the foundations have not been satisfactorily explained.

Figure 3.3 shows that for water to flow in an inverted siphon the intake of the conduit must be higher than the discharge end at the castellum, indicated by the differences in levels $h_1 - h_2$. The amount of this difference, Δh , will depend on a number of factors, including the friction in the conduit, the shape, the roughness of the internal surface, viscosity, and others. The bends where the sloping sides

³ Hodge lists 14 inverted siphons (1992, 428, n.43); Wilson (1996, 8, and n.24) mentions 11 additional inverted siphons. The inverted siphon at Beaunant on the Lyon aqueduct had a depth of 123m compared to the suggested one at Lincoln which had a depth of about 22m. The pressure at the bottom of the Beaunant inverted siphon would have been 1230kPa (12.1 atmospheres), a high pressure for a pipe.

meet the bottom section of the conduit will bear the greatest thrust and is usually anchored.



Flow will take place when $h_1 - h_2 = \Delta h$, when $\Delta h \neq 0$.

Fig. 3.3: Illustration of principle of the inverted siphon (AB).

Because the pressures in inverted siphons can be very high, depending on the height h_2 , the conduit was usually encased in concrete, or in some instances the walls of lead pipes would be abnormally thick. In the case of the Lincoln aqueduct the delivery end would have been either at the east gate or the north gate tank, a height h_2 above the suggested low bridge structure near the Roaring Meg. The source, wherever that was, would have had to be higher by a distance Δh , for water to flow in the pipe. Neither of these two heights are known.

6. TECHNICAL ASPECTS OF AQUEDUCT CONSTRUCTION

Adam (1974) discusses in some detail the construction of structures during Roman times, especially as practiced in Rome, Spain and other parts of the Empire. He does not discuss the construction of leats. Although Vitruvius mentions bridges and aqueducts and other structures, the information given is often too general and not detailed enough for us to know exactly how it was done at that time. Some visual evidence in the form of sculptures has survived; so, for example, the well-known representation of a crane (Smith 1990, 79).

6.1. Stability and instability of aqueducts and maintenance.

It is important to appreciate that Roman engineers were confronted with problems relating to the stability of aqueduct structures, even though they did not have the theoretical understanding of instability. Any form of channel, whether of the open leat type or stone-lined types, is subject to either erosion, instability, or cracking, with consequent loss of water, which can often compound problems. In modern construction

of aqueducts, reinforced concrete pipes (minimizing cracking) and steel conduits are used, and even they have a limited life span. The non-uniform appearance of surfaces of the remains of exposed Roman walls seems to suggest that repairs must have taken place at intervals over a long period and this is likely to have applied to all the other structures (Bruun 1991). Evidence from excavation reports often suggest that reconstruction took place on parts of a site and this could well have been within the period of normal decay of structures, suggesting that it was easier to reconstruct rather than to repair. Although many ancient structures have survived, the evidence of their decay is obvious and their active use as serviceable structures led to their abandonment. The ancient aqueduct structures would have been prone to instability and cracking due to shrinkage of concrete over time, leaching of lime out of the concrete, thus reducing their tensile and compressive strengths, which rendered them unserviceable and led to their abandonment, because of cost of repairs. For leat type aqueducts, the swelling and shrinkage of clayey soils in which they were constructed would have been the source of instability. Modern soil mechanics have shown how the stability of earth embankments is affected by different construction techniques and moisture control. It is probably not unfair to say that many Roman structures must have failed because of poor foundation control. Avery (1993, 1-10, Figs.117-124) gives a good basic account of the theory of stability analysis that can be used to assess the stability of ancient structures if appropriate soil and rock strength parameters are measured *in situ* or in a laboratory. Avery quotes extensively from soil mechanics literature.

It may be conjectured that some of the aqueducts (and wells) could have become inoperative during their lifetimes due to some structural inadequacy or due to the original poor construction, or subsequent unstable development as a result of saturation of soils during flood periods. Similarly aqueducts constructed in clayey soils would likely have failed in places due to wetting and drying resulting in cracking of its embankments, or due to erosion during flooding. The regular maintenance of such service structures must have been a major problem for both public bodies and private owners, as it is even today in our much more sophisticated repair-conscious age. The total maintenance costs of long linear features were possibly prohibitive. This is probably one of the reasons why a number of the aqueducts of Rome and elsewhere fell into disuse.

One wonders to what extent that was an issue in Britain, where the problem would have been somewhat different, given the predominance of leat type structures. Silting up and embankment erosion would probably have been the main in-service problems. Neglect of the leats may also have been responsible for them becoming inoperative, resulting in blockages and other breaches that might have impeded their proper functioning. There is nothing in the archaeological record to indicate how long the known leats in Britain carried water, whereas for a number of the known aqueducts elsewhere there is evidence of how long they supplied water, particularly those in Rome. For the Dorchester aqueduct there is evidence that a slip failure had occurred along a section on Whitfield farm and that it was repaired, but it was not clear when this would have taken place.

Pipe aqueducts used on many sites (as at Cirencester, Caistor-by-Norwich, Chelmsford, Fendoch and Carpow) and internal distribution pipes (as at Bignor, Birrens, Colchester, Caerwent, Gloucester and Wroxeter) would have required regular maintenance, especially wooden pipelines, which could crack if allowed to dry out and burst if under high internal pressure. The seals at joints between individual pipes could have deteriorated over a period of use and would have needed repairs. The joins of stone channels would have been potential weak points subject to leaks, because the sealing mortar would have been very sensitive to even slight lateral and vertical movements in the individual channel blocks. It is reported that several sites had stone channels that carried wooden pipes, which may be the result of experience with leaking joints of the original supply channels. Hence the need to support wooden pipelines for their joints not to be disturbed. I would suggest that on certain sites the stone channels were the original water conduits, but because of problems with the integrity of the joints of the channel blocks to hold water, it was belatedly decided to use wooden pipes and support them on the channels. It could not have been cost effective from the beginning to build a channel and use a wooden pipe to carry the water.

7. SITE TYPES

Owens observes that "An adequate supply of water was one of the major factors in deciding the location of a new city, and many cities were so situated as to take advantage of naturally occurring supplies of water from springs, wells and even rivers" (Owens 1992, 158). It is likely that many urban centers did not start with an aqueduct as the initial source of water supply.

Aqueducts have been used to deliver water to all the listed site types in Roman Britain as shown in Table 3.1.

Table 3.1: Aqueducts at site types.

Site type	Aqueducts	Percentage of total
forts/fortresses	66	48
coloniae	4	3
municipia	1	<1
civitas capitals	11	8
small towns	9	7
settlements	20	15
villas	24	18
Total sites	135	

7.1. Water supply data.

All the data recorded in the database is given in the table in Appendix 1. The sites where aqueducts have been found are listed in Appendix 1 from which their distributions have been extracted and are given in Figures 6.1 (forts), 6.2 (civitas capitals), 6.3 (small towns), 6.4 (settlements), 6.5 (villas) in Chapter 6.

There are biases in the archaeological record data for Roman Britain as represented in the table in Appendix 1. As excavations continue, the number of known Roman settlements increases over the time span. However, the number of sites where the water supply features have been reported comprises a small percentage.

The rescue context of many excavations is a further factor affecting the details of the archaeological record and some water-supply features (pipes of lead or wood) may be poorly represented as a result of decay or ancient reuse. Clearly, the information obtained by me for any specific site may not be complete, so that the presence of one type of structure and the absence of another may not necessarily reflect the true archaeological potential of the site. Hence, during the analysis of site data these shortcomings in the data set and therefore the biases they introduce must be borne in mind.

In Table 3.1 it is shown that forts registered half the number of aqueducts listed in the database, showing that the army had a preference for aqueduct water supplies compared to any other supply. The reason for this may have been that there were usually a large number of troops

concentrated in a confined space, so that large quantities of water would have been used daily, and it would have been preferable to have a running water supply than having to have it carried to the site or drawn from wells. It is not clear why many of the other forts also did not have aqueducts, but this could have been due to lack of excavation outside the fort area, or to their destruction over time, or genuine absence. However, it is considered that aqueducts were more widely used at forts and other type sites than indicated by the archaeological record. For instance, at forts, assuming the daily consumption and other uses of water per person was 20 litres per day, then for a contingent of troops of say 500, at least 10,000 litres of water would have been necessary. To carry or draw that amount of water each day would have been a costly activity both in time and personnel.⁴ The problem is even greater for the larger forts and fortresses and those with cavalry units. Seven fortresses are listed as having had aqueducts, excluding those originally at the *coloniae*. The lack of aqueducts at more small towns may indicate that they also have not been found for a variety of reasons. At sites which were not urbanized, wells and springs are likely to have been the preferred sources of water supply, if for no other reason than an economic one.

Initially it was the military who, as they advanced from south to north and from east to west, introduced water supply and drainage systems not previously used in Britain.

8. AQUEDUCTS

8.1 General.

There must be a number of factors which relegated aqueduct construction in Roman Britain to the expedient based mainly on leats, simple channels at ground level, or pipe conduits. Comparing the lengths of aqueducts (many over 30km long) in the Mediterranean world with those in Britain (all known ones are less than 25km), may suggest that the relative availability of suitable water sources was easier to find in Britain. Topography may have been a factor, but cost may have been more significant in the decision to build the cheaper type structures. Generally, where aqueducts were required in Britain, the countryside did not have deep valleys surrounded by mountains, so the need for elevated bridge structures and long arcades did not arise. Leats could be

⁴ The assumption of 20 l/d would include water for drinking, cooking, personal washing, and for washing of clothes. If a person carried 10 litres at a time, at least 1,000 daily trips would have been necessary. This would have required about 83 trips per hour for a 12 hour working day, which could imply that about 10 people or more were drawing water every day for 365 days a year. The occupation of drawing water from wells would have presented similar work load problems.

constructed to follow and cross contours to obtain the desired gradient to permit reasonable flow rates. But even so, the construction of simple leats, that is, channels cut into the soil or into rock, were major undertakings. Even their relatively lower costs would have been considered carefully, because towns had to generate their own revenue for public facilities, whereas the province financed its own expenditure on capital public works.

8.2. Leat aqueducts.

Examples of leats for which evidence exists are Bowes, Dolaucothi, Dorchester, Great Chesters, Haconby, Haltonchester, Hardknott, Tomen-Y-Mur, Winchester and Wroxeter. Dolaucothi is the only known gold mine in Britain, worked from pre-Roman times, and further developed by the Romans, that was served by three aqueducts of leat construction⁵. Unfortunately the leat-type aqueducts have been eroded or destroyed over the centuries, primarily because of agricultural activity. The routes of the aqueducts of Dorchester, Great Chesters, Winchester and Wroxeter can be traced with difficulty on the ground.

Leat aqueducts were constructed across contours in such a way that the flow could be controlled within the gradient limits set by Vitruvius (1:2,000 min. and 1:200 max.), or what was expedient for the topography of a particular region. For only a few of the leats that have been recorded in the database is there sufficient information to trace them along the ground. Where they were cut into soil, leats have been vulnerable to natural erosion or eradication by agricultural activities over a very long period, so that many have completely disappeared and their traces are unlikely to be discovered.⁶ Where such leats have been cut into rock they seem to have been silted up, as for instance for long lengths of the Dorchester aqueduct in Dorset (Putnam 1995, 128-31) (Fig. 7.3), and portions of the Dolaucothi aqueducts, that is, the Cothi (A), Annell (B), Gwenlais (C), and the Nant Dâr (D) (Fig. 3.4) (Jones and Mattingly 1990, 182, Map 6.3).

⁵ Lewis & Jones, 1982, 4, 10-4; Jones, Blakey & Macpherson, 1962, 71-84, pls.I-V; Burnham 1993, 16-9; Burnham & Walker, 1992, 2-8; Burnham 1994, 41-7.

⁶ This may not be entirely correct, as apparently even if a site has been extensively ploughed, if the light and the time of the year when the growth of the crops is just right, a cropmark may show up and reveal a structure that is invisible at the surface.

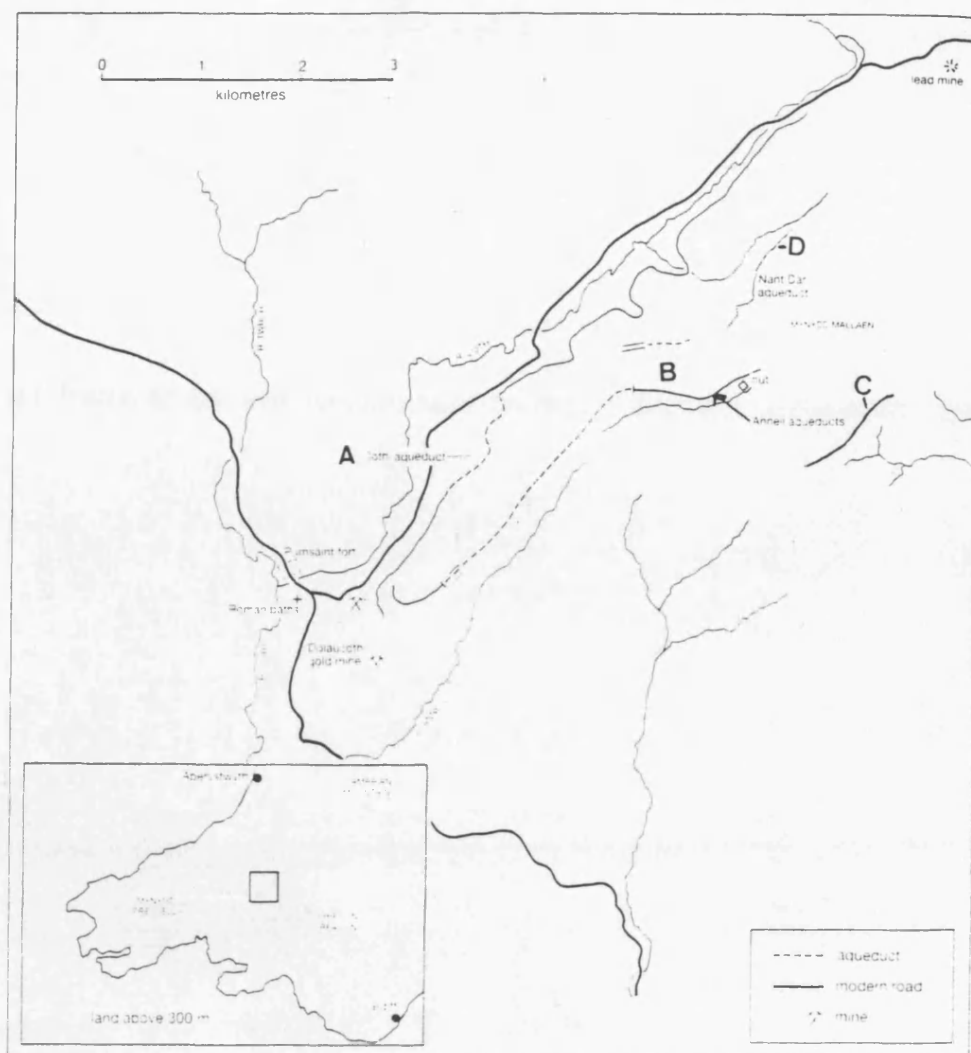


Fig. 3.4: Routes of the Dolaucothi aqueducts (after Jones and Mattingly 1990, 182, Map 6.3).

Only minor excavations have been carried out on the Great Chesters aqueduct (Fig. 3.5), but it has been surveyed twice, the first time in 1850, and again in 1988 by the RCHM(E) (Mackay 1990, 285-7). Several sections have completely disappeared, but sufficient lengths of the aqueduct have survived to show its general route. It has been suggested that the source of the aqueduct may have been a dam at Saughy Rigg washpool (A), of which there is now no evidence. At Benks Bridge (B) it has been suggested there was a bridge structure carrying a pipe conduit across the stream, but no remains have been found. The aqueduct discharged into a tank near the baths at the fort (C).

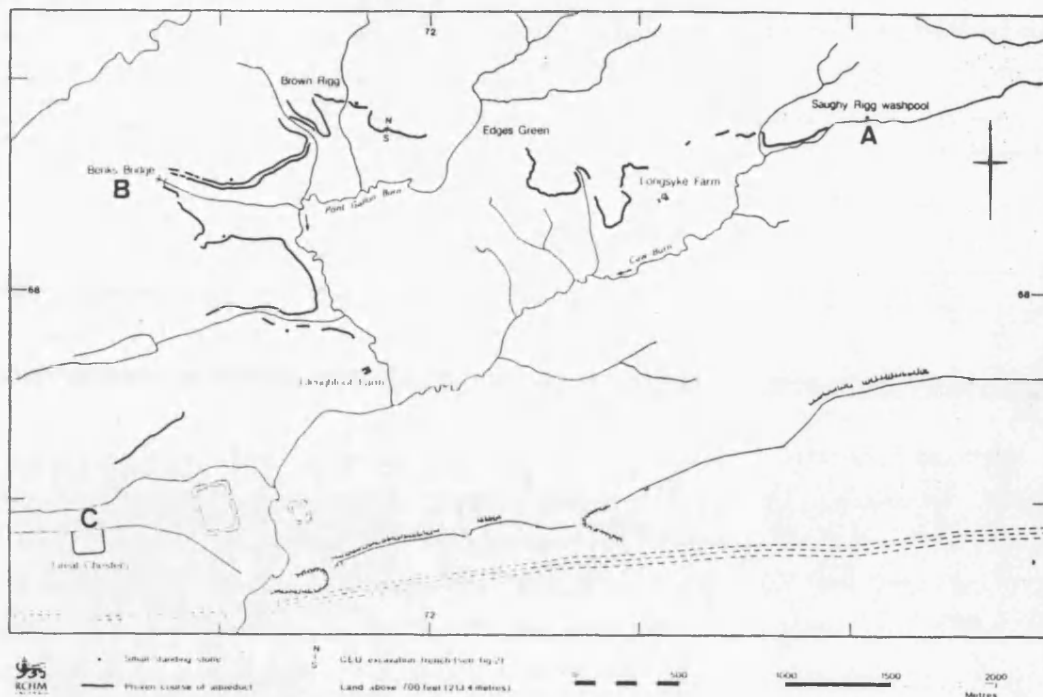


Fig. 3.5: Route of Great Chesters aqueduct (after Mackay 1990, Fig. 6).

Present surveys of these aqueducts usually consist only of a line on a poorly contoured map, making it difficult to visualize their spatial impact on the landscape. For instance, a preliminary survey of the course of the leat aqueduct of Winchester (Fig. 3.11) was published as recently as 1991 (Fasham and Whinney 1991, 6-11). Future work on it could include plotting it so that its 3-dimensional aspect can be illustrated.

Although some work has been carried out on the British leat aqueducts, there is no published information showing cross-sections of their complete routes. It would be helpful for future studies if the known leats can be plotted in a format which will show them in the context of the local topography. These two aqueducts (Dorchester and Winchester) offer the opportunities to have them mapped to standards which modern computer 3-dimensional plotting can now achieve.

6.3. Stone-channelled aqueducts.

Stone channel aqueducts appear to have been constructed only at military sites such as at Birdowswald, Birrens, Catterick, Glenlochar, High Rochester, Lanchester and Stanwix. There may have been a stone-channel aqueduct at the villa of Well.

The three stone-channelled aqueducts of the Roman fort at Lanchester are an example of this type of construction. The Rev John Hodgson reported and provided a plan of the aqueducts in 1822 (Hodgson 1822) "when the channels were apparently as 'visible as the day they were made'" (Reed & Austin 1976, 214).⁷ By 1938 it was difficult for KA Steer (1938, 210-34) to locate the route during a geometric survey of the channels (Fig. 3.4). Reed and Austin state that destruction was due to "Three different forms of land-use - agriculture, new housing and opencast coal-mining - (and these) can be identified as the main agencies which threaten archaeological sites". Natural erosion by the elements has also contributed to this process, but not to the extent and at the rate at which human agencies have caused damage. A prime cause of wanton destruction was opencast coal-mining, since "as a result of deforestation during the last war and the succeeding two decades, some previously protected archaeological remains, such as the dams and aqueducts of the Roman fort, were destroyed" (Reed & Austin 1976, 213).⁸

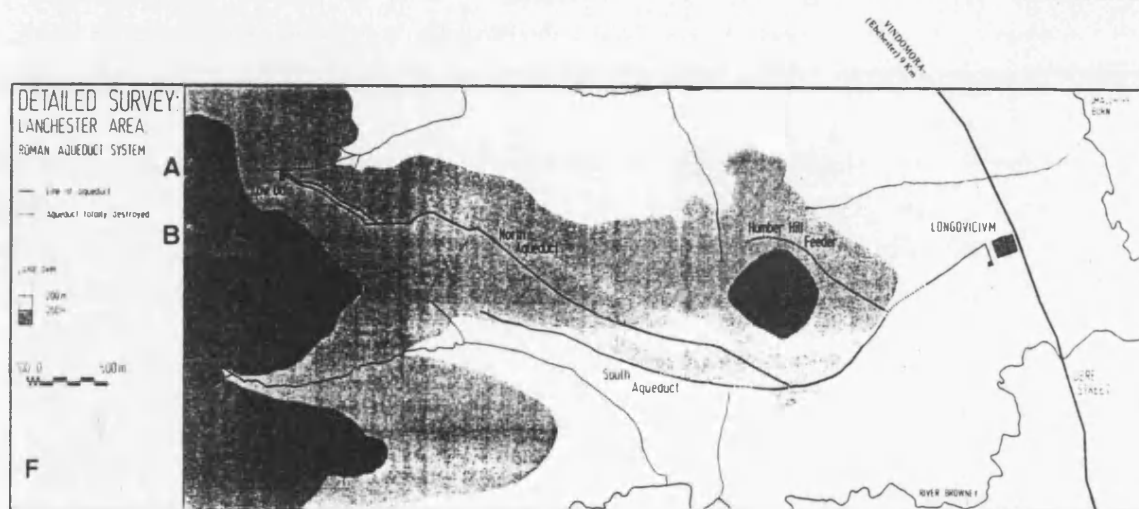


Fig. 3.6: Lanchester fort aqueducts (Reed & Austin 1976, 215, Fig. 37).

9. INSCRIPTIONS

There are no ancient literary reference or epigraphic information for any of the known leats in Britain, but four inscriptions have been found, one about the repairs to an aqueduct, and three refers to the provision of new aqueducts, all four referring to forts.

⁷ The article discusses the early discovery of the three aqueducts to the fort and its subsequent deliberate destruction.

⁸ A recent case of continued destruction of archaeological sites has been the three medieval bridges at Hemmington on the Trent, (*Current Archaeology* 12(8), 1994, 316-21).

In addition to the four inscriptions from forts (Collingwood & Wright, 1965)⁹ the only information we have about aqueducts in Britain is from the archaeological record. At any rate, the epigraphic evidence shows that the lead type water carriers were considered by the Romans as aqueducts. The inscriptions are as follows.

9.1. The four known inscriptions.

RIB 430 (143): Caernarvon, AD 198-209.

[Imp(eratores) Caes(ares) L(ucius)] Sept(imius) Seuerus
Pius Per|[tinax et M(arcus) A]urel(ius) Antoninus |
[Pius Aug(usti)] et [P(ublius) Sep]t(imius) [Geta no]-
b(ilissimus) C[aes(ar) |riuos aq]uaeductium uetus|[tate
conla]bs(os) coh(orti) I Sunic(orum) restit(uerunt) |
[...ARE...|...NL...

'The Emperor-Caesars Lucius Septimius Severus Pius Pertinax Augustus and Marcus Aurelius Antoninus Pius Augustus and Publius Septimius Geta, most noble Caesar, restored the channels of the aqueducts fallen in through age for the First Cohort of Sunicians....'.

Interpretation of the inscription based on morphological grounds, mentioned by Stephens (1985b, 228-30), suggests that there may have been more than one aqueduct channel; one supplied the fort and the other the extramural baths. It is not clear whether these were channels that carried water pipes. Wheeler, (1924, 110-11) says the fort could only have been supplied by pipelines.

RIB 1049 (348-9): Chester-le-Street, AD 216.

...] eq(uitum) | [alae ...Antonin]nanae | ... t]erri-
to|[rium ... aquam] induxit | [balneum ... a s]olo
in|[struxit sub cura ...]diani leg(ati) | Aug(usti) pr(o)
pr(aetore) Sabin(o) II et An]ullin(o) con(n)s(ulibus)

'... of the troopers of the Cavalry Regiment ... Antoniniana ... domain-land ... brought in a water supply, and erected a bath-building from groundlevel under the charge of ... emperor's propraeorian legate, in the consulship of Sabinus for the second time and of Anullinus.'

⁹ Collingwood & Wright 1965, (RIB) Inscriptions for aqueducts have been identified as follows: Caernarvon - RIB 430; Chester-le-street - RIB 1049; Chesters - RIB 1463; South Shields - RIB 1060.

It would seem that the work was done during the reign of the Emperor Caracalla, for which a comparable inscription was found at High Rochester (RIB 1279). This aqueduct is known only from the inscription, as there is no archaeological evidence for it. The fort has a sewer and the baths mentioned in the inscription also suggest that there was a running water supply. Limited excavation or loss of the remains of the aqueduct account for it not having been found.

RIB 1060 (354): South Shields, AD 222.

*Imp(erator) Caes(ar) diui Seueri | nepos diui Magni Antonini
fil(ius) | M(arcus) Aurel(ius) Seuerus Alexander | Pius Felix
Aug(ustus) pontif(ex) max(imus) | trib(unicia) pot(estate) p(ater)
p(atriciae) co(n)s(ul) aquam | usibus mil(itum) coh(ortis) V
Gallo(rum)
in/duxit curante Mario Valeriano | leg(ato) eius pr(o) pr(aetore)*

'The Emperor Caesar Marcus Aurelius Severus Alexander Pius Felix Augustus, grandson of the deified Severus, son of Antoninus the Great, pontifex maximus, with tribunician power, father of his country, consul, brought in this supply of water for the use of the soldiers of the Fifth Cohort of Gauls, under the charge of Marius Valerianus, his propraeorian legate.'

This is one of the most complete inscriptions in Britain relating to the provision of a water supply amenity. It indicates that there may have been two aqueducts at South Shields, the original aqueduct that went out of commission and the new one provided by the emperor Alexander Severus, some time during AD 222-35.

RIB 1463 (354): Chesters, AD 181-5 (Haverfield), AD 217 (Birley).

*Aqua adducta | alae II Astur(um) | sub Vlp(io) Marcello | leg(ato)
Aug(usti) pr(o) pr(aetore)
'Water brought for the Second Cavalry Regiment of Asturians under Ulpius Marcellus, emperor's propraeorian legate.'*

It is uncertain whether the inscription refers to Ulpio Marcellus who was the governor in Britain from AD 181-5, or the governor with the same name dated to AD 217 (Birley 1988, 36, 174). Haverfield (1897, 179) favoured the earlier date, whereas Birley (1988, 174) assigns the inscription to the later date. In the note to the inscription, it is pointed out that the *ala II Asturum* was a 3rd century garrison of

Chesters, and since the posting of garrisons to Hadrian's Wall was rare at the end of the 2nd century, it was unlikely that this unit was present at the fort in Commodus' time (AD 181-92) (Collingwood & Wright 1, 1965, 472). However Birley also points out that a certain Q. Baienus Blassianus, a prefect, "had commanded an auxiliary unit in Britain, in his case the *cohors II Asturum*, which was his first commission." He is reported in a papyrus to have been in Egypt in AD 168, and was active from c.AD 140-168 (1988, 51), so he is unlikely to have been with the *cohors II Asturum* in Chesters in AD 217. To reconcile these two persons' dates it would seem that the inscription refers to the earlier governor. This inscription is also complete, brief and concise. Birley has pointed out that during the 2nd and 3rd decades of the 3rd century there were many examples of the provision of this kind of amenity (Collingwood & Wright 1, 1965, 472, *RIB* 1463).

There are other inscriptions which attest the provision of, or repairs of baths, e.g. *RIB* 605, 730, 764, 1091, 1212 and 1912 (Collingwood & Wright 1983, 87).

10. HYDROLOGY AND HYDROGRAPHIC DATA

Scholars have tried to make estimates of flow and several estimates have been published. Hodge (1990, 346-8) gives some of these discharge statistics for a number of aqueducts over the Empire, though none for British aqueducts. These statistics should be treated simply as orders of magnitude because of the many variables that are involved in calculating flow in channels or pipes. In Roman Britain, some calculations have been done for the Dorchester aqueduct and those at Dolaucothi. However there is very little hydrographic data of measurements of flow and mapping of leats which can assist in their descriptions.

Jones *et al.*, (1962, 78-9) calculated flow quantities for the aqueducts at Dolaucothi at Pumsaint in Wales.¹⁰ They used standard formulae for calculating the rate of flow in open channels for two depths (0.381m and 0.305m) to arrive at quantities of flow of 16.2 and 11.7 million litres per day. The Cothi leat discharged into a tank with a capacity of about 14,300m³ (14.3 million litres). Water was used from this and other tanks on the site for hushing of the ore to be processed for its gold. In the RCHM(E) article on the Dorchester aqueduct a flow quantity is given

¹⁰ The formulae on which they based their calculations are simplified versions of hydrological calculations, but provides adequate orders of flow quantities. Hodge also gives these formulae in his appendix (349-55), explaining in some detail for the non-technical person, how they are to be used.

(using the same formulae) of 58.9 million litres per day. (I have not found any other flow data for the other known aqueducts from Roman Britain.) The quantities quoted are enormous. I suggest that these flow rates are based on the maximum height of flow anticipated for the aqueducts, which would probably have been the flow rate during flood periods. For the Dorchester aqueduct, I calculated, based on the dimensions provided in the RCHM(E) article (p.587), that for one quarter of the depth of flow given, the flow yield would have been one fifth of that at the suggested depth of 61cm (2ft). Even so the yield would have been nearly 12 million litres/day.

Provision of overflow facilities for discharge of excess water was common in Roman water engineering. Such facilities were generally available to discharge water after it serviced public baths, homes, fountains, latrines and washed street drains, before it was allowed to flow into a river or out of the town. At Dorchester there is evidence of a conduit which removed excess water from the main aqueduct to the river Frome.

11. SOME CASE STUDIES OF AQUEDUCTS IN ROMAN BRITAIN.

11.1. The Dorchester aqueduct.

I discuss the Dorchester aqueduct in detail in Chapter 7. There I give an overview of the finding and modern surveys of the remains of the aqueduct, and then discuss a possible background to its original construction. I then advance a series of hypothetical assumptions about the leat-type aqueduct, in order to give a picture of what would have been the engineering implications of its construction. Bill Putnam has discovered that parts of the Dorchester aqueduct channel were in rock-cut (Putnam 1995, 128-31). He mentions that many of these rock-cuts have been silted up with deep overlying layers of soil (see Fig. 7.4) as at Fordington Bottom (B) (SY 6692 9109), at Muckleford (E) (SY 6397 9343) and at Penns Plantation (D).

11.2 The Lincoln aqueduct

Part of the Lincoln aqueduct route was published in 1954, and little additional information has been added since Thompson reported the structure in 1954 (Fig. 3.7a). In his paper on the Lincoln aqueduct, he refers to the eight 'piers' that must have stood on the bases shown in his Figures 2 and 3 (positions D to E) (1954, 112, 115). The figure also shows a projected dashed line from the known position of the aqueduct pipe, giving the relative elevations of suggested piers above the foundations that were found.

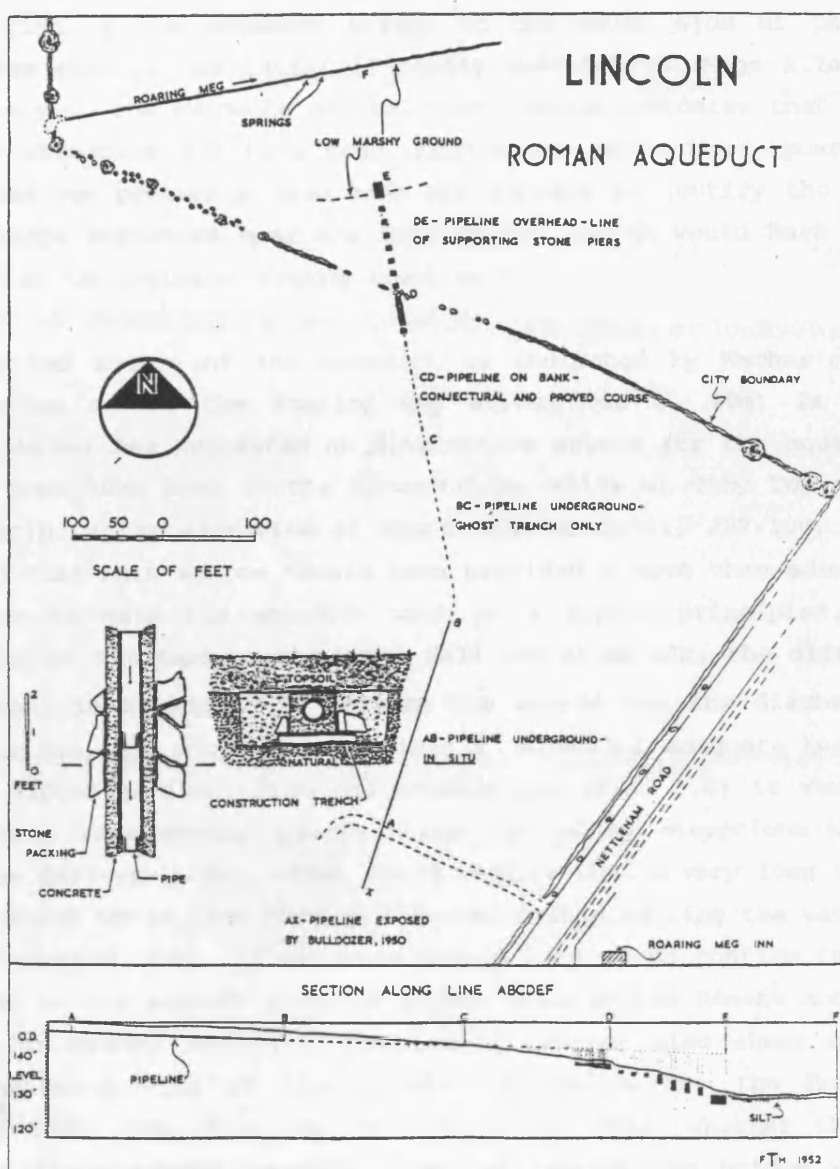


Fig. 3.7a: Route of Lincoln aqueduct (after Thompson 1954, Fig. 3).

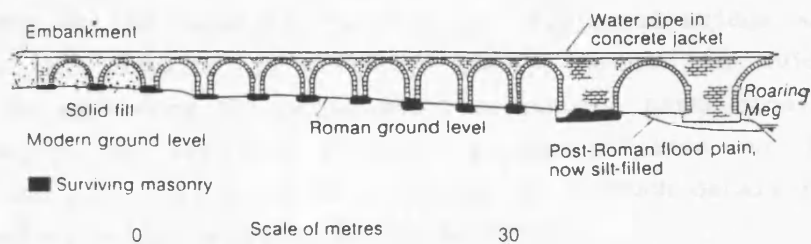


Fig. 3.7b: A possible restoration of the aqueduct bridge (Wacher 1981, 300, Fig. 18).

Wacher (1995, 141, Fig. 60) gives an elevation plan of "a possible restoration of the aqueduct bridge on the south side of the Roaring Meg". The form of the latter is highly speculative (Figs 3.7a & 3.7b). Nevertheless, the evidence of the 'pier' bases indicates that piers and a super-structure may have been constructed above them, possibly 3-6m high. Various proposals have been put forward to justify the existence of a bridge structure near the Roaring Meg, which would have carried a portion of the aqueduct system (section 9.3).

The implied source of the aqueduct as indicated by Wacher's possible restoration across the Roaring Meg stream (OD c. 40m) is unproven, though Wacher has suggested an alternative source for the aqueduct at a spring some 30km away in the Lincolnshire Wolds at Otby Top north-east of Lincoln, at an elevation of about 152m OD (1981, 297-300, Fig. 17). He said that this source "would have provided a more than adequate head of water to make the aqueduct work on a siphon principle".¹¹ If the elevation at the tank on the North Wall was at OD 67m, the difference in elevation (Δh of Fig. 3.3) between the source and the discharge point would be 85m, and would have provided a more than adequate head for the actual siphon portion. From the contour map (Fig. 3.8) it would appear that there were several places where the valley elevations were lower than the delivery point, which would require that a very long section of the aqueduct would have been an inverted siphon raising the water to the final required level. If evidence should turn up to confirm this route, it would be the longest inverted siphon built by the Romans and would be unique in ancient hydraulic engineering. Wacher also shows a proposed restoration drawing of the aqueduct bridge across the Roaring Meg (Wacher 1981, 300, Fig. 18), but it is not clear whether this formed part of his extended aqueduct.¹² By implication the bridge would have extended further north than the Roaring Meg for some distance, about which he gives no comment.

Since no evidence to date has been found of the aqueduct beyond the Roaring Meg or the superstructure of the suggested bridge and arcade structure this remains an unproven theory, until new evidence can confirm the existence of the aqueduct continuing northwards. Wacher's suggestion of an extended aqueduct is nevertheless an attractive solution and his route needs to be looked at in much detail to provide archaeological evidence before it can be accepted.

¹¹ Wacher 1981, and discussion, 297-304.

¹² It is noted that he has not included this reference in the second edition (1995) of his book though he included the discussion on the extended aqueduct.

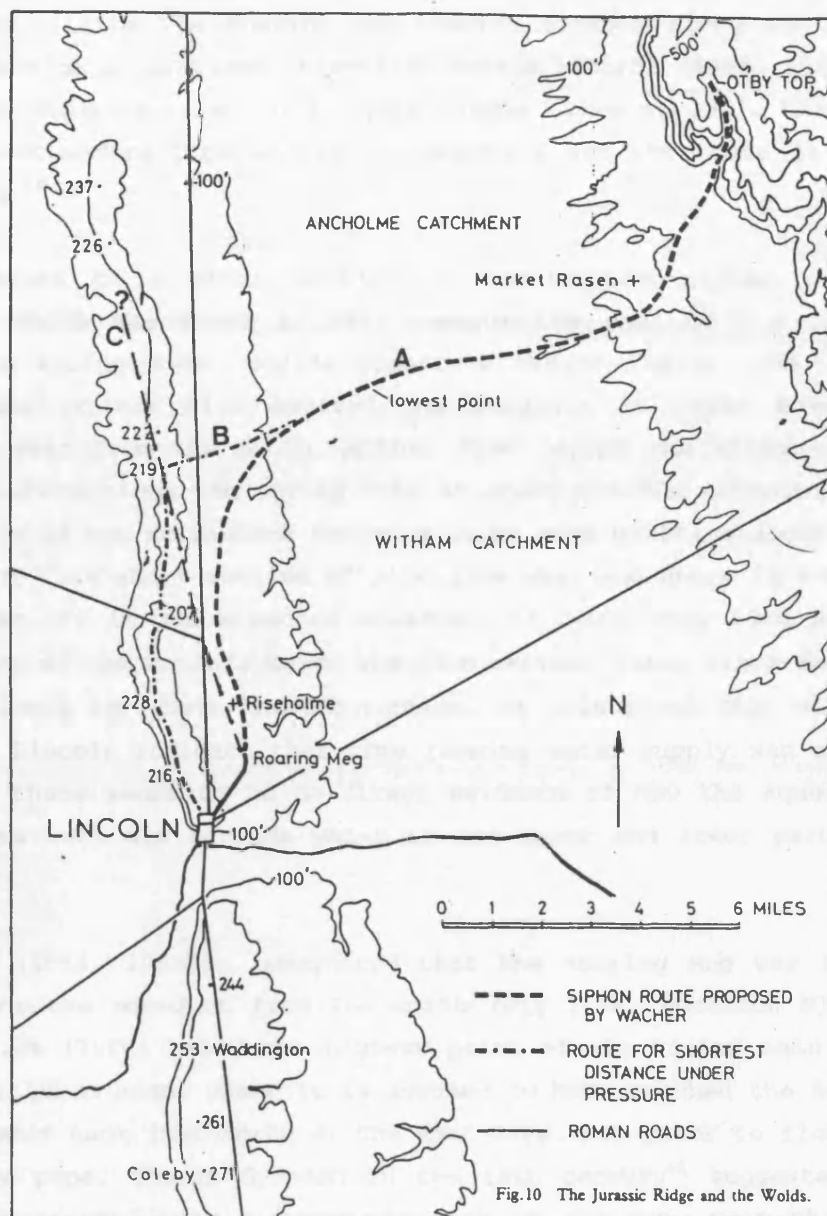


Fig. 3.8: Routes of Lincoln aqueduct suggested by Wachter (A) (1981), Lewis (B) 1984, Barker (C) 1995 (pers. comm.).

The Lincoln aqueduct was first referred to in 1700 by a Yorkshire antiquary in a letter to the Dean of York, commenting that "a small canal, or Roman aqueduct or pipe" was discovered. By 1781 "the aqueduct was apparently well known to the local inhabitants" (Thompson, 1954, 108). At that time certain substructures of the aqueduct were apparently still visible, but by 1806 Gough (1806, ii, 366) says that there was only "a mound where some traces of a tower or some building, supposed the place of a reservoir", which he marked on an accompanying map as

being circular¹³ (Thompson 1954, 109). Thompson describes the details of the aqueduct from the Roaring Meg towards Lincoln along the Nettleham Road, based on excavations undertaken during 1951-52 (1954, 106-28), the direction being revealed on air photographs taken in 1951. The aqueduct was an earthenware pipe encased in concrete and its route is shown on Fig. 3.7a.¹⁴

Lewis refers to a short section of earthenware piping encased in concrete which was found in 1857 towards the east of the lower town above the spring line, beside Greestone Stairs (Lewis 1984, 71, Fig. 11). Since it was also encased, he suggests it could have been a pressure main from the south, either from beyond the Witham river, or from somewhere along the spring line at about the 50m contour. It would seem there is not sufficient evidence to be more positive about what the purpose of this short section of pipe-line was, and where it entered the Roman town. If it was a second aqueduct, it could only have served the lower part of the *colonia* below the 50m contour line, since most of the upper *colonia* lay above the 55m contour. He points out that other pipes found in Lincoln indicate that some running water supply was available. However, there seems to be no direct evidence of how the aqueducts (if there were two) did provide water to the upper and lower parts of the town.

Thompson (1954, 106-28), suggested that the Roaring Meg was the water source for the aqueduct from the north (Fig 3.7a, position F). It was about 21.2m (70ft) below the highest point of the rising main aqueduct along Nettleham Road, where it is assumed to have reached the Roman town at the water tank just north of the East Gate. For water to flow upwards along the pipe, Thomas Sympson in the 18th century¹⁵ suggested that a tower was erected with a reservoir tank at the top, near the Roaring Meg. Its level would have had to be greater than 21.2m above the stream in order to function. From this tank, water could be discharged into the aqueduct through a down-pipe, thus forming a closed inverted siphon system. Excavation during 1951-2 revealed eleven foundation slabs for piers (shown in Thompson's Figures 2 and 3), on which it was suggested the inverted siphon pipe would have been supported. Two proposals for lifting of water to the top of the tank have been made by Thompson,

13 Camden's *Britannia* (ed. Gough, 1806), ii, 366, and Pl.X. Presumably the map Thompson refers to is Camden's Pl.X.

14 There seems to be some vague evidence of piping which brought piped water to the lower *colonia* site, with a suggestion that its source may have been along the Witham river valley (Lewis 1984, 71).

15 Sympson T, 18th c., *Itinerary Curiosum*, i, 88 and his *Adversaria*, see *Lincs. Notes and Queries*, ix, 65-90, mentioned by Thompson 1954, 108.

including an endless chain bucket system, or the use of a Roman type force-pump. Thompson favoured this latter solution (1954, 121-2), but the quality of force pumps at that period is not considered to have been of a standard that could have raised sufficient water for the needs of the *Colonia* (Smith 1991, 125-6).

FT Baker, who was involved in the original excavations, suggested to me in 1995, that he is of the opinion that the aqueduct crossed the Roaring Meg and followed a line towards the left of the main road to the north (B), along the Lincoln Cliff, the Jurassic ridge above the 61m (200ft) contour, where apparently there are springs. However he says, this has not been looked into. Lewis refers to this ridge in his discussion of Wachter's route for the aqueduct (Lewis 1984, 68), but he does not mention the possibility of the aqueduct having its source in this formation. If Baker's suggestion is a possible solution and a spring source was available on the ridge above the 61m contour, then the height to which water would have had to be raised into a tank would have been much less, in order for the inverted siphon to have functioned.

Wood (1981, 107-10) reported that the furthest south the earthenware aqueduct has been located is at a position a distance of 860m from the north-east corner of the Roman city (his Fig 13 p.108). As no evidence has been found of the aqueduct along the proposed line by Thompson beyond point X (Fig. 3.4), it "leads to the speculation that it may have turned from the presumed line".¹⁶ Unfortunately the article provides no spot heights of the last few places where it has been found. However, the 1:10,000 OS map contours indicate that Thompson's line would continue along an upward grade (to about OD 215ft, (65.5m) as suggested by Thompson), whereas, as suggested by Wood, it veered off to the south-west in the direction of the north wall of the *colonia* towards the Roman bath, or the *castellum*, which is at a lower elevation. It thus would seem reasonable to conjecture that the Roman engineers were aiming for a different entry point to the *colonia* than the one suggested by Thompson. The 1:10,000 Ordnance Survey map shows there is a valley (now filled in and built over, carrying a road) between point X and the bath of the *colonia*, which would imply the possible need of another siphon, not mentioned by Wood. At the present time this last portion of the aqueduct's route is still not resolved.

16 Jones (ed.), 1981, 83-114, with subarticle by Wood K F, Sect., 6, 'The Roman Aqueduct at Lincoln: Recent Investigations', Fig 13, pl.XXIa, b, 107-110.

At Lincoln, Thompson states that, from some point not far from the Roaring Meg source, OS surveying shows "that the pipe may have lain 1.3m (4ft) below the Roman period surface at this point. It then follows that there is a rise between source and supply-point of some 21.2m (70ft), attained over a distance of approximately 2km (1¼ miles). It is thus clear that, between point C and the upper Roman *colonia* the aqueduct constituted what water-engineers term a 'rising main'; the method of construction, in lengths of earthenware pipe heavily sheathed in waterproof concrete, indicates the measures taken to withstand the resultant pressure which must have been considerable" (Thompson 1954, 121). Thompson's suggestion would indeed have required a high pressure. No comment seems to have been made about the condition of joints when the lengths of pipe remains were recovered during excavation. From the few lengths of pipe in the Lincoln County Council Museum, I could not see any obvious problems at joints.

11.2.1. *The tank solution.*

Thompson suggests two possible methods of filling the tank: in the first of these, water would have been lifted into a tank at least 21m¹⁷ above the source by mechanical means using an endless chain and bucket arrangement. Water would then be allowed to flow by gravity along the down-pipe and under pressure along the rising main on the principle of the 'inverted siphon'. Alternatively, they could have employed a force-pump, such as the type found at Silchester (1954, 112-22). He discusses the two possible solutions in detail, but each one presents technical problems. The tank solution invokes the concept of the inverted siphon system with a reservoir tank raised on a platform providing the water source (Thomas Sympson's original suggestion). Lewis (1984, 65, Fig.6) shows some possible suggestions of how the tank arrangement would have provided water to the aqueduct.

In order to calculate the amount of water that could be made available using Thompson's suggestions I have produced a schematic diagram (Fig. 3.9) of the tank solution based on Thompson's descriptions and measurements. Some of the features of the superstructure shown, are my own schematic representations, merely to illustrate the principles involved. They are not meant to indicate what the Romans constructed, if, in fact, they did use this as a solution. Gough (1806) apparently reported the tank as being circular. The size of the tank is not known.

17 The height should be more to function as an 'inverted siphon'.

I have assumed that it is rectangular and similar to the dimensions of the foundation platform for ease of calculation purposes (Thomson's foundation No.VIII, p.120, Pl.XI). The size of the foundation was about 4.88m long by about 2.9m wide, giving an area of about 14m². It would have been adequate to carry a tank of similar area. The tower, on top of Pier VIII, may have been of wood construction as suggested by Thompson because of many nails found around the foundation bases, but it is not certain. Lewis, in his drawing, implies a masonry type structure supporting the tank and the down pipe towards the intake of the aqueduct.

If the outlet of the tank at its base was at least 21.2m above the water supply level (the Roaring Meg) relative to the highest point of the aqueduct near the colonia, the choice of height of the tank would have been important depending on how quickly it could be filled. For instance, if the tank height was 2m, then water would have had to be raised from ground level to a height of 23.2m, or 24.2m if the tank was 3m high. Table 3.3 gives some statistics related to the tank supply configuration and the aqueduct as given by Thompson.

It is necessary to know the heights of such a tank to provide sufficient quantities of water. The Table 3.2 below gives height and capacity in litres:

Table 3.2: Capacity of aqueduct supply tank.

Height (m)	Volume (m ³)	Capacity (litres)	Mass (kg) ¹⁸
1	14	14,000	14,000
2	28	28,000	28,000
3	42	42,000	42,000
4	56	56,000	56,000

The minimum head of water between the tank and where the suggested down-pipe enters the aqueduct is 16.3m (OD 61.2m-44.9m) giving a water pressure at Pier V of 163 kPa.¹⁹

18 The tank with a height of 4m would have exerted a pressure on the foundation of between 400 to 500kPa, which would have been well within the bearing capacity of the foundation.

19 A head of water of 16.3m is equivalent to $16.3\text{m} \times 1000\text{kg/m}^3 = 16,300\text{kg/m}^2 = 163,000\text{kgf/m}^2 = 163\text{kPa}$.

Table 3.3: Statistics for tank and aqueduct (Thompson 1954, 112-22).

Heights above sea level are given as Ordnance Datum - OD.

Letters A-F and X are given on Thompson's Fig.2 (p.112) (my Fig.3.9), which are pertinent to his discussion in the text.

E-F: OD of Roaring Meg pool, and top of foundation VIII at 39.9m.

D: OD of foundation I at 42.4m.

C: OD at 43.6m.

B: OD at 44.0m.

A: OD at 44.5m.

X: OD at 45.4m.

Top of pier on foundation VIII at OD 42.9m.

Suggested point where down-pipe enter aqueduct pipe, at OD 44.9m.

Bottom of tank at OD 61.2m, also the delivery level at the Colonia bath(?).

Top of 3m high tank at OD 64.2m.

The relative levels of the bottom of Piers I-VIII and 1, 2 and 3 south of pier I, resting on the foundations discovered during the 1951-2 excavations, are shown on his Fig. 2 and I have reproduced them on Fig. 3.9.

Thompson (1954, 121) suggested that the tank could have been filled with an endless chain carrying bronze buckets (Vitruvius *De Arc.* x, 4.4), which I have depicted diagrammatically in Fig.3.9. Whatever the means of generating power to work this system, it must be assumed that it could fill the tank at a reasonable rate. If a bucket held 5 litres and say the chain system had 20 buckets,²⁰ each complete revolution would have delivered 100 litres of water to the tank. If a revolution took say two minutes to complete, the system would have raised 72,000 litres of water per day. This would have provided about 14 litres per person for a population of 5000 inhabitants. If a bucket could hold 10 litres the system could have delivered about 140,000 litres per day. Also, if there were two sets of chain and bucket systems the delivered water could have been doubled, and it also would have been insurance against breakdown of one of the systems. The assumptions suggested are speculative and is intended merely to provide an order of delivery of water at the colonia. The suggestion is that the aqueduct was directed towards the bath (Wood 1981, 107-10), which means most of the water would have been used for that facility. Of course, in a week the system would have delivered about half a million litres of water, part of which could have been distributed to the rest of the town.

²⁰ The height of the installation would have been of the order of 25m, suggesting a bucket every 2m.

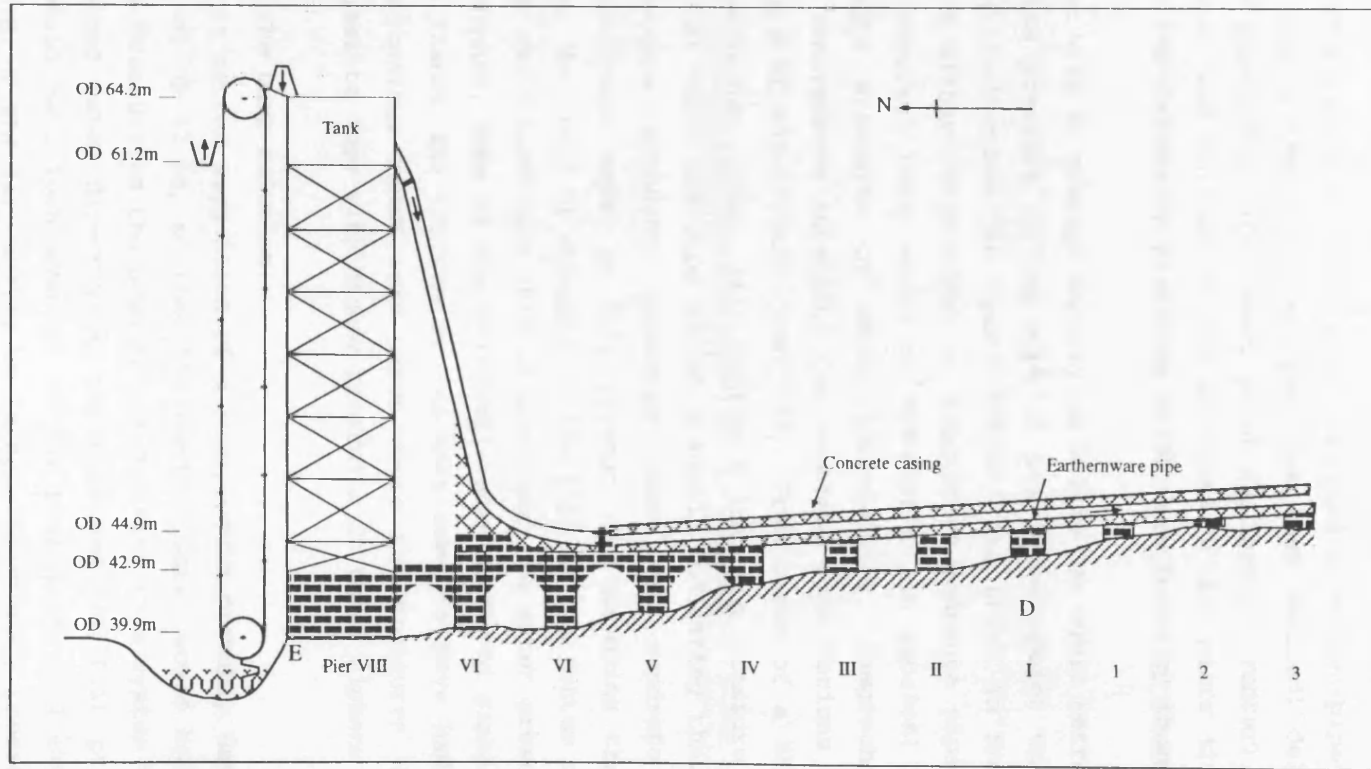


Fig. 3.9: Diagram of suggested tank system at Roaring Meg, (by AB).

The amount of water involved is low compared to what calculations show other aqueducts delivered.²¹ No remains of a tank or a chain and bucket system, or a pump, have been found in the vicinity of the Roaring Meg.

The outlet from the tank would be connected to a down-pipe (here assumed to have been a lead pipe, and may have been encased) delivering water into the aqueduct at its lowest point (Vitruvius' *venter*). This section would have been carried on the proposed bridge piers that would have stood on the foundation platforms which were found by Thompson.

For water with an average density of 1000kg per cubic metre at a head of 16.3m, the pressure in the pipe at its lowest point would have been 163kPa (kilo-Newtons per square metre), for which in modern times we would use either steel pipes or reinforced concrete piping. Very good quality concrete today would be 400-600kPa (in tension) concrete with compressive strengths of about 1200-1800kPa. Lamprecht gives some typical compressive strengths for concrete from various structures in the Empire of 800-1700kPa (1988, 36). From tests of a short length of the pipe Wachter (1995, 141) quotes a bursting pressure of 6.3kg/cm² (630kPa) at which the pipe jacket cracked, indicating that the concrete had adequate strength (assuming that the concrete sample was representative). Based on this strength and assuming that this would have been the order of strength of the pipe at the bottom of the siphon, the pipe would have been able to withstand the water pressure generated by the siphon. Some of the more well-known inverted siphons such as at Gier in France and the one at Pergamon seem to have had much thicker concrete casings round lead pipes where the pressures were generally also higher to cope with higher pressures in their siphons.

11.2.2. *The pump solution.*

Thompson's second suggestion of a pump, would probably have operated at a level of OD 42.9m, so that the head of water would have been 18.3m, giving a pressure on the pump of 183kPa. With this system the pump would have forced water directly up the pipe and the full pressure of the water would have been exerted on the pump piston. I doubt whether a Roman pump of the 1st century could have provided a pressure that would have been necessary to force water up the aqueduct against that back-pressure in the pipe. With the technology available to the Romans it is inconceivable that they could have produced pumps with packing between

²¹ If the rate of flow in pipe is assumed to have been 1m/sec the pipe would have delivered about one million litres of water per day, indicating that with the proposed tank scheme it would have been delivering water well below its capacity.

the cylinders and pistons that could hold a pressure of that magnitude. Today special O-rings are used in pressure pumps with close tolerances between cylinders and pistons in order to transmit high pressures and the casings would be made of steel or special aluminium alloys. The Romans used bronze in the late first and second centuries, whereas earlier they used wooden cylinders. I estimate from replicas of reconstructed Roman force-pumps that they could lift water at most about 4.5m, provided there are reasonably close tolerances between the cylinder casings and the pistons, the surfaces are smooth and the pistons have good quality packing like strong leather to provide a seal between piston and cylinder. Lewis (1984, 64-6) also comments on the use of a pressure pump by the Romans at Lincoln, indicating that the pressure on the piston would have been of the order of 255kPa (37 lbs/in²), which is a load of nearly half a ton. It would have required enormous leverage to lift that amount of water load along the pipe. He concludes that it all seems very unlikely.²²

Thompson suggests delivery quantities by pump of the order of 5 gallons/minute, or 22.5 litres/min. The volume of the aqueduct pipe of 2km length and nominal diameter of 0.12m would have been 22.65m³, a capacity of 22,650 litres. As he pointed out, to provide water for 5000 inhabitants would have taken 16 hours continuous pumping, but it would have taken more than 11 hours merely to fill the pipe. He also suggested that two pumps would have provided the *colonia* inhabitants with double the daily amount of about 5 litres per day. Assuming the pump(s) did not break down and never stopped²³ the water delivered for such an ambitious project does not seem to have been typical of Roman engineering planning. Based on these arguments the proposed pump system seems unlikely to have been an alternative solution.

Lewis (1984, 63-72) discusses the implications of the various proposals by Thompson and Wachter for the water supply to Lincoln, indicating that these were fraught with problems and that Lincoln's supply was still unresolved in 1984. No further work has been done on this since 1980 (personal communication, Mike Jones). Of the two suggested methods by Thompson I would prefer the chain and bucket/tank solution, provided more information can become available about the elements of the system as proposed and evidence of some remains of the equipment used. However, the two proposed solutions would have been very inefficient ways of

²² Lewis 1984, 57-73.

²³ Thompson mentions allowance for leakage of 50%, which would require no stoppage in the pumping cycle to prevent filling the pipe again, a vicious circle.

providing a running water supply to a deliberately planned large colonia.

If the earthenware pipe sections that have been recovered are examined they appear clean with no apparent deposits of calcium carbonate. Pipes carrying water from geological limestone environments similar to that of the Lincoln area usually are encrusted with lime deposits. An obvious investigation that should be carried out is to examine other pipes in the same area in which it is positively known that water has flowed to note whether they show any marked deposition of calcium carbonate. Dr Graham Morgan tested the interior of the portion of the Lincoln aqueduct in the possession of the School of Archaeological Studies, Leicester, for any lime deposit. The test showed no lime reaction, from which it could be inferred that lime-rich water did not flow in the pipe. However, more extensive tests will have to be done to be positive that water did flow in the aqueduct for any length of time and that it did function as intended.

11.3. The Raw Dyke, Leicester.

The Raw Dykes is mentioned by John Nichols in his 1810 'History of Leicester', referring to "the army of King Charles that was drawn up ('in these famous vestiges of Roman labour') when preparing to storm the Town of Leicester in 1645" (Nichols 1810, II(2), 505-6). A slightly different version appears in the Victoria County History, Leicester (I, 1907, xxxi, 14, 252, & 273) where it is stated "that the 'Raw Dykes' are the remains of the oppidum of 'King Leir'". The first reliable information of the occupation of Leicester is from the Roman period. Kathleen Kenyon (1948, 40-1) discussed the possibility that the Raw Dykes (Fig. 3.10) might have been an aqueduct after dismissing the interpretation of the earthworks as a defensive rampart. This was first suggested by William Keay, a consulting engineer, who was on the excavation committee for the Leicester Roman Forum during the early 1930s. He originally presented a paper to the British Association, Archaeological Section in 1933, where he gave his opinion that the Raw Dykes was a likely aqueduct supplying the town of Roman Leicester (Ratae) with running water. He commented that no wells have been located for the Roman period in Ratae (several have been found since) and with a population of the order of 5,000, an external water supply was essential. The *SMR* records have some details of his work on the subject of

the Raw Dyke, including a brief report on his opinion and a plan showing details of the so-called aqueduct site, with survey details.²⁴

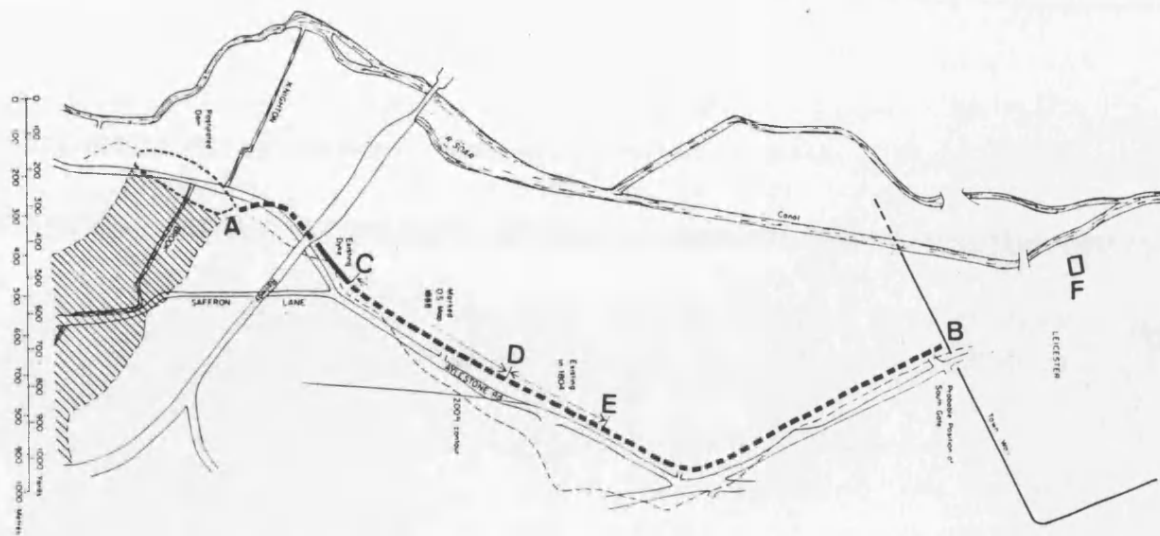


Fig. 3.10: The Raw Dyke, Leicester, (after Wacher 1995, Fig.58).

The conjectured construction of the Raw Dyke consisted of a leat type excavation from the Knighton Brook (A) along the 61m contour for about 2.4km to the Roman town, entering the Ratae town walls through the south gate (B) (Fig.3.10). A portion of this ditch (leat aqueduct) still survives in the town near the junction of Aylestone Road and Saffron Lane (C). At Saffron Lane the ditch was cut along this contour and the material from the east side was dumped along the west forming an embankment. At the top the ditch was about 15m wide and 4m at the bottom, and about 2.4m deep (Wacher 1995, 350). William Keay prepared a plan showing the route of the aqueduct, suggesting that it was fed from the Knighton Brook and that there may even have been a dam constructed across the stream west of the intake of the aqueduct.

Kathleen Kenyon said there were several problems with relative levels relating to the channel and the baths, as it skirts past the baths into the town centre. She suggests that as a theory it is "not entirely satisfactory, but the best that can be put forward on present evidence" (1948, 41). At a door-sill of the Jewry Wall, she points out the level is at 62.3m and the channel bottom is at 57.1m, about 5m too low to provide water directly to the baths (1948, 41). She then says "when experience showed that the level was too low, an effort was made to

²⁴ A copy of this report and the plans, together with a copy of a statement he wrote for the *Leicester Mercury* of 27 May 1938, 'Leicester's Roman Aqueduct', is held in the SMR records at the Jewry Wall museum.

correct it by raising the bottom 6ft 6in" (2m) (1948, 41), but she does not show how this was achieved.

At the Knighton Brook end Keay also shows a length of about 320m (A-C) of the Dyke as being conjectural. The 1888 OS map showed a length of 740m (C-D) of the Dyke south of the short length of the Dyke still visible near Aylestone road. In 1804 a portion of about 300m (D-E) was reported to be still visible. Keay's firm did a tachy survey of the remains of this surviving length of the Dyke and from city plans of the area produced the line for the rest of the Raw Dyke.²⁵ Keay mentions on his plan that Dr Stukeley reported the length of the dyke as being 1,904 feet (580m), which is considerably shorter than his plan shows, that is 2.4km to the south gate.

The interpretation of the Raw Dyke as an aqueduct raises several questions.

Firstly, was it an aqueduct, and was it constructed by the Romans, or was it constructed at a later date? There appears to be no literary or archaeological information to confirm any of these questions, except for Nichol's unsatisfactory reference given above. Secondly, assuming it was of Roman construction, then they must have been aware from the start that it would not be able to serve as a supply for the baths (F), which were at an elevation about 5m higher. That would not have deterred the Roman engineers. I think, if the structure was an aqueduct, the supply of water to the baths became a secondary issue, the main purpose being to bring water to at least the lower parts of the town. It would be reasonable to assume that the aqueduct would have provided a good constant flow of water, the reason for it being built. If so, it must have been purposefully built to supply a large number of inhabitants, other public buildings and probably fountains. Some of the public buildings were, like the baths, at a higher elevation level than the 61m contour, so to supply water from the dyke to these public buildings would also have been a problem. This seems to raise the issue of where the majority of people lived in Ratae who could have benefitted from the aqueduct. Thirdly, assuming that the dyke was the Roman aqueduct and there was this problem about elevation, would it not have been sounder engineering practice to have built a central tower with a raised tank near the south gate and distributed water from there to the various buildings including the baths and inhabitants rather than have the tower

²⁵ Wachter in his book used this basic plan to provide his Figure 158 of the line of the aqueduct.

within the precinct of the bath? Kenyon suggested that a tower was built in the courtyard of the baths and water raised from the river below (Fig. 5.6). The River Soar was another 8m below the level of the Raw Dyke at the east gate, requiring water to be lifted to the raised tank on a tower to a height of about 15-18m. It was not the policy of the Romans to draw water from main rivers for towns. It would seem to me that if the Raw Dykes was indeed the water supply of Roman Leicester, then a raised tower in a more central place would have been the Roman solution, for which there are many precedents, such as at Pompeii. Such a tank would have had similar problems to the one assumed for Lincoln, except that an inverted siphon would not have been part of the supply system. So far there has been no evidence for such a structure.

Kenyon suggested that the Raw Dyke as an aqueduct was a failure, implying that the town did not have a running water supply until the 4th century when a tank supply was provided in the south-west corner of the baths (Wacher 1995, 349). It would seem that there is no physical evidence for such a tank; only Kenyon's attempt to justify the anomalous situation of a large bath needing plenty of water and an aqueduct of doubtful use or even existence. Wacher comments on the large drains virtually round three sides of the bath-building, which seem to indicate that plenty of water was freely available at the baths, and which had to be disposed of (1995, 349). He mentions that a ditch was found on the east side of Southgate street northwards away from the Raw Dykes (352). Belairs (1899, 40-4) described a sewer which started from the vicinity of the baths, then discharging into the river. This would imply that from somewhere excess running water was being drained, which must have somehow reached the bath. The meagre evidence certainly supports the existence of an illusive aqueduct and distribution system.

However, recent archaeological investigations have not been able to confirm the presence of an aqueduct in the vicinity of the supposed south gate. R J Buckley of ULAS (personal communication April 1997), mentioned to me that excavations outside the defences of Roman Leicester on either side of Oxford street did not show any evidence of the Raw Dyke having reached as far as the south gate. The Raw Dykes was also not found during recent investigations near the Royal Infirmary Hospital. Also, between the River Soar and the Jewry Wall baths no evidence of the Dyke has been found, nor has any evidence been found of any water-related features around the semicircle of Keay's suggested loop towards the east gate. There is possible evidence of a fountain base with a draining pipe, which has been found in the south-west corner at the

junction of the Roman road coming from the east and passing south of the forum on the south-north road between the forum and the baths. Based on this evidence it would seem the solution to the water supply of Roman Leicester is far from resolved.

Neither of the two aqueducts discussed above has provided satisfactory answers to the question whether they actually functioned as intended during Roman times. If they were intended to do so but did not actually deliver water as planned, it would indicate poor planning, ingenuity and surveying on the part of the Roman engineers. However, lack of archaeological evidence in these two instances leaves that verdict about their engineering planning still to be determined by future work.

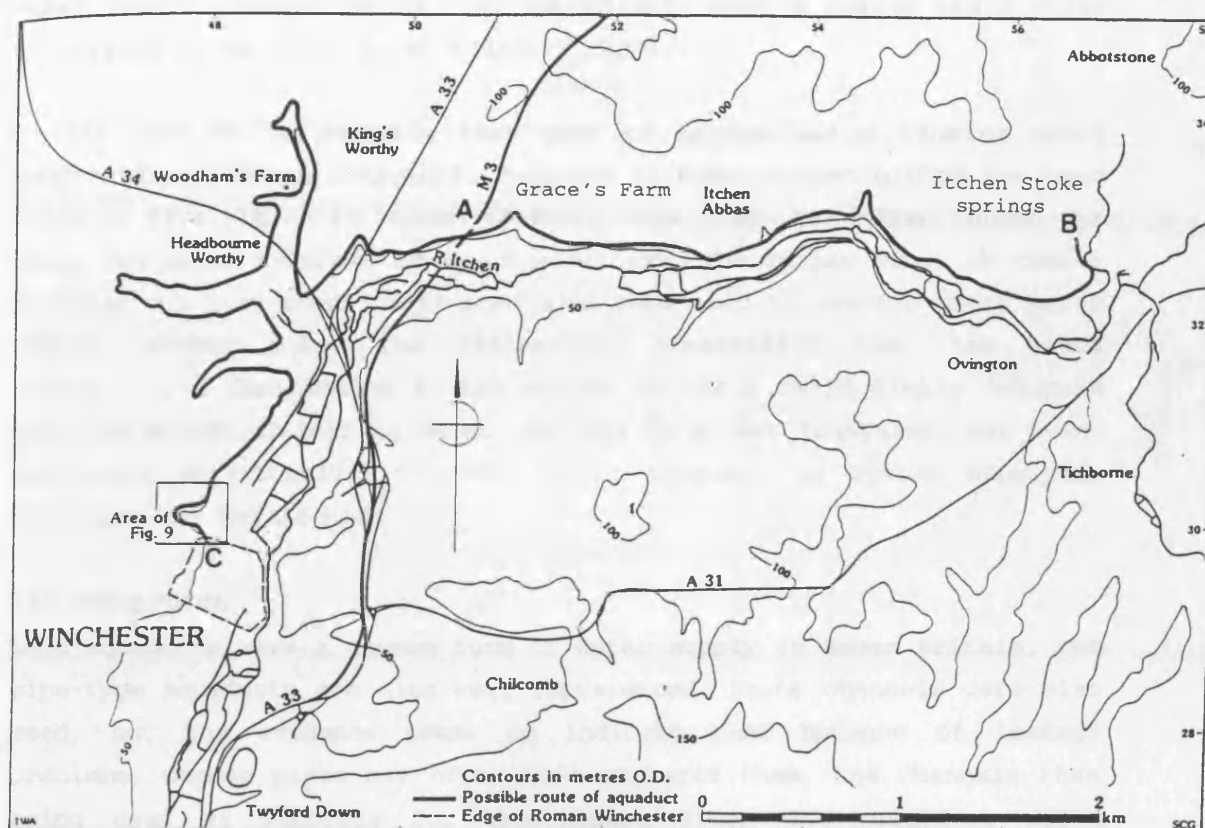
11.3. The Winchester aqueduct.

Until the 1980s only the terminal end of the Winchester aqueduct was known (Stephens 1985a, 203-4), although it was suspected that its source must have been the river Itchen near its headwaters. During 1983, the watching brief and rescue archaeology whilst the M3 motorway was being reconstructed, revealed the presence of the aqueduct on Grace's Farm (A) (SU 5060 3286, Fig.3.11)²⁶ along the route of the motorway. The Trust for Wessex Archaeology, through the M3 Archaeological Rescue Committee, then did a geophysical survey of a portion of the aqueduct near Grace's Farm, and an airphoto study of the whole route. The importance of this recently discovered aqueduct is that it is the longest aqueduct so far known in Roman Britain. Its length is reported to be 23.75km (p.8) (Fig. 3.11), following a winding route along and across contours to maintain an acceptable flow grade. The source is at several springs above the Manor Farm near Itchen Stoke (B) (Fig.3.11) some 6 kilometres in a direct line from the delivery point at the north-west corner of the Winchester defences (C) (Fasham & Whinney 1991, 9, Fig.7).

The report on the structure so far can only be considered as an interim one. There would have to be a more detailed examination of the aqueduct over its full length to establish its exact route and the profile of the structure along its length. The geophysical work was done on sections along its assumed route based on detailed 1:10,000 OS maps and from this information a complete route has been provided. The report mentions several problems with the location of the route, but is not clear on the details. Further investigation of the structure will be necessary to

26 Fasham & Whinney 1991, 5-11.

confirm whether, like the Dorchester aqueduct, it also needed to be dug into the underlying rock along parts of its course.



Wilmott's reports), from within the walls of Roman *Londinium*, and distributed to places in the town along pipes. This type of situation may not evoke the idea of an aqueduct in the accepted sense of bringing water from a distant source, but technically such a system would still be classed as an intra-mural aqueduct supply.

At any rate it is possible that part of London had a running water supply, discussed in Chapter 4. Evidence of Roman wooden piping has been found in five places in London (Wilmott 1984, Fig. 1).²⁷ Even though the first two baths referred to above were along the spring line, it cannot be ruled out that conduits of some kind were used to provide their water supply. Wachter makes the interesting observation that "as seems likely,..., a diminishing in the number of wells could simply indicate that the supply of running water, perhaps to street fountains, was being used more efficiently..." (1995, 110); however, no system supplying fountains has been found.

12. CONCLUSION

Leat aqueducts were a common form of water supply in Roman Britain, but pipe-type aqueducts are also well represented. Stone channels were also used, but the evidence seems to indicate that because of leakage problems, wooden pipes may often have replaced them, the channels then being used as supports for the pipes. Sites with aqueduct water supplies, based on the archaeological evidence, represented only a relatively small number of sites with running water supplies and I believe that the number should be considerably higher. In the archaeological literature reference is often made to the likelihood of sites possibly having had aqueduct water supplies, but that they have so far not been found. For a better understanding of the wider issues relating to the internal distribution of water at urban centres, clarity on their external water supplies requires urgent further research. Progress on water supply and internal distribution at many sites like Cirencester, Colchester, Gloucester, Leicester, Lincoln, Verulamium and York, cannot be made without further study of where their running water supplies came from.

²⁷ Home 1948, note 2, p.170, 'From the Bank of England site have come lengths of squared oak, 7¼ x 4½ inches, with circular piercing 1¼ inches in diameter. These wooden pipes seem to indicate one of the various forms of supply'. Marsden P, 1980, 23, reports 'a wooden pipe made from interconnecting links joined by iron collars or rings ran alongside the front of the building, ensuring a supply of running water to at least some of the tenants...., and it was through the end wall of this room that a wood-lined drain emptied waste water into the area beyond'. Merrifield 1965, at pages 73, 148, 239 item 170 and Fig. 29, confirm the two sites where water piping have been found.

Other issues such as who constructed and surveyed leat aqueducts is completely unknown for Roman Britain. For instance how often were inverted siphons used in Britain? Except for Lincoln, inverted siphons are usually only suggested as possibilities, such as at Chester and Colchester, but no firm archaeological confirmation has been provided. The subject is in need of specific research.

Wooden pipes were a very popular means for distribution of water. The evidence for lead and ceramic pipes is more difficult to trace. Lead pipes may have been used more widely than presently acknowledged in the record.

Water sources were generally from springs, or the head waters of streams. Dams were often built at stream heads as sources for water, but evidence for them in Britain is scarce. Many sites relied on wells for their water supply, and other less secure systems such as tanks collecting rainwater. The next section will discuss these alternative means of water supply, and attempt to assess whether aqueducts were a substitute to the standard form of well water supply.

CHAPTER 4.

WATER SUPPLIES: 2) RAINWATER CATCHMENT AND WELLS

1. GENERAL

Rainwater catchment will be discussed first, because the main part of this chapter will be about wells.

2. RAINWATER CATCHMENT

Storing of rainwater, such as at hillforts, was probably the earliest form of man-made water supply. Although water could be carried in skin bags and pottery vessels, the quantities would have been limited, so that ponds would seem to have been a solution. In ancient Babylonian, Minoan and Mycenaean palaces there were structures found which appeared to have been used as storage tanks, including the very large urns found at Knossos. Tanks as a storage structure in Britain were introduced by the Roman army in their fortresses and forts, and thereafter they were features found in all the different site types.

In the typical Roman houses in Roman Italy the *atrium* usually had a tank below floor level where water was drained to from the roof of the house. Houses in Britain did not seem to have a principal room with a tank, but provision was made for storing of rainwater in specially constructed tanks. Tanks were constructed with materials of wood, lead and stone. Wooden tanks were not large because of the problem of containing the planks so that they would remain waterproof. Barrels usually had a truncated oval shape because it was found that this added to their strength and improved the sealing between staves, but this was not possible with larger vessels used for water storage. The one redeeming factor about wood is that when it is kept wet it self-seals as it swells. Lead tanks were used, but lead was an expensive commodity; they generally seem to have been round. Several lead tanks are reported, including some used for Christian religious purposes. Stone tanks were the most popular water storing facility in forts, public buildings and private homes. They generally were rectangular in shape and the walls were constructed on a plinth usually made of ashlar slabs. Various means of water proofing of stone tanks were used: wood-lined, lead-lined, clay-lined and lime mortar-lined. I would think that stone-lined tanks must have required constant maintenance, especially the clay- and mortar-lined ones. The clay must have been a specially heavy clay with a high plasticity in order to stick to the walls. With the elapse of time the clay would have become completely saturated and would have slaked from the wall, thus requiring resealing. Mortar-lined stone walls would

have been very sensitive to minor movements which could have been caused by constant buffeting by buckets and being bumped by humans or animals, or settlement of the foundation slabs. The mortar across a joint between stones has no tension strength, so that the slightest movement caused either by an external agency or temperature variation, could have created leaky joints.

A number of villa houses have been reported with such tanks such as at Gatcombe (metal-lined?), Halstock (stone), North Leigh, North Fleet (clay-lined) and West Wickham (wood). At the small town of Ashton a lead tank is reported. Tanks at forts were generally of stone construction, even at the Lunt fort, where most of the buildings were of wood construction.

I have recorded the remains of 102 tanks at all site types, but there must be many more not recorded, or they have not been found. Table 4.1 gives the distribution of sites with tanks (and lists the total number of sites included in the database below).

Table 4.1: Sites with tanks

Forts	Coloniae	Muni- cipia	Civitas capitals	Small towns	Settle- ments	Villas	Total sites
32	2	-	6	8	16	38	102
24%	50%	-	43%	12%	8%	10%	
135	4	2	14	67	212	372	

2.1. Sites with tanks.

2.1.1. Forts.

The number of fort sites recorded to have had tanks is unrealistically low, because most forts must have had a water storage feature, even if there was a well on the site. With many soldiers being around much of the time, easily available water would have been a necessity. The remarks relating to wells and the number of fort sites recorded in the database compared to the total number of forts known, applies to tanks as well. Even the small fortlets would have required more water storage than could be stored in *amphorae* alone.

The cavalry fort of Lunt at Baginton had 15 tanks, some of them used for drinking water for horses, although they possibly could have been taken to the River Stowe to drink. It had 6 wells which would have been the water supply for the tanks.¹ Housesteads had 5 tanks made of stone slabs and lined with mortar, including the still well-preserved remains of the

¹ There are three excavation reports for the Lunt fort, but I have only had access to the first two.

one north-east of the latrine near the South Gate. How these tanks were filled is not clear, although a few of the possibilities of how water was supplied to the fort have been mentioned in Chapter 3.

Some tanks were filled from the roofs of buildings that had gutters with down-pipes, but how general this would have been in forts is not known. Storing water obtained from rain water could have been only a supplementary source of water and is unlikely to have been sufficient for auxiliary forts, but could have been useful in emergencies when the other sources were temporarily out of action.

2.1.2. Other sites with tanks.

Tanks were recorded at all the site types other than the two *municipia*. However, Table 4.1 shows that the number of sites that had tanks for the sites recorded in the database is low, which makes it even worse when considered for all the known sites of the Roman period. It is most probable that tanks would have been used at these sites but have not been discovered yet, or have been completely destroyed. In Frere's extensive reports on Verulamium no mention is made of tanks or shown on any of the plans, although many other water-related features are shown, such as drains and pipes (1972, Vol.1; 1983, Vol.2). In London, the remains of three tanks have been found. A tank is associated with the Billingsgate baths south of the *frigidarium*. A large timber tank preceded the 3rd century bath-building. At the Cheapside baths the remains of a timber-lined 28m³ tank (Fig.4.1 below) was found, situated to the north of the baths. It was not revealed how water was transferred from the tank to the baths or how the tank was filled. The tank was partly sunk into the gravel layer and it had no bottom, so it may have filled by seepage from the bottom, since the water table was high and ground water was abundant in the area (Wilmott 1982b, 239). At Silchester only one tank is recorded, but this also seems unrealistic, considering there were 76 wells. The villas at Keston and Whitebeech had 6 and 5 tanks respectively, and the settlement at Sibbington had 4. These are the highest number of tanks recorded for non-military sites. Generally one or two tanks is the norm for the other sites.

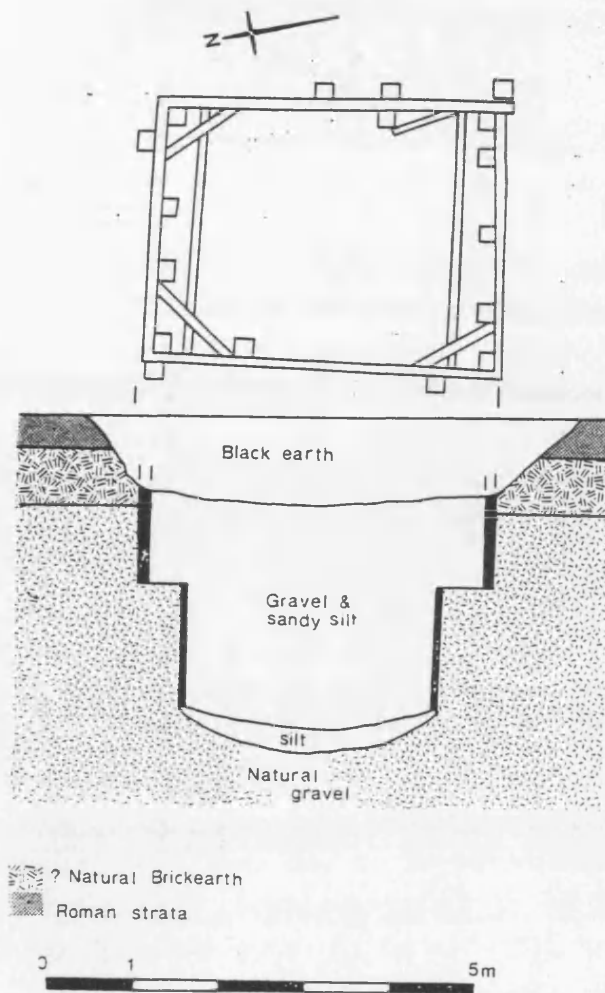


Fig.4.1: Plan and section of timber water tank at Cheapside baths, London (after Wilmott 1982b, 238, Fig. 6).

Where there are records of sites with tanks and aqueducts and other water-related structures, the possibility may also be that the tank (or at least one if there are more) is associated with the aqueduct, as for example at Aldborough, Darenth, Halstock, Lincoln, Prestatyn and Stanwick.

Obtaining water from the roofs of buildings other than at forts was probably also a common practice, but the evidence would be difficult to substantiate, unless guttering can confirm it and has been found attached to fallen down roof structures. I have not come across such evidence, but it would be surprising that rainwater catchment was not a general practice in Britain during Roman times, since it was a common practice elsewhere.

3. WELLS

3.1. General.

Wells were a common form of water supply for both public and domestic use in many parts of the world from the early Bronze Age. It was important to have well water supplies even if a community had a running water supply because of possible droughts, attack by an enemy who could cut an aqueduct supply, or because an aqueduct became inoperative. In dry climates like North Africa and the Near East wells were an important means of water supply because of the short rainy season. In many parts of Africa it is still a basic form of water supply. Wells were used as water supplies in Britain until the early part of the 19th century, when boreholes increasingly replaced wells, which continued the principle of winning water from underground sources.

For wells of about one metre in diameter one person usually had to do all the work of digging the soil or chiselling the rock material and filling the containers. Wells of about 2m diameter and larger could be dug by more than one person at the same time. As the depth of a well increased from about 10m the problem of fresh air became important and diggers would have had to be relieved more often than at shallower levels. I have personal experience of this; once when inspecting a dry pit 12m deep I had to be hauled up after 20 minutes at the bottom because of dizziness due to foul air. In modern engineering practice, fresh air is pumped through pipes to the bottom of deep small dimension pits to prevent suffocation resulting from foul air, mostly caused by an individual inside the pit exhaling and reinhaling carbon dioxide. The exertion of digging makes this problem worse and one wonders how many well diggers in early times succumbed while digging such deep wells. Pliny the Elder mentions the problem of noxious gasses down deep wells, and says it can be improved by fanning with linen cloths. He also mentions that deep "well-diggers are killed when they encounter sulphurous and alum-laden fumes", (*HN* 31.49).

Few wells from antiquity, certainly for Roman Britain, have been excavated for information on their intrinsic water supply function. Where they have been excavated, the reason generally has been for finds found in them (Chapter 2, p.41, item 3). However, some wells have been excavated in sufficient detail to reveal their lining by steining, such as examples at London, Silchester, Scole, Southwark and Lancaster (see Table 4.3, p.108). I traced at least 30 sites with wells that were lined.

For Britain I have been able to trace 350 sites with Roman wells, but this underrepresents the likely total number. Table 4.2 shows the number of sites with wells found at the different site types. Column 2 gives the number of sites with wells for each site type, and column 4 gives the number of all sites with water-related (w/r) features for each site type.

Table 4.2: Sites with wells

Site types	Sites with wells	Percent* of well sites	All sites with w/r features	Percent** of well sites in relation to total sites
Forts	43	31%	137	12.0%
<i>Coloniae</i>	4	100%	4	1.2%
<i>Municipia</i>	2	100%	2	0.6%
<i>Civitas</i>	11	78%	14	3.1%
Small towns	52	79%	66	14.8%
Settlements	135	63%	212	38.6%
<u>Villas</u>	<u>104</u>	<u>28%</u>	<u>372</u>	<u>29.7%</u>
Total Sites	350			

* Percent of sites with wells is arrived at by dividing items in column 2 by items in column 4 and multiplying by 100.

** Percent of sites with wells in relation to total well sites is arrived at by dividing items in column 2 by the total number of sites and multiplying by 100.

The percentages in column 3 represent the proportion of sites with wells found for each site type compared with the number of sites with all water-related features for each of the seven site types. The percentages in column 5 represent the proportion of sites with wells for each of the site types compared with the total number of sites with wells for all site types. In the table the generic site name 'fort' has been used which includes fortresses, forts and fortlets.

The percentages are not statistically significant, but they do show some trend in the archaeological record. For instance, the 43 fort sites with wells is a relatively low percentage of the total number of all site types with wells, whereas 135 settlements had wells recorded, nearly three times as many as at forts. Villas with wells also show a larger percentage of sites with wells than for forts. An obvious question seems to be, did a lesser proportion of forts in reality have wells than other types of site?

It is to be noted from the data in the table of Appendix 1 that most sites have few wells; however, there are several exceptions. Table 4.2 lists the sites with 10 and more wells given in Appendix 1. At 222 sites only one well was recorded and at 128 sites more than one and less than 10 wells were found.

Table 4.3: Sites with 10 and more wells.

Site name	Site type	Number of wells
Newstead	fort	107+
Southwark	fort	38
London	<i>municipium</i>	51
Caerwent	<i>civitas</i> capital	16
Silchester	<i>civitas</i> capital	76
Wroxeter	<i>civitas</i> capital	17
Tiddington	small town	14
Stonea Grange	settlement	13
Stanwick	villa	12
Thetford	villa	10

It is significant that of the large towns, *coloniae* are not represented in this table, whereas three of the *civitas* capitals are represented. There is a lack of evidence for wells at these sites, to be discussed in Chapter 6.

3.2. Geology and hydrology of wells.

As mentioned above (p.45), Vitruvius gave advice on how to locate a source of water below the ground surface, but it is not known to what extent this was practical guidance to Roman water engineers charged with deciding on a site for a well. The range of geological and hydrological conditions will normally determine where wells should be dug to produce artificial sources of water, and this would in ancient times have depended on local knowledge and experience. It is also likely that accumulated experience over a long period was passed on to new generations of water engineers, who would have learnt how to recognize geological conditions where water-bearing materials existed. It would seem that some forts and towns were deliberately established in geological conditions where water from wells was easily available, such as the fort at Newstead or the town of Silchester, both of which had large numbers of wells.

Wells are dug to a depth where seepage from a perched aquifer occurs, such as at a spring line along a slope, or down into the water table zone, which would provide an adequate level of water in the bottom of the well so that water could be drawn from it continuously. Shallow aquifers usually occur in gravel and sand layers overlying clay, whereas a water table also can be shallow, for instance in marshy land or near the coast. Inland, the water table can be at depths of 10m and deeper. Fissured limestone, arenaceous rock and sandstone formations also incorporate aquifers from where water can be found. The Romans perfected the digging of wells in all kinds of geological conditions and many remains of Roman wells have been found all over the Empire including Britain.

The British government produced a series of publications from the late 19th century to the 1940s of the water supply potential of springs and wells for a number of counties. In the publication for London's water supply from underground sources (HMSO 1938) the key map (Pl.1, opp. p.1) is titled 'Map showing contours of the Chalk surface', illustrating the significance of limestone formations in underground hydrology. There are also other water-bearing formations, as mentioned above. It would be interesting to check the relationship between Roman wells and the geological stratigraphy, to discover whether these limestone and other water-bearing material aquifers were exploited by the Romano-Britons when they dug their wells. How successful the choice of sites for the wells have been, will depend on how accurately the stratigraphy of the geological formations have been described during archaeological excavations. Local modern borehole data would be useful to determine the geological formation in which such wells were made. These government reports can assist interpretation of sites where no water supply features have as yet been recorded.

An example is Brixworth (SP 747 719) (App.2), a villa in Northamptonshire, since no Roman well had been found during archaeological excavations up to 1981. However there are remains of a substantial bath-house for which water was needed. The HMSO report (1909) for this area quotes the hydrological data for four post-Roman wells, and there is also a spring nearby, indicating a water aquifer in the vicinity. The spring still provided water before 1909. Two of these wells provided almost no water and the other two produced water in the wells from 3.66m (12ft) and 3.35m (11ft) respectively. The report states: 'There are numerous wells in and around Brixworth deriving water

from the Northampton Sand' (HMSO 1909, 80-90). This suggests that the villa probably did have a well(s), but that it has not been found yet. If the spring was functioning in Roman times it may have been the water supply for the villa.

A study of the HMSO reports could also supply information on the potential yield of wells in Roman times. Because it has been found during archaeological excavations that some of the Roman wells are now dry, it is possible, based on principles of soil mechanics and knowledge of under-ground hydrology, in some instances to estimate the drop in the water table since Roman times. This could indicate what the likely yield of wells during the Roman period would have been.

There are a number of sites where remains of baths have been found but no water supply of any kind. The reason for this may be that for many sites their complete areas were not excavated to detect wells or other forms of water supply, or the well-heads may have been covered with so much overburden that it was not possible to find them. Examples of sites where baths have been found but no water supply are Acton Scott (villa), Badbury (settlement), Bearsden (fort), Bignor (villa), Braughing (small town), Castell Collen (fort), Rivenhall (villa).

3.3. Typology of Roman wells

Wells were dug in both soils and soft rock with hand tools and the loosened material was removed by hauling it to the surface in containers such as leather bags, wicker baskets or metal buckets. The well shafts were sometimes square, particularly when dug in soils, gravels and sands, because often their walls had to be protected to prevent collapse. When dug in rock such as chalk and other types of limestone, and sandstones, they were generally round. In rock the walls of the wells were stable and did not as a rule require revetment, except in fracture zones. Wells dug in soils, gravels or sands nearly always required some form of revetment especially around the opening and near the zone where water seeped into the well.

Roman wells in Britain varied in their construction, of which there were generally three types: unlined, wood-lined and stone-lined. Many of the early wells were unlined, indicating that the materials in which they were dug were stable, such as at Colchester, although later wells with no lining have been found. There are examples of unlined wells found at forts such as at Brecon Gaer (Wheeler 1926, 41), Caerhun (*Arch. Camb.* 85, 1930, 77), Newstead (Curle 1911, 33-6), Richborough (Bushe-Fox,

1928, 27; 1932, 61) and Slack (YAJ.1922, 22). Whether at some wells which have been reported as being unlined, the original timber linings have perished without trace, is an issue which is unlikely to be proved. Wells in rock were generally not lined because their walls were usually stable. It has been claimed that wells dug in chalk or other rock material were steined with clay to waterproof them (Hanson 1970, 397). I cannot see the reason for this, because steining with clay can hardly improve the stability of a rock well wall, and one of the functions of a well was to allow water to seep into it. Also, if there was an aquifer higher up a slope and seepage from it flowed towards the well wall, a clay surface would be penetrated by the seepage because of seepage pressure. Wells with wood and masonry linings are discussed below.

4. STEINING OF WELLS

Revetment of well walls is referred to as steining, which consisted of lining of the well walls with wood or masonry (White 1984, 157). Steining of wells was usually carried out using three methods: timber-lined, lining the walls with stone (*Archaeologia* 62(I), 1911, 417) either as dressed stone or rough stone (May 1922, 35-6; Wright, 1872, 218-9; Donel, 1993, 1-2, Figs.3-5), or lined with brick (Wilmott 1982a, 2; Hodge 1992, 52). Wilmott doubts the Roman dating of a supposed stone-lined well (No.7) at Aldermary House in London, "as no other stone-lined Roman wells have been found in London" (1982a, 22). Sometimes discarded wine barrels were used to line wells, such as at London (Wilmott 1982a, 23) and Silchester (*Archaeologia* 61(I), 1908, 15). At Silchester it is also reported that three wells had the bottom part lined with wicker baskets below the masonry lining above (*Archaeologia* 61(I), 1908, 15). The opening of a well often was protected with a well-head built in either stone or brick as at the Roman well at St Paul-in-the-Bail in Lincoln (Camidge 1984, 15-21; Donel, 1993, 1-2, Figs.3-5), serving also as a means to prevent undesirable material washing into it, and a stone block as at Gloucester (TBGAS 80, 1962, 56), or as at Bar Hill (Macdonald and Park 1906, 40, 92). The well-head also could serve as the support for a water-lifting device such as a pulley and bucket arrangement, or even the more elaborate chain and bucket system. The military establishment seems to have favoured masonry or brick lining of wells (Hanson 1970, 399).

Two typical examples of Romano-British well revetment practice will be discussed: those at London (Queen Street) (Wilmott 1982a, 9-19), and Scole².

At London there is evidence that at least 13 wells were lined with dis-used wine barrels (Wilmott 1982a, 10, 18, 22, for example well 19 pl.6 and well 37 pl.5, p.12). The use of barrels to line wells must have been cost-effective, because there would have been no need to construct the lining, as was the case with the corner-post vertical timber-lining or box-frames used widely over Britain. Because of the shape of barrels they were able to withstand active earth pressures which develop as material is removed for the shaft. Sometimes box-frames and barrel linings were used in the same well. The barrels seemed always to be below the box-frames, the probable reason being, that as the construction reached the water table, the gravel layer became unstable because of seepage, so that a preformed lining had to be inserted to prevent collapse of the walls as further penetration into the water bearing stratum continued (Fig.4.1, Wilmott 1982a, 27, Fig.19, Well 31). Corner-post construction of linings was used at many sites such as at the baths at Cheapside and at Queen Street (Wilmott 1982a, 25, Fig.18, No.24). Other examples of corner-post linings occur at Colchester, Chigwell, Skeldergate and Scole. Box-framed linings were constructed of four planks lying on their edges in a horizontal position, jointed at the ends in several ways. Sometimes the end planks were rebated so that two planks could fit into each other forming a right angle and this was done with all four planks to form a box. A number of these boxes would be fitted on top of each other for the length of the lining in a well (Fig.4.2), as shown for the upper part of well No.31.

Often for wells for which depths are not given, an Ordnance Datum level is given because it was not clear how much of their upper parts has been lost, or how thick the subsequent deposits were over the original well openings. However some observations can be made, especially regarding depths and sizes of wells and their lining. The four wells, numbers 20, 24, 35, 36, (see Table 4.4 for depths) indicate how relatively thin the gravel layer was in some areas of London and how high the water table was in the layer. Where the depths were greater than about 3m the wells were in the Warble valley where the gravel layer was about 6m thick. The gravel layer overlay the very impervious London clay, which seemed to have determined the depth to which wells were dug.

² EAA 5, 1977, 108, Fig.46, well I: 111, 112 Fig.48; 113 Fig.49; well II: 114, 115 Fig.50, 116 Fig.51, and pages 116-7 give dating of the wells.

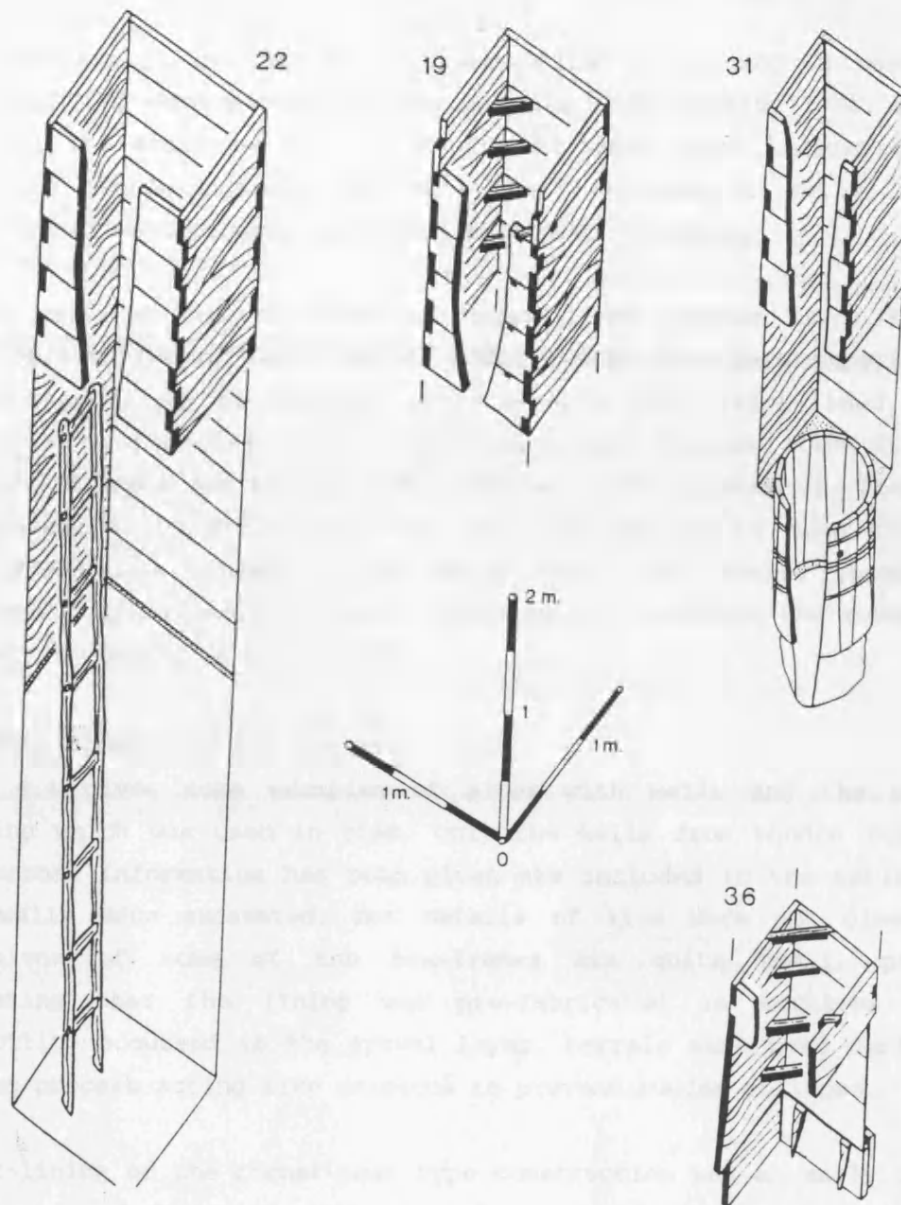


Fig. 4.2: Box-frames and barrel lining (well 31) from Queen Street Roman wells, (after Wilmott 1982a, 27, Fig. 19). Wells 22, 31 with lap joints, and wells 19, 36 are bridled and braced.

The dimensions of some of the box-frames are quite small, probably indicating that the lining was constructed from the bottom upwards. Where instability occurred in the gravel layer, barrels were used during the digging process, which would have prevented sudden collapse.

Another method was to have four corner posts which were mortised at top and bottom and also in a face at right angles, so that it formed a framework for planks to be placed behind the posts, forming an extended box-frame, such as at Lancaster and Scole.

At Silchester 52 of the 76 wells were flint-lined, and 21 were lined with wood, and some were lined with barrels (Hanson 1970, 125). The fact that all the known wells from Silchester were lined indicates either that many people acquired the skill for revetment of wells, or that professional well-diggers were used to construct wells.

The 16 wells at Caerwent were all stone lined (Hanson 1970, 84). The need for steining of wells was no doubt learnt from hard experience of well collapse. Why at Caerwent all the wells were flint-lined (Hanson 1970, 84), is not clear, but it could have been because flint stone was readily available and that wood had become scarce because of other uses, and expensive. It would seem that the practice was to make all wells with stone-built linings round, which makes good sense, because the surrounding active earth pressure would tend to compress the stone ring, in that way making it more stable.

4.1. Well dimensions and lining.

Table 4.4 gives some examples of sites with wells and the type of steining which was used in them. Only the wells from London for which dimensional information has been given are included in the table; many more wells were excavated, but details of size were not given. The dimensions of some of the box-frames are quite small, probably indicating that the lining was pre-fabricated in sections. Where instability occurred in the gravel layer, barrels were used during the digging process acting like caissons to prevent sudden collapse.

Timber-lining of the corner-post type construction was an early type of steining, used during the 1st to early 2nd centuries, such as the two wells at Scole.

Table 4.4: Lining types and dimensions.

Location	Feature	Lining type	L(m)	B(m)	D(m)	Depth(m)	Reference
London, Queen St	2	barrel			0.63		(Wilmott 1982,
	16	barrel			0.84		7, 8, 21,
1st-2nd c.	35	barrel			0.93	1.68	Figs. 5, 6,
	9	box-frames	0.66	0.53			14)
	20	box-frames	0.68	0.68		1.19	
	22	box-frames	1.30	1.07		6.25	
	33	b/f + barrel	0.58	0.49		5.24	
1st c.	24	timber, vert.	0.99	0.99		shallow?	
3rd-4th c.	19	box-frames	-	0.99		4.14	
	36	box-frames	0.68	0.53		2.44	
Great Dunmow	S11	box-frames	0.76	0.76		6.9	EAA 41, 1988, 25
Scole	Well I	box-frames	c.1.	c.1.		>4	Figs.4 & 13. EAA 5, 1977, 112,113
	Well II	box-frames	c.1.	c.1.		>3.5	EAA 5, 1977, 115,116
Caerwent	16 wells	stone-lined				2.4-14	Hanson 1970, 84.
Lincoln, St Paul-in-the-Bail	stone and brick					2.4-c.16.5	CLAU 1993, Rep.63, 1-2
					1.2 (sq)		LAT 1984, 15-21.
Margidunum		stone-lined			c0.9	3.65	JRS 16, 1926, 37, Fig.3
Silchester	76 wells	stone-lined (52)				2.4-9.1	Archaeologia 53, 1893 to 61, 1909
		timber-lined (24)					
Templeboro'	stone-lined				3.1	c.9.1	May 1922, 35-6.

* L and B are the lengths and breadths of timber type linings and D is the diameter of barrel linings.

It would seem, as improved methods of working with wood were developed, steining with box-frames became the favoured style of lining wells (Fig.4.2), with further improvements during the 3rd century as illustrated by the box-frame construction from Southwark settlement, Fig.4.3 (Yule 1982, 243, Fig.1).

The Scole corner-post construction shows a crude finish to the woodwork, while those illustrated by Wilmott (Fig.4.2) and that by Yule (Fig.4.3), show a progressive improvement in quality of workmanship. Further research into steining of wells with wood is required to determine

whether the lining of wells improved over time during the Roman period, and whether it occurred only regionally or all over Britain.

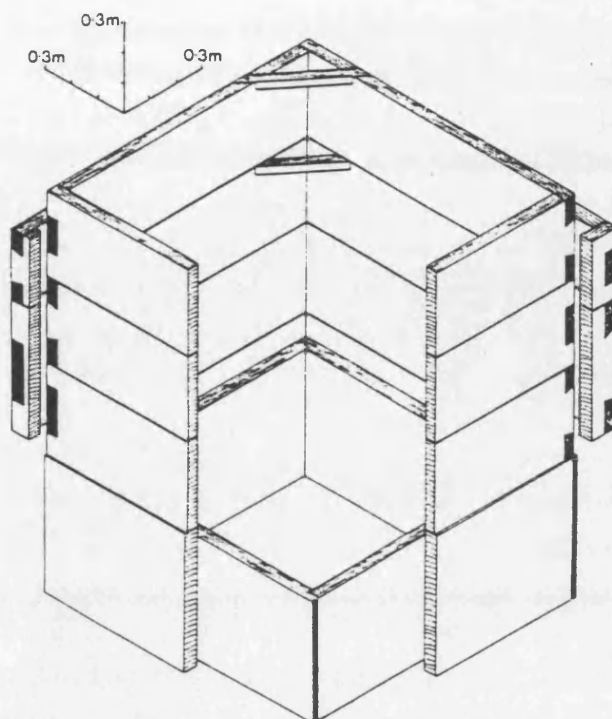


Fig. 4.3: Third-century box-framed timber-lined well steining with dove-tailed joints and braced, from Southwark (after Yule, 1982, 243, Fig. 1).

4.2. Steining of two wells at the villa near Scole.

Two timber-lined wells were found at the villa near Scole, identified by the excavators as the *Villa Faustini*, referred to in the *Antonine Itinerary* (*Britannia* 1, 1970, 47,) (TM 146 786). The villa originated in the Flavian period and was still active in the late 4th century (EAA 5, 1977, 107-17). The original excavations were carried out by the Norfolk Archaeology Unit, who identified four periods for the villa. The timber-lining of the two wells (Fig.46 in the excavation report) was identified covering two phases, the earliest phase dating from the late Flavian period and the 2nd phase dating from the Trajanic to mid-Antonine period. Both wells were excavated to a depth of about 3.5m without reaching the bottom of the wells because of the high water table, even though sludge pumps were used to hold the water level below about 20m OD for Well I, and 18.4m for Well II. It is therefore not known whether the

steining went deeper. The description of the soil formations through which the wells were dug shows that the clays must have been soft unstable soils, hence the reason for steining them to the depths to which they were excavated.

Figures 4.4a to d show details of the wells and their linings from Scole (EAA 5, 1977, Figs 48-51). From the drawings of the cross-sections of the wells it can be seen that the steining probably went down deeper. Since the wells were dug through clay formations, the wells must have been deep enough below the clay to penetrate an aquifer of either a gravel or sand layer which would have been water bearing, or they may have penetrated into a porous or fractured rock formation which would have provided the necessary aquifer. The general topography of the area is low lying, being between the Fens on the west and the sea on the east, which accounts for the high water table at Scole.

Figs 4.4a and c show that the linings in the upper parts of the shafts were decomposed and were not recovered. The excavators commented that the reason for the phase 2 rebuilding was likely due to the rotting of the timbers of the drier upper part of the shaft (EAA 5, 1977, 111). For both the wells, the lower parts of the timber lining were remarkably well preserved, though the quality of the carpentry-work seems to have been of a poor standard (Figs.4.4b and d). The timbers were rough and not cut to the same size. The irregular manner in which the 2nd phase timbers rested on those of Phase 1 seems to indicate either shoddy workmanship or work done in a hurry to prevent collapse of the wells.

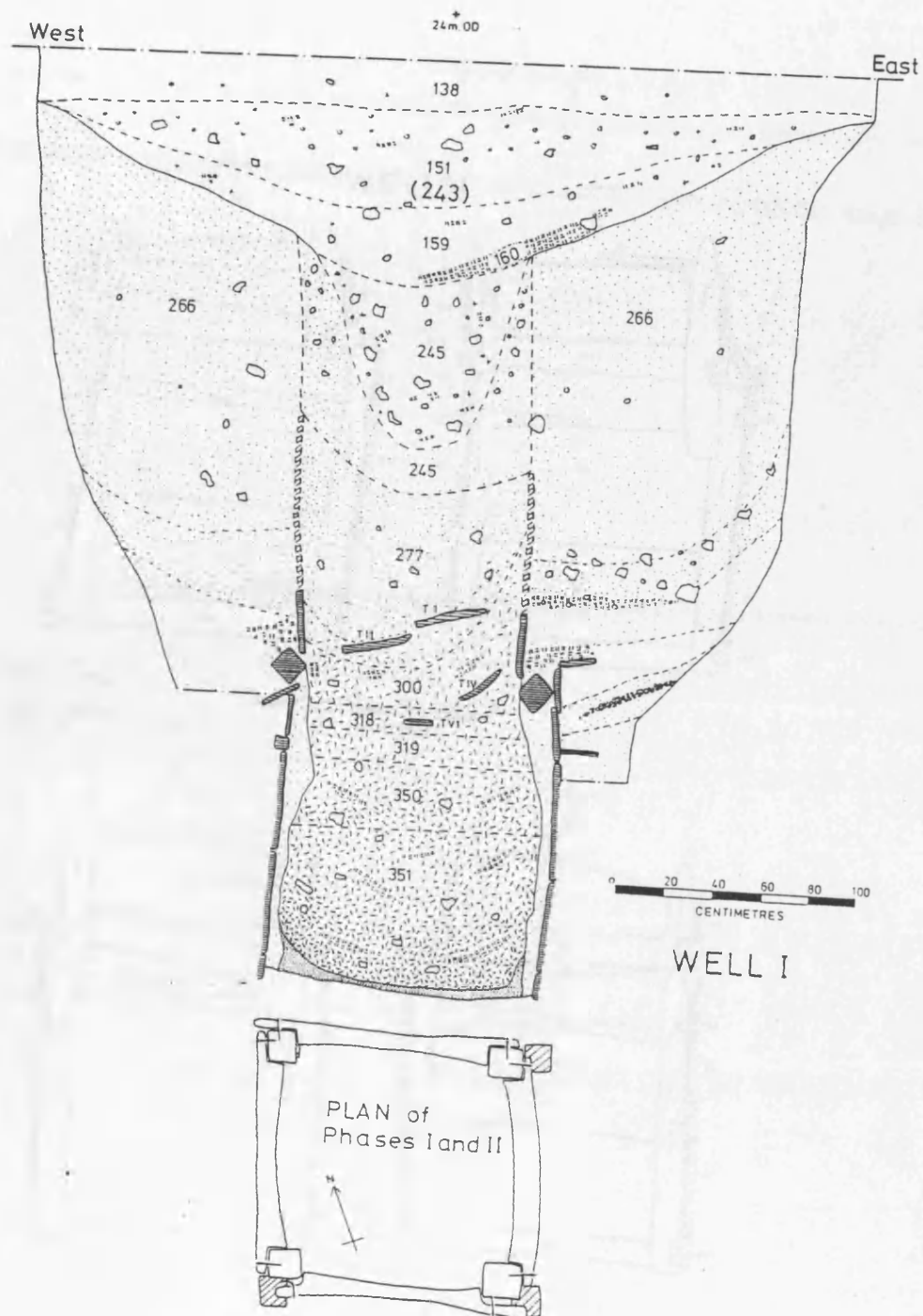


Fig. 4.4a: Well I at villa near Scole: section and plan (from EAA 5, 1977, Fig. 48).

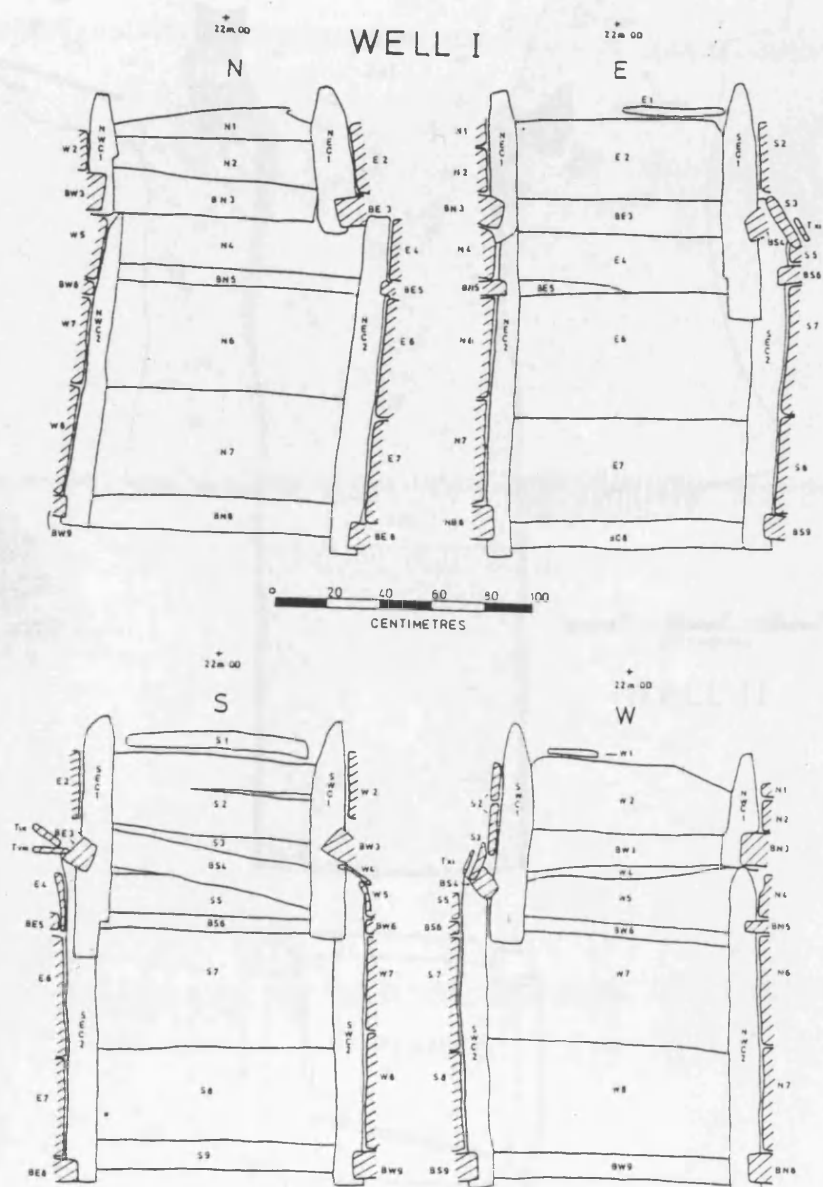


Fig. 4.4b: Well I at Scale: elevations of timber lining (from EAA 5, 1977, Fig. 49).

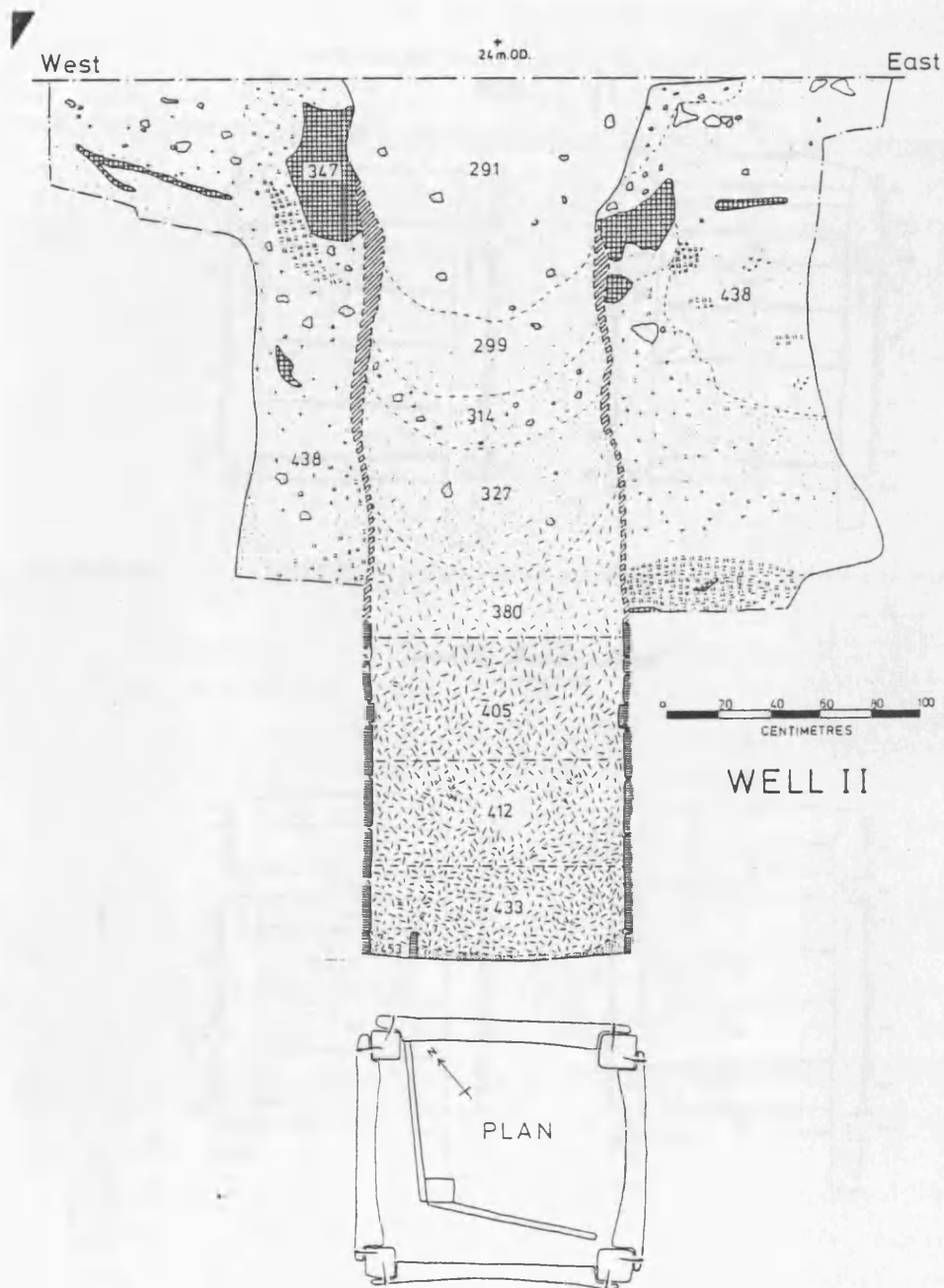


Fig. 4.4c: Well II at Scale: section and plan (EAA 5, 1977, Fig. 50).

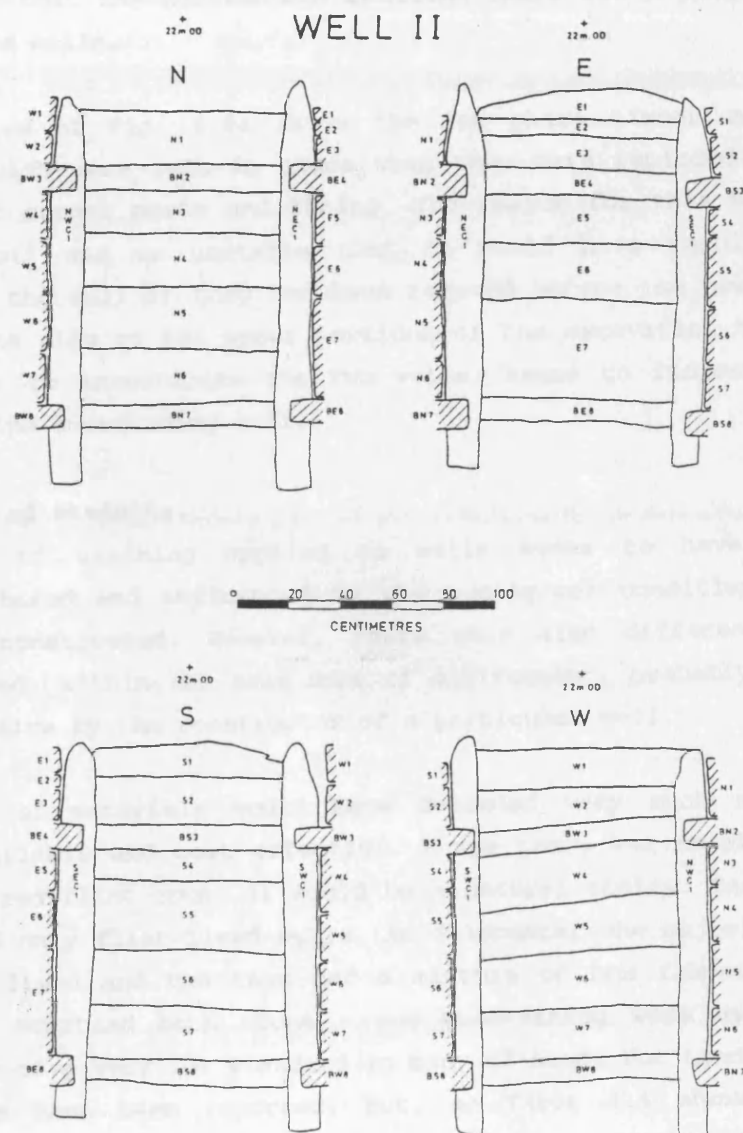


Fig. 4.4d: Well II at Scale: elevations of timber lining (from EAA 5, 1977, Fig. 51).

The method of steining was to insert four vertical wooden corner posts with flat planks placed between them forming roughly one metre square boxes. The planks had corner-cuts at their ends to fit round the two outside diagonal corners of the vertical posts, which also stabilized the posts in their vertical positions. The planks seemed to vary in thickness from about 5-10cm and had varying widths. The thickness of the planks shows that the contractors realized there was a need to support very unstable soils.

The plan view of Fig. 4.4a shows the 1st phase timber corner posts (hatched) which were left in place when they were replaced by the 2nd phase timber corner posts and lining. The reason for this was probably that the soil was so unstable that it would have resulted in the collapse of the wall if they had been removed before the new lining was inserted. The size of the upper portions of the excavation holes (about 3.5m across) to investigate the two wells, seems to indicate the poor quality of the surrounding soil.

4.3. Styles of steining.

The styles of steining applied to wells seems to have been both regionally based and influenced by the geological conditions in which they were constructed. However, there were also different types of steining used within the same sort of environment, probably indicating personal choice by the constructor of a particular well.

The choice of materials would have depended very much on what was locally available and cost effective. Where there was an abundance of suitable sized flint rock, it would be a natural choice. Caerwent seems to have had only flint-lined wells. At Silchester the majority of wells were stone-lined and the rest had a mixture of box frames and barrel lining. At Newstead both stone - and wood-lining were used, but the quality was of a very low standard in many of them. For London no stone-lined wells have been reported, but, as Table 4.4 shows, box-frame lining with wood was the accepted form of steining, combined in a number of cases with barrels. Sometimes barrels were used by themselves. At Southwark a very well constructed wood-lined well was found, whereas the lining at Scole the quality of the lining was of a poor quality, as shown by rough hewn timber and the construction had a shoddy appearance (pp.112-5).

There is a need for further research into these issues of regional differences, geological conditions and quality of workmanship for lining

of wells, because it may also provide information on the development of lining techniques and could provide information on how the skills of carpentry developed from the 1st to 4th centuries.

5. STABILITY OF WELLS

Wells develop instability problems, whether dug in soils or in the softer rocks. Boon mentions that at Silchester in Insula XXIII a well had collapsed during its construction phase as the Roman workmen went below a stable upper layer into an unstable layer, leaving behind their ladder as they escaped (1982, 85). Well walls formed in clayey soils could easily have slumped as water tables rose and the soil lost its cohesive shear strength in the capillary zone, or due to swelling and shrinkage of the soil resulting in flaking of the walls of the well. Many wells must have become inoperative as a result of collapsing soils, especially in the vicinity of the water table, unless they were supported by steining.

The primary reason for steining of wells is to stabilize the walls against inward collapsing due to the earth pressure acting on an unsupported vertical wall. Positive pore pressures that could develop in the soils contribute to reducing the shear strength of the materials behind the walls of the shafts. The theory behind this is complicated but can be explained as follows. Every soil regime is subjected to earth pressure due to gravity acting vertically downwards on a soil mass and increasing with depth. Since soil can be described as a 'particulate fluid' there will also be a horizontal earth pressure component. When this horizontal earth pressure thrust exceeds the shear strength of the material a critical unstable condition is reached and a soil will fail, or become unstable. It is this horizontal earth pressure which tends to make a vertical wall unstable. All soils (and sedimentary rocks) usually have some moisture in it, which will impart to it negative pore pressures. When a soil becomes saturated the pore pressures become positive and it is these saturated pore pressures which reduce the shear strength of materials. Soil is saturated immediately above (or within) the water table and the positive pore pressure acting on the soil within this zone will reduce its shear strength to a critical low value. At a certain level above the water table the degree of saturation decreases due to evaporation from the surface and the pore pressures become negative, providing capillary suction between soil particles, which increases the friction between them and thus provide the soil with its shear strength. If there is a perched water table at a higher level than the well shaft from which water can seep downwards and sideways to its

wall surface, this seepage flow will saturate the soil and develop positive pressures in that zone. These positive pore pressures will reduce the negative capillary pore pressures, thus reducing the shear strength of the soil surrounding the well shaft. If the negative pore pressure is reduced to a very low value (of the order of about -5kPa to zero), the soil friction will be unable to resist the horizontal earth pressure due to the weight of the soil above and will collapse. The mechanics of the hydrological regime and shear strength of soils around well shafts are complicated, but have been formulated mathematically, and their physical implications are nowadays well understood. The Romans would not have had this knowledge, but they must have had experience of the collapse of soil surfaces and through trial and error learnt how to prevent it by supporting it with various forms of revetment.

The stability of the walls of wells can also be determined by the methods described by Avery (1993, III, 1-10), though there is the added complication that the well geometrical configuration is often circular, a factor not dealt with by Avery. To analyze a linear feature for instability, special empirical techniques have been developed to determine where the active earth pressure will act on a free surface and it is combined with the water pressure that acts against or on the surface of a structure or a wall face. A net resultant thrust against the wall can then be calculated using the procedures described by Avery. Included in the method will be the procedure for determining the direction and slope of the slip surface. This theory highlights the reason why steining became necessary when wells were dug in potentially unstable areas such as London, Newsteads, Silchester and other areas with unstable materials in which wells were constructed.³

The problems of well digging and their stability in difficult materials is illustrated at Newstead. Here 107 pits were found, of which 94 were outside the walls, including a number found under the later defences of

3 Many empirical methods were developed based on classical statics and dynamics theory to determine the stresses and strains acting on a soil mass, using strength parameters and the geometric configuration of a particular structural problem. The most critical aspect of such analyses is to choose the correct strength and pore pressure parameters, usually determined by triaxial tests in an engineering soil mechanics laboratory. If the soil mass is saturated, then this water pressure can, for analysis purposes, be shown to act at a position of one third of the height of the structure from its lowest point or from its foundation. If the structure is hollow like a well and is cylindrical (this applies to some extent also to wells with rectilinear cross-sections), both the earth and the seepage pressures have the effect of compressing the surrounding soil inwards with a resulting increase in excess pore pressures. When the excess pore pressure exceeds the shear strength of the soil it collapses, particularly for sands and soft clays which have very low shear strengths. The cylindrical shape of a structure makes the mathematical formulation more complicated and cannot be expressed in a simple form such as for linear structures. Several of the references Avery quotes deal with this problem. Transcendental functions are required in the mathematical formulation to arrive at solutions, presumably the reason why Avery did not include them in his simplified presentation of stability analysis.

the fort and is reminiscent of the 99 wells found at Saalburg⁴. The interpretation of these pits has been controversial ever since Curle reported the original excavations in 1911. He classed most as rubbish pits, but they have now been classified as wells since over 90% of the pits penetrated the water table (Clarke and Jones 1994, 115). Because of the unstable nature of the drift geology it was easier to dig new wells rather than to have cleaned out unlined or lined wells that became silted up (Clarke and Jones 1994, 117). The shafts of wells at Newstead seemed generally to have been poorly lined. Curle recorded that of 19 lined wells six were lined with river cobble stones and one with poor masonry, and others simply with stakes, so that most of the lining was ineffectual against the unstable nature of the local material (Clarke and Jones 1994, 117). The shapes of the wells at Newstead were unusual because many had a conical configuration of different kinds (Clarke and Jones 1994, 115, Fig.6), which was probably due to the difficulty of digging into the cobble and gravel drift materials. This would have contributed to the problems of stability of the wells and also would have made it difficult to line them effectively, and could well have affected the period over which it was safe to draw water from them.

5.1. Life span of wells.

How long wells functioned to supply water is difficult to say, but their life-spans must have been closely related to the nature of the local geology of a site and the hydrology of the area. At a site like Newstead it would appear that wells had a limited life span, either because they dried up, became contaminated or became unusable because of some problem with part of their structure that collapsed. In a situation such as the boulder and gravelly nature of the subsoil at Newstead and the type of latrines used by the army, it could be possible that seepage from latrines would contaminate the underground aquifer. Clarke and Jones refer to the poor cobble revetment of 6 wells and two unlined ones. One of the unlined ones lasted for about ten years before it was used as a rubbish pit (1994, 117). They suggest that if this life span was typical for the Newstead wells, then not more than 15 to 20 would have been open at the same time. Similarly, the proliferation of Roman wells in London in the Queen Street area may have been due to their limited life span.

There seems to be a lack of information on the hydrology and stability of Roman wells, both regionally and at individual sites. It is stated that the quality of the lining of wells at Newstead was generally poor,

4 'Germania Romana', *Romisch-Germanischen Kommission*?, 26, Fig.xxx(2).

but whether there was a difference in the quality of the linings found within and those found outside in the surrounding vicus, is not clear. Presumably the wells inside the fort area would have been dug by soldiers, but who would have dug the large number of wells outside the fort?. It is likely that this type of problem applied to the other major sites such as London, Caerwent, Silchester and Wroxeter, where large numbers of wells have been found. The problems of stability of the wells at Newstead emphasizes the need for further research to be carried out to provide an overall picture of areas of unstable conditions, and how the problems relating to instability of wells were dealt with in Roman times.

6. WELL-HEADS AND DRAWING OF WATER FROM WELLS

Well-heads have been found at a few sites, but evidence for them is scarce. It is likely that most wells, especially those dug in soil or gravel, must have had some well-head protection to their opening. At Gloucester at one of the wells a well-head was discovered consisting of a square block of stone, about 0.3m thick and 1.3m square, with a central opening to the well of 0.75m. Surrounding the opening parallel to the four sides of the block are four shallow runnels and along the centre of one runnel to the outer edge is a sloping runnel, presumably to control water spilt from buckets. Four square holes are just outside the opening hole, appears to have been used for wooden posts which may have supported some superstructure, to which may have been attached the pulley arrangement for lifting the buckets from the well. The block is supported on the stone lining of the well. The top surface of the well-head was found 3m below street level at the Bon Marché site at Gloucester in the 1955 excavations (TBGAS 80, 1962, 56). At Wroxeter several wells were reported with well-head stone blocks. Bushe-Fox reported a well-head with two blocks forming a square with sides of 1.3m and a hole in the centre of 0.75m diameter (1912, 3-4). At another well the well-head block consisted of four separate stone blocks, but no further details are given (Wright, 1872, 218-9). It has been suggested that the number of squared oak timber posts found in the well at Bar Hill may have been remains of a wooden well-head structure (Macdonald & Park 1906, 40). The well at St Paul-in-the-Bail at Lincoln had a stone and brick arched well-head - described below (Donel, 1993, 1-2, Figs.3-6). The Templeborough fort had a large well (3.1m diameter) in the *principia*, which had stone blocks from the surface down to the water surface about 3.1m below ground level (May 1922, 35-6), so that water carriers could walk down to the shallow water level to fetch water.

A wide variety of methods for drawing water from wells was available, but there is not sufficient evidence to indicate whether all of them were used in Britain during the Roman period. J P Oleson (1984) discusses the remains of many forms of water lifting equipment, including those for drawing water from wells. The following are the types used in Britain:

- 1) a *container (wood or metal bucket, skin bag)*, at the end of a rope that could be lowered by hand to the water level and hauled up manually. Evidence of rope marks as it scoured a trough next to the well-head opening has been recorded at Gloucester.
- 2) a *simple single pulley* attached to some framework above the well opening with a rope and bucket, operated manually. A more complicated pulley system may also have been employed.
- 3) a *bucket and chain system* where the chain would wound round a small wheel attached to a framework above the well opening, described by Vitruvius (Book 10). There appeared to have been several arrangements for this system.

The force pump (such as the one recovered from Silchester, Hope and Fox 1896, 232, Fig.1), was used to raise water from a water source, but not used down deep wells. Large wooden wheels of different designs were also used to raise water (fragments of one was recovered from Dolaucothi, Boon and Williams 1966, 126, Fig.6).

Archaeological evidence of remains for water lifting devices is scarce from the Roman period in Britain. From Bar Hill remains of a bucket, timbers and parts of a pulley have been found (Macdonald and Park 1906, 40. 92). Similar remains were found at the fort of Old Kirkpatrick (Miller, 1928, 23). From the well at Lincoln a wooden bucket with iron bands had been recovered (CLAU Archaeological Rep.63, 1984, 24, Fig.1). At the fort of Reculver remains of an unusual system for raising water in a bucket was recovered from a well, where a system of stone counter-weights were attached to a rope on a frame down the well, in such a way that the length of rope was sufficient to raise a bucket of water to the top without manual assistance from a person (Arch. Ael.⁴ 72, 1958, 160-1).

Drawing large quantities of water from wells must have been a problem especially for the larger establishments. If the bucket and rope system was used it would have been almost a full time occupation for an individual. Even at settlements and villas, water demand may have

required long periods of drawing water from a well. From illustrations of buckets that have been recovered, the quantity of water that could be raised was probably of the order of 10 to 20 litres per bucket. For the smaller establishments like villas, the domestic and bath demands were probably not more than 1,000 to 2,000 litres per day. However for public baths which were dependent on well water, drawing water with a single bucket would not have provided the quantities needed, even if water was not replaced on a daily basis. To fill a small tank of say 2m x 2m x 1m would require 4,000 litres, which could have taken a single person a whole working day. The chain and bucket system was also used for raising water from wells. This system required a well-head from which a structure to support the axle and wheel arrangement round which the chain could be operated. Various ways of turning the axle were available, generally a large wooden wheel supported on the axle for the bucket and chain system. The wheel was powered by a person 'walking' along the inside of the rim turning it about the axle. The chain would move around the axle lifting a set of containers attached to it. Even this method would not deliver a vast amount of water during a day's work.

It can be assumed that normally one well could serve a single household with all its needs. Where the smaller establishments of non-military sites such as small towns, settlements and villas had activities such as pottery manufacturing, smithing, dyeing, fulling, etc., a single well may not have been sufficient for the needs of the community, indicating that the wells are under-represented at such sites. For the major towns and military sites this may not have been a problem if they had aqueducts and tanks to provide sources of water. Further research is required to determine how much water was needed for a particular group in a community and whether the ways of obtaining water from wells would have been adequate.

7. WELLS AT SITES IN ROMAN BRITAIN

7.1. Forts

Generally fortresses and forts had wells, but where there were also aqueducts and tanks, they would probably only have been standby water sources. Many of the forts would have been small and a well water supply would have been the obvious source if the soil or rock formations were water bearing materials. At some forts there may have been a *vicus* outside the defences where a water source was available, but it is unlikely that the army would have relied on external water sources for many of its forts. A possible reason could be that many forts are known

primarily from airphotos, and have not been excavated in detail, if at all, hence the lack of evidence for wells or any other features. For many sites only the outlines of the defences are known from cropmarks and very little else have survived. Wells that have been covered over with deep soil would probably not show up in airphotos.

7.2. Coloniae and municipia.

At all four *coloniae*, wells were found, but the number recorded at each site seems to be low for such large towns. At **Colchester** 9 Roman wells were found (Fig.6.17, p.198) north-west of the walls of the *colonia* and none were found within the town (Crummy 1984, 26-8, Fig.14). The reason for this may be that there are still large areas of the modern town covering the Roman town which have not been explored.

At **Gloucester** a number of wells were found in the Bon Marché area, of which two were stone-lined (Hanson 1970, 58; *TBGAS* 56, 1934, 73; 80, 1962, 56).

At **York** only 2 wells have so far been located (*Yorkshire Philosophical Soc. Annual Rep.* 1901, 104; *RCHM Roman York*, I, 1962, 53, 59, 61). This is probably because of limited excavation, because the *colonia* was built over gravel and sand formations, where, like at London, Newstead, and Silchester, it would have been relatively easy to sink wells.

At **Lincoln** two wells have been found: one near the west gate (pers. comm. from M. Jones), and the other in the east range of the forum. They must have been important sources of water, considering the uncertainties about the aqueduct.

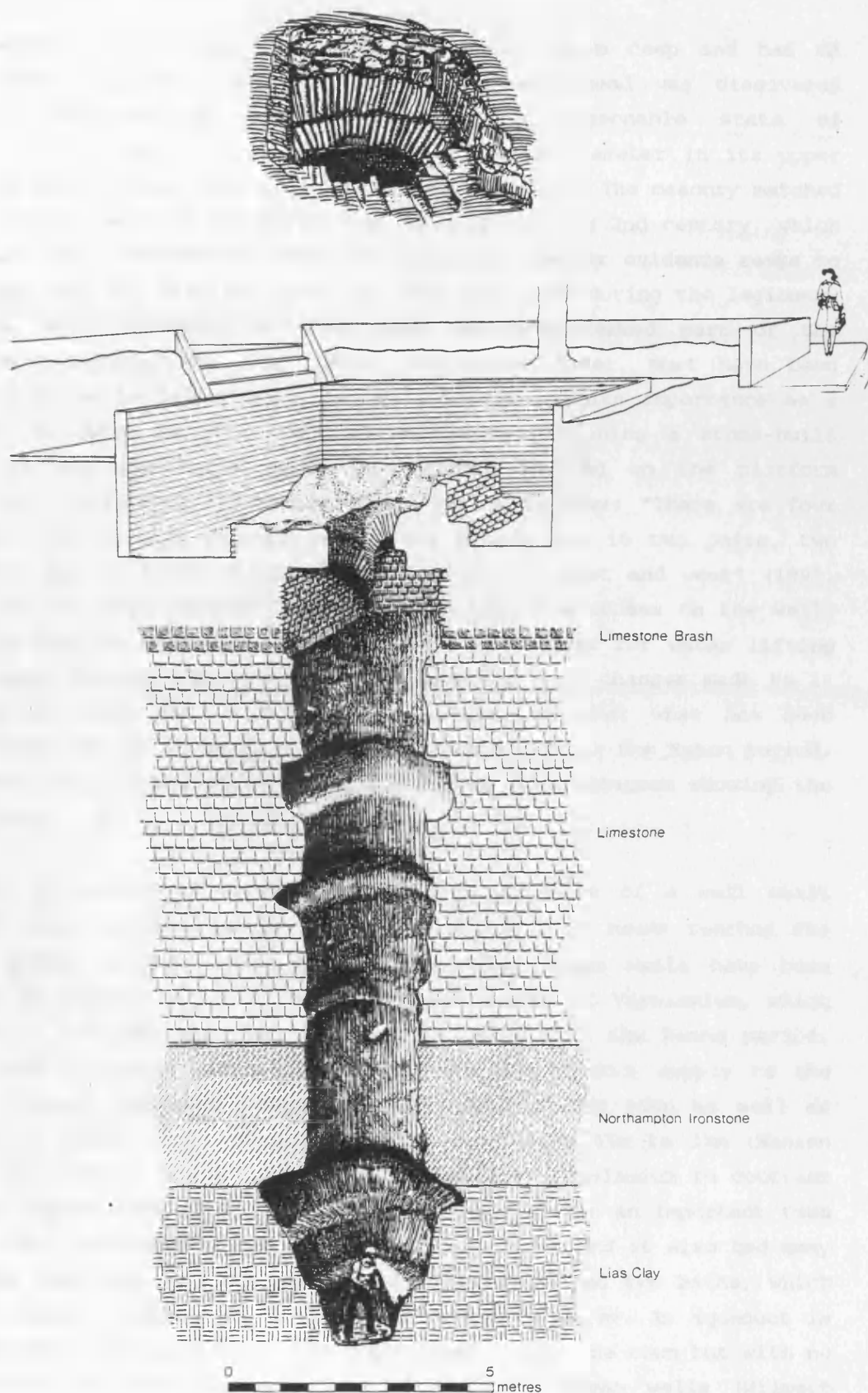


Fig. 4.5: Well in forum at St Paul-in-the-Bail, Lincoln (CLAU 1993, 1-3).

The well at the forum (Fig. 4.5) was about 16.5m deep and had an elaborate well-head over the opening. The well-head was discovered beneath post-medieval masonry, but in a reasonable state of preservation. The shaft of the well was 2.4m in diameter in its upper section and narrowed down to 1.2m square lower down. The masonry matched that of this part of the forum, and is dated to the 2nd century, which may have been constructed after the aqueduct. However evidence seems to indicate that the original shaft may have been sunk during the legionary period, which probably at that time may have formed part of the legionary headquarters. The forum, constructed later, must have been located so as to incorporate the well, because of its importance as a source of water for the town. Above the well opening a stone-built platform was constructed with four arches resting on the platform forming a well-head. Donel describes them as follows: "There are four arches, one at each compass point. The arches are in two pairs, two smaller, to the north and south, resting on the east and west" (1993, 1). The two larger arches seemed to have been the access to the well, and the smaller arches may have held the structures for water lifting equipment. However the structure must have had many changes made to it during its long use as a source of water, so that what has been discovered may not be exactly as it was constructed in the Roman period. The well is illustrated in Fig.4.5, with an inset diagram showing the well-head.

At the *municipium* of **Verulamium**, there is evidence of a well shaft (11.6m deep) in the vicinity of Insula xiv, but it never reached the water table (TSAHAAS 1932, 18), and no other Roman wells have been found. In Chapter 3 I discussed the water supply of Verulamium, which presented problems, so that the lack of wells from the Roman period, must make it almost certain that there was an aqueduct supply to the town. Several Medieval wells have been found in the town as well as nearby St Albans with average depths of from about 15m to 23m (Hanson 1970, 70). Why so few wells have been located at Verulamium in contrast to the similar town of Silchester, is strange. It was an important town with a well developed street system like Silchester and it also had many private dwellings, and the usual public buildings and two baths, which would suggest a demand for a plentiful supply of water. An aqueduct is conjectured from piping along Watling Street within the town but with no certainty. In contrast London had at least 51 Roman wells (Wilmott 1982b, Fig.1).

7.3. Well water supply of London

For **London**, Wilmott comments on the 'special importance' of the underlying geology "in evaluating the nature of the ground surface on which the earliest Roman activity took place and in suggesting an explanation for the large number of wells found on these sites" (Wilmott 1982a, 3). The Thames valley in the London area has been formed by the meandering Thames river over a long period and during that time terraced gravels were deposited over the London clay derived from up-land erosion, probably during the major ice age. These gravels were covered by soil layers through which the Walbrook stream eroded the valley that bisects the site of Roman London into two low hills, Cornhill and Ludgate. London itself was built over the 1m thick brick earth layer overlying the water-bearing gravel terrace (Wilmott 1991, 14). Soil deposition continued subsequently and the Walbrook valley almost completely disappeared beneath medieval and later London. North of the Thames river the ground rises steadily and the sands and gravels formed a natural aquifer creating springs in the lower valleys. It is into this layer that the Romans dug their wells for their water supply. At the lower reaches of the valleys the overlying soils of the gravel layer were relatively thin, varying in thickness from about 2m to 5m. This made well-sinking easy, but because of the gravelly and sandy nature of the soils, they were generally soft and friable, and therefore unstable, so the wells needed internal support. In Fig.4.6, Wilmott (1982a, Fig.2) gives a reconstructed section of the geology of the area, showing how the aquifer-bearing gravel sits on top of the London clay, which is impermeable, thus providing the circumstances for springs to emerge along the lower slopes. Since the gravel layer was not deep it was relatively easy to sink wells to the water table. There were several spring lines along this area and the surrounding soil would have been saturated and had little shear strength, so that wells would invariably have had to be lined to prevent collapse.

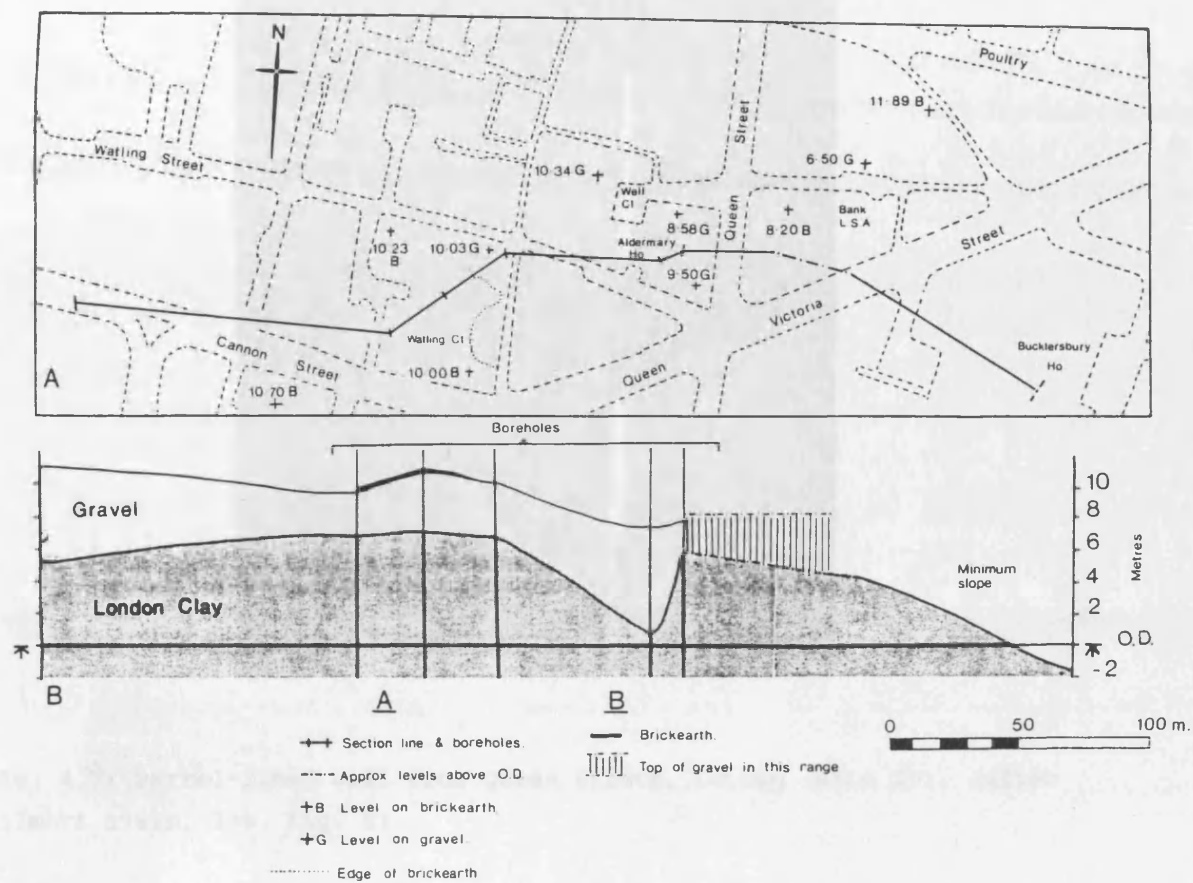


Fig. 4.6: Reconstructed geology of Roman London (after Wilmott 1982a, Fig. 20).

Since most of London's wells required lining, their horizontal cross-sections were usually determined by the type of lining that was used. The wells were steined with wood and therefore usually square, except when discarded wine barrels were used in round shafts (Fig.4.7). It is interesting that no stone-lined wells of Roman date have been found in London, although a number from the Medieval period onwards were stone-lined (Wilmott 1982a, 22).

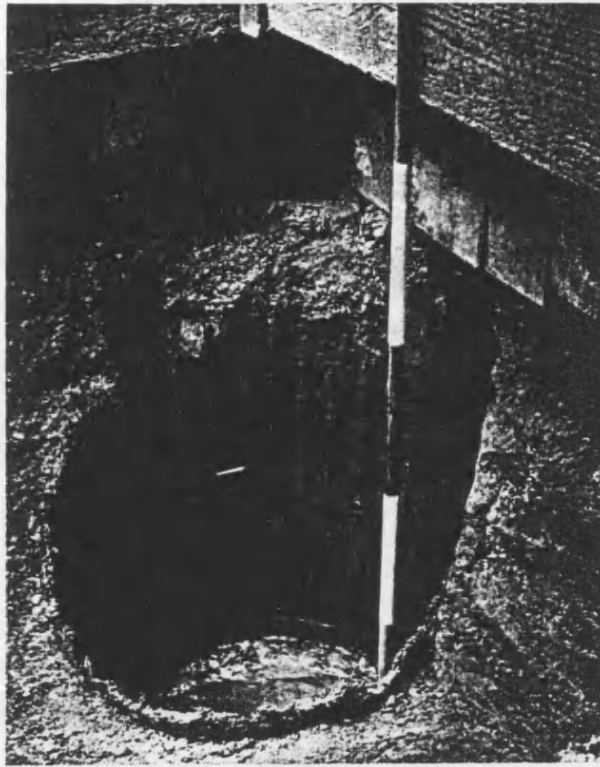


Fig. 4.7: Barrel-lined well from Queen Street, London (site 26), (after Wilmott 1982b, 239, Fig. 8).

John Wacher had suggested that from the evidence of Roman water pipes found in several areas in London, the town may have been supplied by an external aqueduct supply (Wacher 1995, 90, 101)⁵. Wilmott comments that the evidence for the abundance of well and spring water sources "argues strongly against an aqueduct water supply for London" (Wilmott 1982b, 241). The evidence of Roman water pipes, for instance, the pipes found at the Guildhall Extension (site 9), at the Bank of England (Site 20) and lead pipes found in a well (Site 26) (Wilmott 1982b, 241, Figs.10 & 11), and pipes near the Mithraeum (near Site 28) and the forum (Site 36) (Wacher 1995, 101) (see Fig. 6.19), suggests that a running water distributive system was available,

Wacher comments that since the pipes at the Mithraeum were found in a north-west and south-east direction, they perhaps suggest a *castellum aquae* in the vicinity of Cornhill. No evidence has yet been found of any

⁵ Wilmott would have used Wacher's 1974 edition of *The Towns of Roman Britain*, where the same comment is made on London's water supply.

distribution tanks, or an aqueduct from outside the central town area, so that an aqueduct is neither proven nor ruled out as a possibility. Tanks may have been situated near wells from which water pipes could have led water to specific buildings, but this is also mere speculation.

Table 4.5 gives a summary of the wells at the *coloniae* and *municipia*.

Table 4.5: Summary of wells at *coloniae* and *municipia*.

Site name	No. of wells	Comments
Colchester	9	All the wells were external; none found inside the walls.
Gloucester	?	'Many wells' reported.
Lincoln	2	Likely that there were more wells not yet found.
York	2+?	Limited excavation; gravel and sands formations suggest more wells.
London	51	Wells over most of southern part of walled town.
Verulamium	1 (+?)	Uncertainty about Roman wells as several medieval wells found.

7.4. *Civitas* capitals.

Of the 13 *civitas* capitals listed in the database 10 had wells. It is likely that the remaining *civitas* capitals also had wells even if they also had running water supplies such as at Caistor-by-Norwich, or even Aldborough for which an aqueduct is only suggested. Neither Carlisle or Carmarthen has wells recorded, but they had aqueducts and baths. It seems strange that all the other listed *civitas* capitals should have wells but not these four, and again it would seem there could be some reason why they had not been found. All the wells reported at the *civitas* capitals were intermural.

At **Caerwent** 16 wells have been recorded (Hanson 1970, 84) and it also had a running water supply as implied by a sophisticated distribution system (*Archaeologia* 61(2), 1909, 157). Four of the wells were situated in houses in the south-west of the town, and the rest in the middle north, mostly in the premises of private houses. There may be more

undiscovered wells because the plan by Brewer (Wacher 1995, 380, Fig.170) shows that the areas of the north-west and south-east and east parts of the town had not been excavated by the 1980s.

Both **Chichester** and **Cirencester** had four wells, but the other six *civitas* capitals had only one or two recorded at each site⁶. Four wells at each of these two relatively large towns seem low, which suggests that excavation have not revealed the true number, for whatever reason.

At **Dorchester** 3 wells have been recorded and a further 3 at Colliton Park Villa (RCHM(E) 1970, 556). At **Leicester** 3 wells have been recorded, though apparently some more have been found, but are not yet published.

Silchester is exceptional with 76 wells recorded over a long period of excavation during the late 1800s and early 1900s. Although there was this large number of wells in the town, neither the public baths, nor the *mansio* with its substantial bath, obtained water from wells, and the indications are that they were not supplied from an external water supply (Hanson 1970, 126). However, abundant springs in the vicinity of both baths were their likely sources of water, but it is not clear how water was transferred from the springs to the baths. The wells at Silchester were evenly distributed throughout the 37 *insulae* of the town as shown on the large map produced by Hanson⁷.

At **Winchester** one well has been recorded and it has been suggested that there may have been more, but because of the present high water table excavations have not been carried out in areas where there were likely more wells (*Britannia* 3, 1972, 271-6, 348-9).

At **Wroxeter** Bushe-Fox (1912-4) reported 11 wells and Atkinson (1942) reported an additional 6. Ten of the wells found by Bushe-Fox were found closely grouped south of the forum area near a large house. The 6 found by Atkinson were all in the Forum and first bath area. Much of Wroxeter has not been excavated yet, so further wells may still be found during future investigations.

6 A problem with the archaeological record is that often a report on a site will refer to it having a number of wells without giving the actual number found. In such cases I have usually recorded them in my database as W1+, and where it is stated that a site had a large number of wells I recorded them as W1++.

7 Hanson (1970, 126, Plan) produced a large scale plan, showing all 37 *insulae*, on which all the wells were plotted with their depths in feet. Excavations of Silchester were reported in a series of reports in *Archaeologia* from 1893 to 1911, reporting on the systematic excavation of the whole Roman town.

The evidence suggests that there must have been more wells at the *civitas* towns. Wells are generally underrepresented at all the major towns.

Table 4.4: Summary of wells at *civitas* capitals.

Site name	No. of wells	Site name	No. of wells
Aldborough	nil	Cirencester	4+
Caerwent	16	Dorchester	2 + 4
Caistor by Norwich	nil	Leicester	3+
Canterbury	1+	Silchester	76
Carmarthen	nil	Winchester	1+
Carlisle	nil	Wroxeter	17
Chichester	4		

7.5. Small towns.

Wells at the small towns, settlements and villas are poorly described in the records. Out of a total of 66 small towns listed by me, 52 sites had wells; however, they still represent only 53% of the total number of small towns (97) listed by Burnham (1986, 187). The distribution of the small towns where wells have been found is concentrated in the south and midlands regions of Britain. The number of wells found at small towns varies considerably, from one well to as many as 14 at Tiddington (Burnham and Wachter 1990, 312, Fig.107). At six sites I recorded W1+, indicating that there were more than one well at each site, since I found some records not clear on how many were found at those sites. *Tripontium* and *Scole* both had 7 wells, *Ewell* 6 and *Ancaster* 5, the rest with more than one well all having two or three wells. Whether the sites with one well reflect the true situation for an urban community is problematic, because it would imply that it could have been a public well. This does not seem to be a correct interpretation, because of the uncertainty of how closely a small town community cooperated as a unified group. Since there is evidence that some small towns had a number of wells, the situation could well be that for most of those sites with only one well, the remains of others have not been found.

7.6. Settlements.

Wells were found at 135 settlement sites out of a total of 212 recorded in the database. However, the number of total sites recorded in the

database is small compared with the total number of sites in the archaeological record, hence the number of sites with wells is a poor representation of the true number of settlement sites having had wells. The densest distribution of sites at settlements with wells is broadly within the Midlands region north of the Thames valley, in the same area where the majority of sites with wells was found for small towns and villas.

Most of the settlements had only one or two wells, whereas six sites had 3 and 4 wells, the site at Cow Roast had 8 wells, Long Wittenham had 7, Lower Slaughter had 11 and Stonea Grange had 13. These last four sites were probably much more spread out settlements than the others, each with larger communities not living close enough to each other to be able to share wells, hence the larger number of wells, or they may have had special functions such as Stonea Grange which had some form of an administrative function (*Britannia* 13, 1982, 366). Also, wells may have become disused for some reason and new ones dug. At some of the other sites all the wells may of course not have been found. The number of sites with wells indicates that it was the principal form of water supply and the likelihood is that sites with wells were far more widespread than the archaeological record suggests.

Pitt-Rivers (1887, 193 & 198) excavated two wells in Dorset at Woodcut Common near Rushmore, within a small settlement, one was 41m (136ft) deep and the other 50.6m (188ft) deep. These were major structures cut into chalk, hard enough to have required considerable effort to sink them, both monetarily and in terms of labour. Comparing the sections given of the shafts by Pitt-Rivers with more modern drill holes made by him, seems to indicate that they may have reached the water table when originally dug.

7.7. Villas.

Villas also used wells as their main supply of water, but the record again underrepresents the likely number that had wells. The evidence of remains at many sites is often limited to a few finds and no information is available about their water supply, as clearly shown in Scott's gazetteer on villas (1993). The three sites of Oakley with 7 wells, Stanwick with 12, and Thetford with 10, probably indicate villa complexes with several households and where certain commercial activities needed plenty of water. A possibility could have been that all the wells may not have been serviceable at the same time. The majority of the other sites had records of only one or two wells, and

only four with 3 wells as at Ashill, Barnsley Park, North Leigh and Rockbourne, and two with 4 wells at Colliton Park and Greetwell Fields. Six sites have been recorded as having had more than one well, but how many wells I did not discover. At Scole 2 wells were found with their wood-lined steining still in a good state of preservation (see pp. 111-4). Since the excavations reported in 1977 further excavations reported in *Britannia* (25, 1994, 278) states that "an area of the 'small town' was excavated...other possible structures were found and seven wells". It is not clear to me how far the villa is from Scole, and whether these new discoveries belong to it, or to the small town.

8. WELLS AND RELIGION

8.1. Religious aspects of wells.

This is a controversial specialized subject and I do not wish to get deeply embroiled in the debate relating to the nature of religious wells. The principal criterion for identifying 'ritual' wells/shafts is the structured way in which supposed votive articles have been deposited within well or shaft fills (Webster 1997, 136). An example is the 12m shaft at Ashill, Norfolk, where from about 5.8m down "urns were found placed in layers in a symmetrical manner, and continued to be so placed down to the bottom" (Ross 1968, 258). At Jordan Hill there was also evidence of votive objects placed in a deliberate manner, suggesting that the purpose of the shaft had a ritual function only (Ross 1968, 266-7). Votive offerings were placed in wells and springs by the Celts and, as is suggested in recent literature on Celtic religion, these offerings in pits and shafts/wells were regarded by them as entrances to the underworld. Jane Webster states that "Almost without exception, it is the nature and characteristics not of the cut but of the subsequent filling of wells and shafts which has been the basis for their archaeological identification as 'ritual' features" (1997, 136). She also comments that "despite the fact that wells and shafts are firmly entrenched in the 'Celtic ritual' corpus, numerous uncertainties surround the fundamental issues of both date and function" (1997, 135). Clearly one needs to judge carefully early evidence and the original interpretation in reaching conclusions from the reported literature on archaeological finds in well shafts. Some wells/shafts seem to have been focal points for religious practice, but whether wells used as water supplies also had ritual functions seems doubtful.

8.2. The evidence for religious wells.

Ann Ross (1968, 255-85) gives details of 59 sites where she considers that 'shafts, pits and wells' had a religious significance. She emphas-

izes the great importance religious ritual had for the soldiers of the Roman armed forces and that many Roman army artifacts are found in wells of the Romano-British period. Few of these structures are dated, but the implication for her is that many of them are in origin of pre-Roman date. As a result of analysis of their fills, wells that were previously classified as Iron Age, "cannot in fact be shown to predate the conquest" (Webster 1997, 136). Webster mentions "some spectacular Romano-British examples" and quotes Jordan Hill as an exemplar of such ritual wells (136). A number of the structures of all three designated kinds are very deep, in excess of 10m and some as deep as 30m and more⁸. For only a few of the structures is there any indication that water was found in them. This may have been due to it not having been recorded by the original excavators, many of the excavations dating from the 18th and 19th centuries, or the water table may have dropped. Also, the topography and geology through which wells were cut have rarely been discussed. However, the deep structures were often cut through an upper layer of soil cover to the underlying flint and chalk rock formations. It would be unusual for shafts deeper than 10m not to have had seepage water from the fractured chalk and flint formations, particularly if they were not situated on the top of hills. Many of the sites are generally lower down the slopes of hills or even in valleys, which would provide conditions for seepage from the aquifers in the upper slopes where perched water tables could be present.

Ross makes it clear that some structures were specifically sunk as ritual shafts, such as the shaft at Minnis Bay (Birchington) and Bekesbourne (Fig. 66, 276). She observes that during the Viking period at the fortress of Trelleborg "two of the ritual wells appear to have been cleaned out and used as water wells". She then suggests that might have happened in "certain instances in Roman Britain, especially in towns such as Caerwent, Silchester and Wroxeter" (278). Ross prefaces her entries for each one of the three sites with the comments that they were "extremely difficult to classify", or "selection is sometimes difficult", or the "difficulty to differentiate between those having cult importance and those having none" in that order. In none of the Caerwent wells she quotes were the small finds specifically placed or found in an ordered fashion (Ross 1968, 262). For Silchester, she is much more general in the description of finds in the wells. She mentions as evidence the ritual use of a well in *Insula I*, in which a sword blade

⁸ Ann Ross does not specifically define her interpretation between shafts, pits and wells. However, she comments 'A shaft of over 120 feet in depth, for example, may also be a well; and pits seem to have begun their existence as wells which had subsequently dried up or where digging had been abandoned before water was reached' 1968, 284.

broken in two and two iron bars were found, with below them a collection of almost 60 iron objects. In another well not identified except by depth, a collection of over 100 iron objects was found (Ross 1968, 273). At Wroxeter, the three wells she gives as examples of possible ritual use, the type of finds are no different to what have been reported in other wells (Ross 1968, 274). At Bar Hill she refers to the 13m deep well in the *praetorium* as having several capitals and bases of columns, a fragment of an inscribed tablet and pieces of oak, and some iron objects and other finds, and interprets this as possible ritual use of the well. An alternative explanation would be that the Caledonians were using the well as a convenient hole down which to throw anything suggestive of Roman origin. None of the cases given here suggests the type of shaft such as found at Bekesbourne, Kent, (about 7m deep), where urns seem to have been found placed in an ordered fashion on a platform with other ritual items round them, probably indicating a ritual site (Ross 1968, 260). Wait is critical of Ross' interpretation of some of the religious implications of the finds in shaft/wells, but agrees that some finds represent ritual deposits in the shafts (1985, 51). It seems to me that Ross was reading into the finds from the wells more than is justified. Many of the examples she gives are typical of wells filled with rubbish or the deliberate discarding of material such as happened when the army vacated a fort, or when civil sites were abandoned, or perhaps when Christian religious groups disposed of all pagan evidence.

Webster considers 17 sites where previous scholars have intimated that wells or shafts were classed as ritual-type structures, but on close analysis she casts doubt on some of the interpretations, particularly their pre-Roman dating. Many of these sites were excavated by amateur archaeologists in the last century or earlier in the present one. She draws attention, very significantly, that wells and shafts which have been excavated within the last 3 or 4 decades in similar areas to the older excavated sites, have produced only post-conquest fills, in contrast to what was reported for excavations from the earlier excavated sites (135). This, in fact, seems to be a problem with the interpretation of other types of finds also, and that of their dating. She makes it clear that "many wells and shafts had principally functional origins (being cut for water and chalk)" (136) She very firmly states that "Wells and shafts are not part of an Iron Age 'Celtic' tradition, but attest to the development of Romano-British traditions of practice and belief" (141). I agree with that view, as I consider that the data I have collected on water-related features and other structures, were partly instrumental in the development of

cultural and religious interaction between the British and Romans after the conquest. Many of the remains that are described in the archaeological record during the Romano-British period clearly are the type of structures that exhibit a Roman influence such as the buildings, roads, and water-related structures. The Britons adopted many of the Roman innovations and evolved a new material culture which blended with their own British traditions.

Springs converted into wells were often the centres of religious practice. Probably one of the more publicised of these religious wells is that of the well-spring of *Coventina*, at *Brocolitia* (Carrawburgh), first reported in 1732 by John Horsley in his *Britannia Romana*. Many votive offerings were recovered including pins, more than 14,000 coins, votive heads in bronze, a bronze dog and horse, etc. Large intact altars dedicated to the goddess of the well were also found there (Ross 1967, 30; Allason-Jones & McKay 1985). The most famous Roman associated native votive spring is that at *Aquae Sulis*, Bath, where the cult of the local nymph-goddess was important, derived from the native deity or *Sulis*. This local god and the ritual associated with it became equated with the cult of classical Minerva (Ross 1967, 30). Other springs or wells, where Celtic and local goddesses were important, in Roman times, and seem to have been adapted as Romano-British religious figures, are: at Buxton, Derbyshire (spring, for *Aquae Arnemetiae*); at Well, Yorkshire (spring, local cult); High Rochester, Kent (relief depicting nymphs); and at Chester, a dedication of local nymphs and springs, where wells were worshipped. In Scotland offerings made in wells have been found at Carlingwark, Eckford, Blackburn Mill and at Torrs in Kirkcudbright (Ross 1967, 30). However Webster points out that this could all represent "the growth of new, idiosyncratic rites which should properly be considered as Romano-British rather than as Roman or Celtic" (1997, 141). Earlier interpretations were inclined to view votive finds as either Roman or Celtic rather than as a combination of local forms of Romano-British religious practice. Clarke (1996, 76) suggests that the original interpretation by Curle of many artefacts as ritual objects from the wells/pits from the Newstead fort is unlikely. The more recent view of wells and shafts in the Romano-British period is that the vast majority, when they were situated in forts, towns or other settlements, were used primarily as sources of water supply.

A few special wells or shafts have been excavated because they are isolated from other archaeological sites and it is not clear whether

they were used as wells for the supply of water or were used only as ritual wells or shafts. In other instances wells normally used as a water supply also seem to have had religious associations. The Wilsford shaft in Wiltshire (SU 1086 4148) excavated in 1961-62 is considered by some scholars to be a ritual shaft while others believe its initial function was as a source of water (Ashbee, et al, 1989). Ashbee (1963, 118-9) suggests, based on radiocarbon dating of organic matter found in the shaft, that it could date from the Bronze Age period, and also on the evidence of a bronze broad-bladed axe that was found at the bottom of the shaft. It was found to have a large surface opening of about 6m (20ft) in diameter, with sloping sides down to about 6m, after which the shaft diameter became constant at about 1.8m (6ft) to a depth of about 30.6m (101.6ft). Urns with Celtic religious motifs were found in the shaft at a level of about 18m which seemed to indicate to some of the excavators that the shaft may have had some religious significance, but what the connection was has not been established. Other artifacts found in the shaft are also interpreted by Ashbee as being of a votive nature (Ashbee, et al, 1989, 133-8). Whether the water in the last 10m of the shaft was ever utilized is not clear. The original excavator Edwina Field (Proudfoot) believed it was primarily a well used for its water only, and Paul Ashbee favoured both a religious purpose in addition to its use as a source of water⁹. For whatever reason such a deep shaft was dug, it must have been a costly and labour demanding enterprise.

Other such shaft/wells have been found at Maiden Bower and Biddenham, also in Bedfordshire. The latter was 11m deep and contained a variety of small finds that are reported to have been deposited for ritual cult reasons. Another shaft/well is from Wolfhamcote at Sawbridge, Warwickshire (Haverfield 1904, 249), which had a stone slab at 6m depth on which stood 24 urns of gray ware (Ross 1967, 28), but it remains undated (Webster 1997, 143). The shaft at Ashill, mentioned above, with its many objects including urns placed in layers embedded between leaves of hazel and hazel nut, fibulae, some iron utensils, bones, and flints, seems to reflect some Celtic custom (Ross 1967, 28). What is puzzling about some of these comments are that certain artifacts were apparently found in an ordered state and in a horizontal position. This would indicate that they were placed in the shaft rather than thrown down as

9 In the HBM(E) English Heritage Publication, 1989. *Wilsford Shaft : Excavations 1960-62*, the excavators who were in charge at different times during the excavations, give separate reports, each one with their own interpretations of the shaft's function and what parts they played in the excavations itself. Each one has definite opinions about the original function of the shaft.

is found in many other wells. The question here seems to be not their dating or whether they originated from a particular ethnic group, but how they came to be in those specially placed positions and why? For such instances where the finds down a well or shaft seems to have been deliberately placed at a certain level, the probability must be high that these shafts were in fact used for a ritual purpose, whatever their original function may have been. I think that in the confined space of a well from which water was drawn, it could hardly also have been used for ritual purposes with objects placed at specific levels, because the movement of buckets or other containers would have destroyed them. Votive objects may have been thrown down a well, but that would not be the same as using the well as a ritual shaft.

8.3. Interpretation of views on religious features.

What is important in view of Webster's comments regarding the finds at certain sites is that different scholars interpret the same data quite differently. Curle (1911, 113) and Frere (1987, 136) advocated a theory "that Newstead had suffered a disastrous military encounter with a native force, which had overrun the site or forced a hasty withdrawal" (Clarke 1996, 73). Ann Ross, in contrast, suggests that most of the pits were ritual shafts (Clarke 1996, 73). Finally, he observes that Manning takes a view opposite to both Curle and Ross, arguing that 'by and large the deposits were quite normal for Roman period sites, representing the simple disposal of rubbish' (Clarke 1996, 73). These comments raise two main issues: 1) that very competent scholars using the same raw data can reach totally opposing interpretations based on archaeological information, and 2) even if one agrees with the interpretation of the ritual significance of a site, it seems to depend on what one's background approach is to the subject that colour one's interpretation. Ann Ross seems to have seen most ritual sites in Roman Britain as having had a Celtic dominant aspect, and as Jane Webster says, so do most of the 'Celtists' archaeologists. Clarke suggests that there is a considerable amount of data indicating that up to about 25% of the pits/wells excavated showed some form of votive content, deposited over several centuries, but that the Celtic content was not dominant. The soldiers who occupied the fort were from many different ethnic groups from both local origin and elsewhere in the empire and the diverse ritual small finds of a ritual nature reflect that diversity (Clarke 1996, Table 2 68). Clarke says that from their recent analysis of their own excavations and that done by Curle, that of the more than one hundred pits and wells found, only a limited number appears to have been in use at any one time.

The association of religious contexts with a functional structure such as a well, which was primarily used as a source of water supply, was complex. There seems to be evidence that under some circumstances votive objects may have been cast into wells for some ritual purpose by individuals or groups, but this would not necessarily mean the well was a religious well. Merely the association of deep down in the unknown and the presence of water would have provided the motivation to cast votive objects into it, which would not have detracted from the use of the well as a water supply. Evidence that some shafts were used primarily as religious features have been suggested, but I am not sure that it can be categorically accepted as having been positively proven. It would seem that much past evidence needs to be reexamined in order to provide more rational answers to this complex problem.

9. CONCLUSION

Wells and springs were important sources of water supply to many sites. Although many of the wells were lined, the useful life of wells was often limited. In areas such as London, Newstead and Silchester, wells were relatively shallow because of the high water table in the gravel beds on which the towns were built. In all the three towns many springs ensured plentiful supplies of water, but little evidence has been found about how their water was effectively supplied to baths and other consumers. Because of the nature of the geological conditions in many areas, wells invariably had to be lined to prevent their collapse. Archaeological evidence seems to indicate that wells silted up, in part due to infiltration of soil as a result of seepage, and often resulting in their having to be abandoned, and new wells dug nearby. It would be useful to investigate the extent of this problem and whether there was evidence for maintenance of wells.

The record about availability of tanks for catchment of rainwater is not well documented. How water was transferred from them to baths is poorly understood and needs to be investigated.

In towns like Caerwent, London, Silchester and Wroxeter, and for instance the settlement of Goadby Marwood (see App.2), there is evidence that a number of private residences had well water supplies. There may have been regional differences that need to be investigated. I have not specifically studied this aspect of well water supplies, but there is a need for research on how 'normal' it was for private residences to have had wells during the Romano-British period. Many forts, towns, villas

and settlements had wells, but it is considered that there were likely to be many more sites with wells, and more wells within sites than shown by the archaeological record.

This raises the issue whether there were professional well diggers who tendered their services to owners of homes to dig their wells, because although the operations are simple, there is a certain amount of general knowledge required to be efficient at well digging and to be aware of the dangers involved. The same question may be asked about well digging for public use, and the contractual implications that would have been involved. Was this part of the duties of the local builders? Where geological conditions were not difficult for digging of wells, private owners of homes may have dug their own. Most men would probably have had the skills to build their own homes and may also have been able to construct their own wells and their linings. The constructional aspects of well digging for the Romano-British period are poorly understood and needs to be investigated.

Very little evidence is available on how much water was needed by a community, and how much water could be drawn from wells to provide their needs. The supply of water to baths from wells and from rainwater catchment could have been adequate for only the smaller baths. In the next section I shall be discussing baths over a large range of sizes and the question of how effectively they were supplied with water, which at present is not well understood.

CHAPTER 5.

OTHER WATER-RELATED FEATURES: BATHS, DRAINS AND SEWERS

1. GENERAL

In this chapter I shall discuss various aspects of Roman baths in Britain, as well as drainage and sewer systems at military sites, towns and villas. Drainage was an essential feature of most sites to remove used water from baths and waste material from latrines, and to control surface runoff. Some military sites and towns had elaborate sewer systems for the removal of waste materials. In order that such systems could function efficiently many sites had a running water supply to flush waste materials into the sewers, and to facilitate cleaning of drains and streets.

Excavation reports regularly present the notion of continuous dynamic change throughout the Roman period, not only political and social, but also at sites and to the many structures within their boundaries. The reasons for the changes at sites are varied, of which the most important ones were wear and tear of structures, destruction by fire - especially of earlier wooden constructions, abandonment of a site for a period, new occupation or ownership, the need for improved facilities, and to provide defences to towns. These problems are illustrated by the phases of reconstruction referred to in excavation reports for baths and other structures at forts, towns and villas. In a few instances there is epigraphic evidence (all from forts) for repairs to baths (Welsby, 1980, 89-94). An inscription from Bowes (*RIB* 730) records that c.AD 197-8, Virius Lupus "restored the bath-house, burnt through violence of fire" (Welsby 1980, 89). Inscription *RIB* 791, probably from the fort of Brougham (Cliburn), records that "...this bath-house...which after the old work had been burnt had fallen into ruins,...by renewing the pillars in all the rooms and by...the channels and pipes...". At Birdoswald an inscription (*RIB* 1912, AD 296-305) records that both the *praetorium* and the baths were restored, which may indicate that the fort was attacked, or abandoned for a period (Welsby 1980, 91). The bath-house and basilica at Lancaster were restored about AD 262-66, because they were "ruined by age and fallen into ruin" (*RIB* 605) (Welsby 1980, 92). There appears to be no epigraphic evidence for such repairs to baths at other types of sites. However excavation reports regularly report on the various phases of repairs and reconstruction of all type of structures, water pipes and drains, which also allows one to consider developments in bath construction and style.

I have traced evidence for the remains of 488 Roman baths in Britain at all site types. Baths were introduced to Britain by the army as they advanced west and northwards. Fortresses and some forts had internal baths, but at a number of forts baths were built extramurally in the *vici* that developed nearby. As towns were established baths became an important acquisition to its amenities. There appears to be no evidence for Roman Britain concerning the commercial basis on which public baths were operated. At villas or private houses baths would most likely only have been used by the household members, their labourers, families and visitors.

Classification of baths is discussed in detail by Nielsen (1990) and Yegül (1993), both accounts being based on the principles laid down by Krencker, *et al.*, (1929). I shall not discuss the elaborate bath arrangements found outside Britain, but will look at the local bath configurations used at both military and other site types, with particular reference to their relative areas. The superstructures of baths in Britain are poorly known and most of the reconstructions that have been suggested usually are based on counterparts from elsewhere in the Empire.

I have found dating of structures a problem because it is often not known when during the life of a site the various structures were built. Although baths can be easily identified because of their distinctive layouts (heating, drainage and decorations), in the absence of detailed excavation, it is not generally possible to provide reliable dates for their construction, useful life and abandonment. Inscriptions usually indicate when a structure was dedicated, not necessarily constructed, but the information is nevertheless useful. Dates are often referred to as being during the early, mid or late parts of a century. For some sites circumstantial evidence may be known, such as when events took place during a governor's period of office, for which dates are known. The sites related to the Antonine Wall can generally be dated to within narrow limits because of the two short periods of occupation of Scotland. Some lead and ceramic pipes or tiles can be dated because of stamps found on them.

Millett lists the loss of public buildings, including baths at four Roman towns, only by the century during which they went out of use, were destroyed or demolished (Millett 1990, 130, Table 6.1). For these reasons the chronology of water-related features can generally only be

referred to in broad periods. For instance, it is known that the civilian bath-house at Wroxeter was built after Hadrian's visit to Britain and destroyed in the 4th century. It is not known when the aqueduct to the town was constructed or when it went out of use. In a few instances I have mentioned dates given by excavators based on findings of pottery and coins, or other datable material, but often these only give an end date for the structures. Reference to dating of structures has therefore been limited to those that are fairly certain.

2. ROMAN BATHS

The subject of Roman baths is vast. It has been documented in detail during the 1980s by Manderscheid in a number of publications¹, supplemented by Inge Nielsen's seminal books on *Thermae et Balnea*², covering baths from all over the Empire, and Fikret Yegül's *Baths and Bathing in Classical Antiquity*. Roman Britain has its fair share of baths, initially introduced by the army and subsequently adopted by sections of the civilian community. The bath institution became a feature of the Romano-British landscape, both private and public, from the mid first century AD to the early 5th century AD. Whether baths were used in Roman Britain on the same commercial basis as were their counterparts in the rest of the empire is difficult to say because there is no literary evidence and virtually no epigraphic evidence about baths for Britain. Both Nielsen and Yegül discuss the many literary references relating to baths, particularly about those in Rome and Italy, and to the numerous inscriptions about various aspects relating to them.

Roman baths were the places where the Romans washed and bathed, sought their communal pleasures and companionship, and where they could socialize, drink, eat, have massages. The ritual of daily bathing was generally popular among the élite and wealthy members of communities throughout the Empire, but the poorer classes also used them. The entrance fee was low enough for all people to have access to bathing (Nielsen 1990, I.132). It would seem that baths were lucrative business enterprises which attracted many other forms of business activities within their precincts (Nielsen 1990, 144-6). The Britons and many of the other nations conquered by the Romans adopted the bath as a part of their own culture under Roman rule, hence the large number of baths traced by me from the literature for Britain.

¹ Manderscheid 1981, 1983, and three in 1988 - see bibliography.

² Nielsen 1990, Vols.I & II. In Vol.II 13 baths from Roman Britain are listed.

Natascha Zajac, has posed the question, "Did the Romans go to the baths to get clean or be dirty?" (*Omnibus* 32, 1996, 16-20), which is a refreshing and interesting commentary on the social aspect of the Roman baths institution. She says, "The trouble with Roman baths is that they are common as muck: they are the most common archaeological remains in the Roman Empire, and they are common in the sense that they are seen as part of low culture and associated with dirt, bodies, and sweat, rather than the high culture of religion, politics and art. However, far from being simply public conveniences, *they were an integral part of daily life and a defining element of Roman culture*" (my italics, p.16). She also notes that the baths were nicknamed "the palaces of water" (p.19). Zajac is discussing mainly the activities in the large *thermae*, the public baths, where all sorts of traders, pimps and the like, came to attract business from the bathers. New research into the customs of the Roman world is providing a panoramic view of the ordinary daily social behaviour of Romans as exemplified in their use of the public baths and other amenities. Katherine Dunbabin has commented on the large amount of epigraphic evidence relating to baths, which extols both the pleasures and dangers of bathing, and also its curative value (1989, 7-12). There seems to be a confirmation of the unsocial behaviour that Juvenal complained about (*Sat.* 6.419-21), of women attending the baths only in the evening seeking pleasure, and what the moralist Seneca "perceived to be the increasing perversions of bathing habits" (*Omnibus*, 1996, 19). Seneca (*Let.* 56, 86) complains about the 'deafening noises', the panting and grunting of men swinging weights, and the smacking noise of body massage, the shouting of traders advertising their wares, and other complaints. Such contemporary comments give an insight into the behaviour of people at public baths. Whether it can be concluded from those perceptions that such behaviour was normal in other public baths around the empire is difficult to say. We have no comparable information for behaviour at baths in Roman Britain. Most of the public baths in Roman Britain were much smaller (Table 5.3) than those in Italy and lacked the grandiose atmosphere that was so typical of those of Rome and possibly also those of Pompeii and Ostia. On the other hand, many of the *vici* at forts in Britain had Roman baths and, since their inhabitants provided some of the commercial and service needs for the army, it is likely that similar activities took place also at public baths in Britain during the Roman period.

2.1. Types of baths.

Classification of baths is difficult, particularly if they are to be characterized by their layouts. I shall use ideas from other scholars,

but simplify them to fit in with the layout patterns found for Roman baths in Britain. Krencker (1929) classified and defined eleven areas within a bath complex as being typical and he designated a code of letters related to each one of the areas to indicate them on plans, and most scholars who have written about baths have adopted his conventions (Yegül 1992, 130-2). The typical Roman bath had a *caldarium*, *tepidarium*, *frigidarium*, the usual sequence in which it is believed they were used. Additional facilities were a *laconicum* or *sudatorium* (dry sweating room), *apodyterium* (changing room), latrines, a *praefurnium* (furnace) and a *vestibulum* (entrance area). Some baths also had a *palaestra* (sports area), a *natatio* (swimming pool), and usually a service yard. The last three items generally identified the difference between *thermae* and *balneae* types³, although *thermae* were usually very large complexes. Within the first three type of rooms would have been plunge baths with hot, tepid and cold water respectively. The size of the plunge baths would depend on the size of the three main bathing rooms. The earlier hot water plunge baths were heated by hot convection currents coming from heated air generated by the furnace. Later plunge baths received their hot water from heated tanks through a pipe system controlled with stopcocks. All the elements described above have been identified in Britain. Heated water introduced special problems and the large baths would require greater volumes of water which would have had to be replaced fairly frequently because the heating was at a temperature that was conducive to algae growth.

Roman baths developed from the *γυμνασιον* (*gymnasia*) and *βαλανειον* of the Greeks. Vitruvius gives a basic theoretical approach to Greek baths and *gymnasia* for the Hellenistic period (Vit. 5.10 on baths and 5.11 on *gymnasia*), but his model was superseded by the development of the Roman bath during the later 1st century BC and the 1st century AD. What specifically characterize Roman baths is the addition of hypocausts during the early first century, which brought a whole new social dimension to the comfort and pleasures of bathing (Nielsen 1990, 14-22; Yegül 1992, 356-95). Nielsen and Yegül⁴ both seem to agree that Roman baths were broadly divided into two types: large public baths (*thermae*⁵), which usually had *palaestrae* attached to them and smaller

3 The most recent treatment of baths in English by both Inge Nielsen (1990) and Fikret Yegül (1992), give excellent descriptions of the developments of baths and provide plans of many of the most important ones.

4 Yegül 1995, 43. n.95 & 96. The author refers to the interchangeability and confusion of these two terms and gives an example of an inscription (n.94) to show this.

5 Large institutions like the baths of Caracalla and of Trajan at Rome, or the Antonine baths at Caesarea, Cherchel, North Africa, Nielsen, 1993, 3 Fig 58, 2 Fig 53, 29 Fig 191.

bath-suites (*balneae*), many of which were run as business enterprises. However Nielsen defined *thermae* to be baths with a *palaestrae* and often included an external swimming pool, whereas *balneae* are defined as baths without these additional facilities (Nielsen 1990, 3). According to these definitions the eleven large monumental baths in Rome were *thermae*, as were many other baths with *palaestrae* found elsewhere in the Empire. Baths without *palaestrae* were classed as *balneae*, as used in this thesis.

Inscriptions generally attest the construction of baths by private citizens and that they had a commercial purpose (Yegül 1992, 43 no.97), but none has been found for Britain. During the Republican period all Roman baths used by the public were described as *balneae*, and were usually privately-owned businesses. It was during the reign of Augustus that Agrippa built the first *thermae* (approx. 1ha) in 25 BC, which included sports and other facilities not specifically connected with bathing. After his death they became public buildings, as were all the other *thermae* in Rome (Yegül 1992, 135).

The layout and size of Roman baths varied widely over the Empire, and although Britain did not have the monumentally large public baths found in Rome, the legionary baths and some of the *civitas* capital baths were of the *thermae* type because they had (*palaestrae*), of which examples are Caerleon, Chester, Exeter (fortresses), and at the *civitas* capitals of Leicester and Wroxeter. The term *thermae* was generally used to describe large bath suites, which included *palaestrae* and the term *balneae* was applied to smaller bath structures.

There are, however, other ways of classifying Roman baths, most notably through their layout.

The following simplified layout classification of baths will be used in what follows for discussion:

- (1) the linear or row type (*Reihentyp*),
- (2) the block type, and
- (3) a complex linear or block type layout of the basic bathing rooms with various additional rooms.

The block type bath layout varies in pattern because the three types of bathing rooms can be linearly orientated with additional rooms to form a block pattern, or the basic bathing rooms can with an additional room form a square. For the larger bath complexes all three types of layout

may have had *palaestrae*. There were many variations of each type and the intention is not to discuss details of classification, but merely to have a basis for discussing layouts of baths at some typical sites.

2.2. Roman baths in Britain.

Both *thermae* and *balneae* were built in Roman Britain. The type of bath built at a particular site depended on the need of the type of site and on the economic circumstances that prevailed at the time, particularly for non-military sites. The large numbers of soldiers concentrated in legionary fortresses and larger forts often required substantial baths of the *thermae* type as at Caerleon, Chester and Exeter (fortresses), Red House and Gelligaer (forts) (Nielsen 1990, II, 19). The large towns also had *thermae* type baths such as at Leicester, London, Silchester and Wroxeter. The reasons for these towns also having *thermae* type baths are probably because of their large populations, the healthy economic climate during the 2nd and 3rd centuries and that the inhabitants of the towns had become used to their daily bathing ritual. I have not been able to ascertain whether any other sites had *thermae*, but it is likely that some of the other main towns and legionary fortresses had them.

The large Roman baths were notable for the richness of their architectural attributes and provided communities with a special type of spatial layout. Many baths had beautiful and well executed mosaics and often painted walls to create a pleasing ambiance for the users. Both paintings and mosaics often used water images from mythology to create an atmosphere of pleasure associated with the act of bathing. The mosaics at Bignor villa are illustrations of such images. There has sprung up a whole literature amongst archaeologists, anthropologists and sociologists about the concept of 'social space', and for the social functions of the daily Roman bath ritual this architectural space was explored to its fullest.

The legionary bath at Caerleon (Fig.5.1) is a prime example of the standard of architectural refinement achieved by the Roman army 'architectus', the remains of which David Zienkiewicz (1986) describes in detail. He makes comparisons between the four similar baths at Caerleon and Exeter in Britain and Avenches and Vindonissa in *Germania Superior*, (115-29), all of the same vintage, with very similar architectural features.

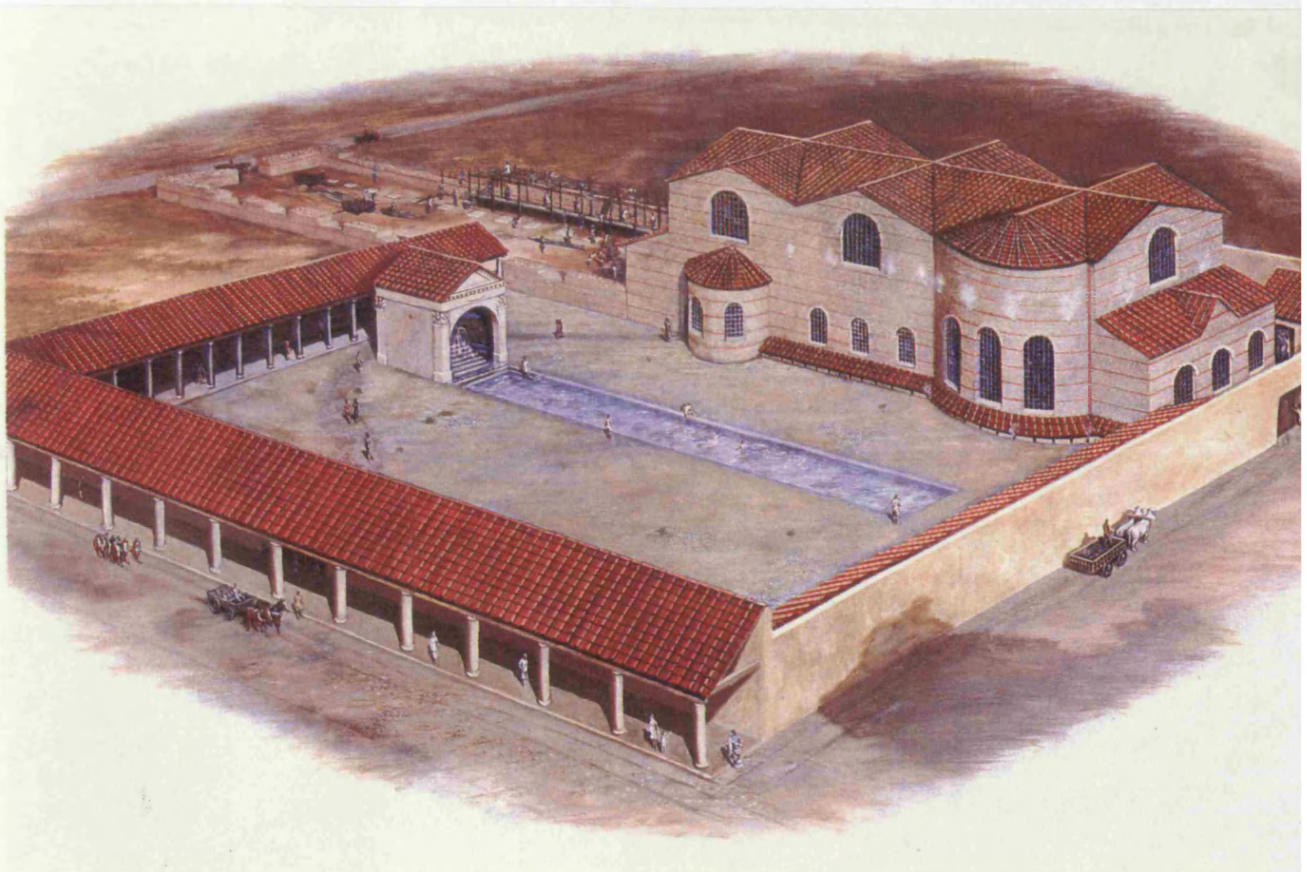


Fig. 5.1: Caerleon fortress *thermae* showing bath with *palaestra* and swimming bath (after Zienkiewicz 1986).

The reconstructed exterior of the *thermae* and the *palaestra* with its swimming pool and sports area are illustrated in Fig.5.1. Legionary fortress baths were large structures that had to serve a garrison of at least five thousand soldiers, and perhaps also their dependents. The structures were of a monumental type which required large halls that were unobstructed by internal supports. For practical reasons the arched roofing were constructed of masonry, so that very large vaulted spans were attempted (Zienkiewicz 1986, 22). The heights were as much as 15m with spans of 12m.

The baths usually were the most massive structures in the fortresses and at Caerleon covered an area of nearly one hectare (Zienkiewicz 1986, 27). None of the baths found in Britain compares with the eleven large imperial baths of Rome whose construction seems to have been motivated to show the power of the Emperor and to win the confidence of the people.

2.2.2. *Size of Roman baths in Britain.*

Table 5.1 gives comparative sizes of some baths in Britain extracted from information given by Nielsen (1990, II, 19-20). I have added fourteen additional sites with their estimated areas for comparison⁶.

⁶ The areas calculated are only estimates, since they are based on plans given in various texts and it depends on how the dimensions were used. Different texts will seldom give the same areas for the same sites, as for instance the total areas for Wroxeter are variously given as 0.81ha, 0.53ha and 0.45ha, depending on the areas that are included as part of the baths, such as the *marcellum* and the *piscina*, both within the bath precinct.

Table 5.1: Areas of some Roman baths in Britain (after Nielsen 1990, II, 19-20, and an additional selection).

<i>Viroconium Cornoviorum</i> (Wroxeter)	<i>civitas</i>	0.533ha (<i>thermae, palae.</i> 0.150ha)
<i>Ratae Corieltavorum</i> (Leicester)	<i>civitas</i>	0.420ha (<i>thermae</i>)
Castell Collen	fort	0.103ha
<i>Coriosopitum</i> (Corbridge)	fort	0.230ha (<i>palaestra</i> 0.140ha)
Gelligaer	fort	0.210ha (<i>palaestra</i> 0.130ha)
<i>Callewa Atrebatum</i> (Silchester)	<i>civitas</i>	0.069ha (<i>thermae</i>)
<i>Hunnum</i> (Halton)	fort	0.065ha
<i>Aesica</i> (Great Chesters)	fort	0.054ha
<i>Cilurnum</i> (Chesters)	fort, <i>vicus</i>	0.049ha
<i>Brocolitia</i> (Carrawburgh)	fort	0.044ha
<i>Condercum</i> (Benwell)	fort	0.044ha
<i>Vindolanda</i> (Chesterholm)	fort, <i>vicus</i>	0.031ha
Sizes for other sites:		
<i>Isca</i> (Caerleon)	fortress	0.80ha (<i>thermae</i> , 0.576ha <i>palae.</i>)
<i>Deva</i> (Chester)	fortress	0.64ha (<i>thermae</i>)
<i>Isca Dumnoniorum</i> (Exeter)	fortress	c.0.40ha (<i>thermae</i> , Bidwell)
Bath	small town	c.0.22ha
<i>Londinium</i> (London) (Huggin Hill)	<i>municipium</i>	0.131ha (<i>thermae</i>)
<i>Durnovaria</i> (Dorchester)	<i>civitas</i>	0.126ha (<i>palaestra</i> ?)
Red House	fort	0.109ha (0.046ha, <i>palaes.</i>)
Chedworth (north bath)	villa	0.032ha
Caerhun	fort	0.030ha
Rockbourne (West range)	villa	0.028ha
Great Witcombe (S-E bath)	villa	0.029ha
Bewcastle	fort	0.024ha
Brecon Gaer (internal)	fort	0.021ha
Bearsden	fort	0.016ha
Bothwellhaugh	fort	0.014ha

The listed baths from Britain are a whole order smaller than the baths of Rome or some of those from North Africa. In contrast the areas of the large British baths were relatively small in comparison with the bath complex of Caracalla in Rome which occupied a total area of c. 11.05ha, of which the area without the *palaestra* was 2.508ha, and about 1200m² of this area would have been used to hold water (Nielsen 1990, vol II, 3, item C.8). The large *thermae* at Carthage covered a total area of 3.99ha of which the bath-suite had an area of 2.625ha (item C.208). Most of the large public baths in Rome and elsewhere were imperial baths sponsored and funded by emperors, whereas the public baths at urban centres in

Britain were probably funded locally by the towns and financial contributions from benefactors.⁷

One of the problems of comparing sizes of different baths is that generally published information includes the area of the *palaestra* where it existed. This masks the true area of the bathing section. I suggest that, when such comparisons are made the area of the *palaestra* should not be taken into consideration, except when comparisons are made of *thermae* with their *palaestrae*.

For instance, the total area of the Caerleon fortress bath is calculated to be from c. 1ha to 0.80ha depending on which areas are included, whereas the area of the three rooms of the bathing area is only about 0.1ha (12.9% or 14.8%).

At Red House fort the area of the bathing block was c. 0.0634ha and the area of the *palaestra* was 0.0458ha, which occupied 42% of the total area of the complex (0.1092ha).⁸ The bathing area at Wroxeter is about 0.133ha, while its total area including the basilica (*palaestra*) attached to the bath is 0.533ha. The bath at Silchester is about 11 times smaller than the bath at Wroxeter, and the last five forts in Nielsen's list are of the order of 16 times smaller than that at Wroxeter and the legionary bath at Caerleon. The baths at villas are also very much smaller than those at fortresses, forts and towns. The area of the S-E bath at Great Witcombe villa is only about 4% of the total area of the baths at Caerleon and only about 6% of that at Wroxeter. If the Great Witcombe bath area is compared with only the bathing-suite area of Caerleon, then its area is nearly 30% of the area at Caerleon and about 22% of the area at Wroxeter. To illustrate comparisons of total areas and areas without the *palaestrae*, I compare firstly the area of the bath at Great Witcombe villa with the total areas at those of Wroxeter, Caerleon, Carthage and the Baths of Caracalla - 1:28:34:137:381, and secondly, with the estimated areas of the bathing areas only, at the same sites - 1:4.6:3.4:90:86. These areas are all estimates based on the data and plans found in the literature. Nevertheless these percentages and ratios provide relative orders of magnitude. Arising out of these comparisons an important statistic is

7 Wroxeter's second public baths may have been sponsored and paid for by the Emperor Hadrian (Barker 1990, 2).

8 Another problem is that plans given in the literature are often copies of either original plans or even copies of copies, so that measurements made from these and using the scales provided can introduce errors. Therefore areas calculated from these plans can only be approximations of what the remains actually represent on the ground.

that the bath at Great Witcombe villa is quite substantial in terms of provision of bathing facilities when compared with the larger baths in Britain, and the areas of the bath-suites at Chedworth and Rockbourne villas given in the table above, indicate similar trends.

An important aspect of the size of baths would have been the cost of running them, of which the cost of fuel would have been a major factor. Fuel requirements of the smaller more compact baths would have been much less than for the larger baths because the volumes of rooms to be heated would have been smaller. The larger baths would have been more difficult to heat efficiently because of the large size and height of the rooms. The ratios between the larger baths of Britain compared to the large baths of the Mediterranean indicate that their heating costs would possibly have been much lower, a probable reason for the more modest size of baths in Britain. To what extent the colder climate of Britain would have influenced heating costs of large sized baths compared to those of the Mediterranean countries would require special study, but certainly during the winter months more heat energy would have been required per unit area in Britain than in the southern Mediterranean warmer areas.

2.3. Layout of baths in Britain.

Both Nielsen and Yegül discuss a variety of configurations of baths across the Empire with often complicated classifications. From an examination of the bath complexes illustrated by Nielsen and Yegül it would seem to me that baths built before the Trajanic period can be divided into two basic groups: firstly, bathing areas consisting of the usual hot, tepid and cold rooms, each room type with their respective plunge baths and changing rooms, and secondly, the *thermae* type baths that had the additional areas for *palaestrae*. After the Flavian period many baths in the other provinces took on exotic plans with the distribution of the basic bathing areas configured in many different patterns, even for private villa baths. These are not found in Roman Britain. In order to examine the bathing area layout of bath facilities it is necessary to concentrate on the bathing area alone, ignoring the *palaestra* area and other buildings associated with the baths, as is so clearly shown for the baths at Wroxeter.

2.3.1. Military sites.

Legionary fortresses usually had internal bath-houses, and they were necessarily large to be able to cope with the large number of users. Auxiliary fortresses normally had their bath-houses outside the fort.

However there were exceptions, such as the later small internal baths at Brecon Gaer and Caernarfon for reduced garrisons when the areas of the forts were reduced (Johnson 1983, 193-4). Excluding the bath-suites of commanding officers, which were always within the defences, the bath-houses for other ranks were usually outside forts. Sixteen bath-houses are known in the zone of Hadrian's Wall, of which four were inside the forts, Bewcastle, Carvoran, Halton Chesters and Risingham (Gillam, et al, 1993, xv), the others all being extramural in the nearby *vici*.

Some of the smaller forts had the linear type (1) layout with all the rooms along a single linear axis, with apses sometimes projecting from the sides, or some small rectangular rooms appended to it, and often an *apodyterium* was added at either end. Examples are the forts of Halton Chesters, Bearsdon and Bothwellhaugh (Fig.5.2); block type (2) baths are found at the forts of Benwell, Carrawburgh, Red House and Vindolanda (Fig.5.3); and of the large baths with a *palaestra* such as at Caerleon the bathing rooms had a linear type (1) layout (Fig.5.4). The very large room at Red House is shown as an *apodyterium* by Anne Johnson (1983, 221), but this seems to be unusual. There is a large room to the right of the *frigidarium* which is unmarked on her plan and also on Roger Wilson's plan (1980, 62, Fig.75A), with its entrance on the right leading from the large enclosure (see Fig.5.3). This unmarked room may be the *apodyterium*, and the large room is the *palaestra*, or an enclosure with some other function, perhaps of a religious nature, since it has the portico in its centre. Daniels, the excavator, called this a courtyard (1959, 176, plan). (Scale for small bath layouts is 1:380, and for large baths is 1:900).

The size of these changing rooms vary considerably. At the four block type sites, Benwell, Carrawburgh, Red House and Vindolanda (Fig.5.3) they were the largest rooms in the bath-suites. The four bathing rooms (hot, tepid, cold and dry hot rooms) at Vindolanda forms a symmetric square block, as shown in Fig.5.3. Next to the cold room is a rectangular cold plunge bath, and the rectangular *apodyterium* with its entrance to the bath-house, lies at its east end next to the cold bathroom and the hot dry room.

Military sites seem to have used only the linear and block type layouts, whereas civilian baths used both of these, and also complex linear and block type layouts. It would seem that it was the fashion at military sites to have this block type layout during the later 2nd century.

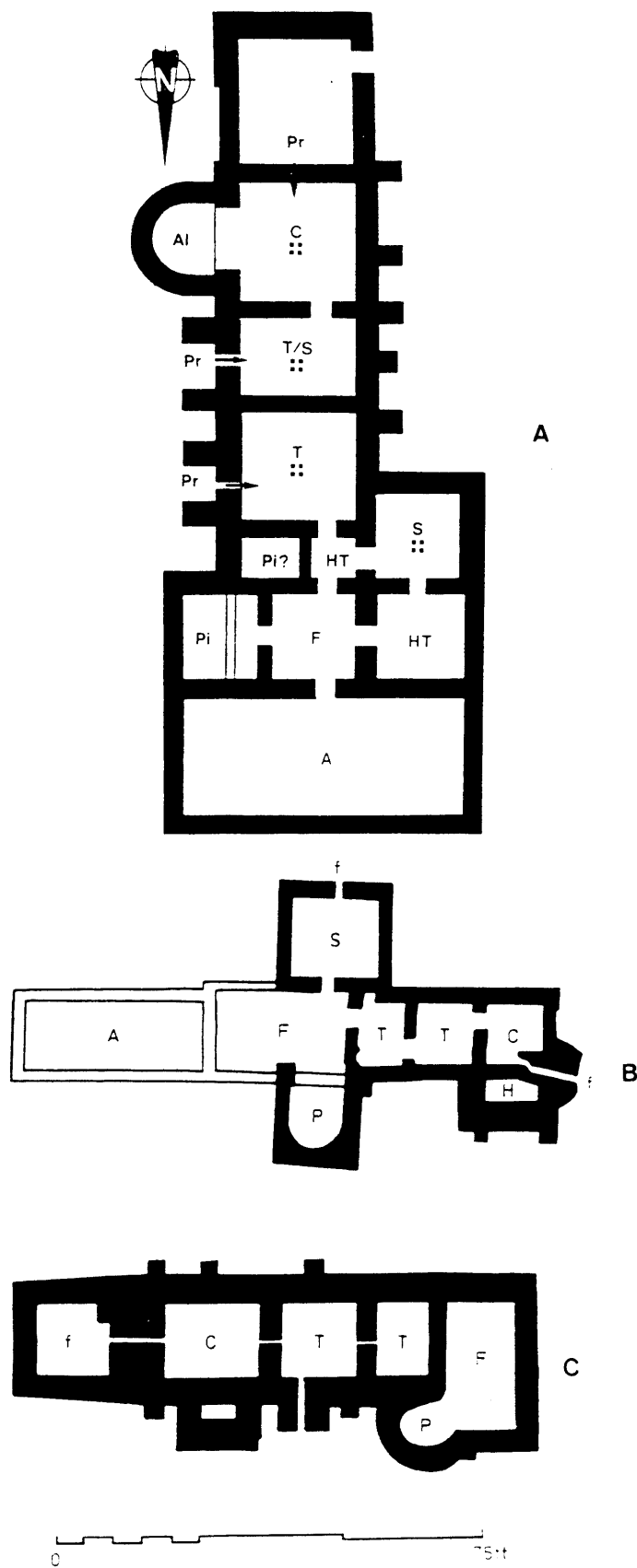


Fig.5.2: Linear type layouts:
 (a) Halton Chesters (from Nielsen, II, 1990, Fig.136);
 (b) Bearsden and (c) Bothwellhaugh, (from Wilson, 1980, Fig.74(a), (b)).
 (Scale 1:380).

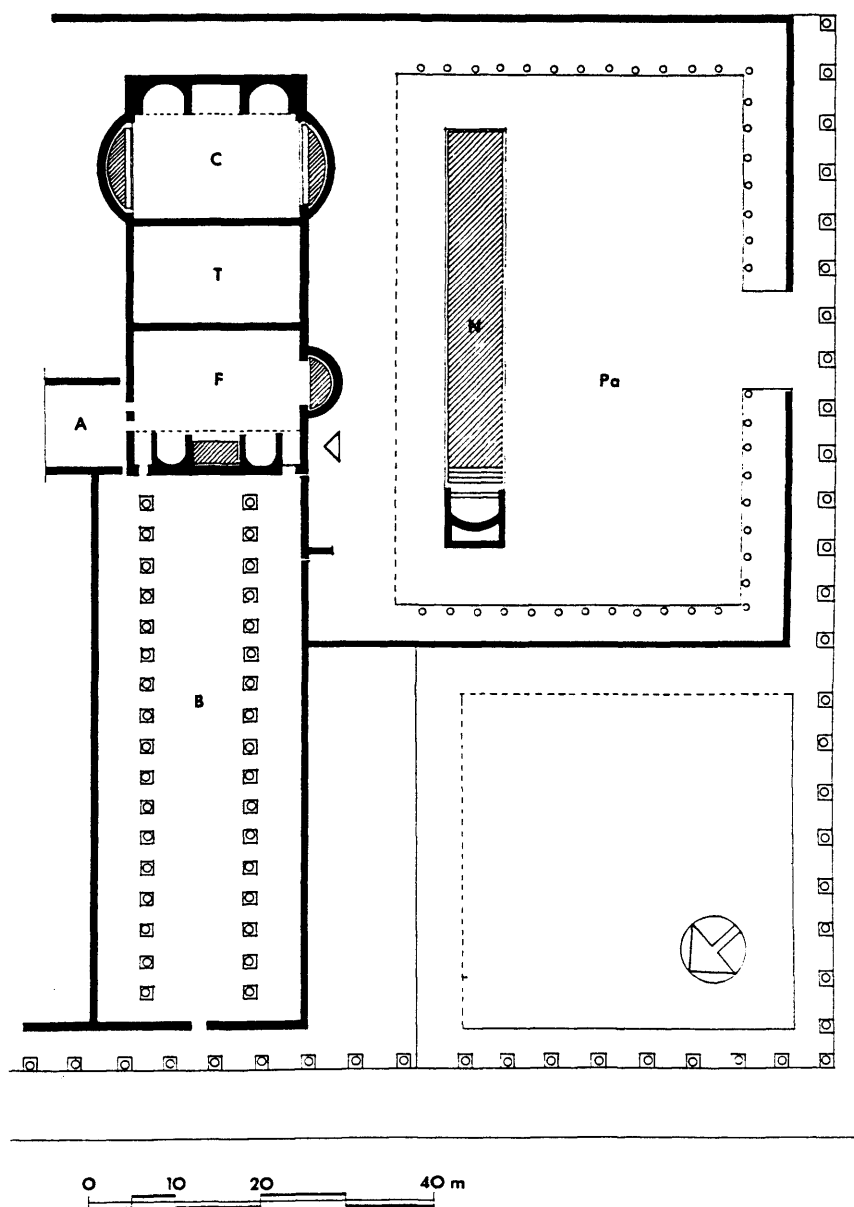


Fig. 5.4: Caerleon fortress baths, (from Yegül 1992, 78, Fig.87),
(1:900)

The forts along Hadrian's Wall such as Benwell, Bewcastle, Chesters, Great Chesters and Vindolanda were in the active military zone, and for those sites probably the important need was to provide a basic service, rather than additional facilities such as *palaestrae*. Also, space within many fort enclosures did not allow for large sports areas. At Strageath the bath-house was of the simple row type with only a *caldarium* and a *frigidarium*, because it had to fit into a narrow space between the ramparts and the barracks (Frere & Wilkes 1973, 1989, Fig. 53).

Chesters is an example of a fort which went through several phases of changes during its occupation. George Macdonald produced a study of the site (1931, 219-304) in which he gives details of the construction of the baths and its changes, but makes clear it is not an excavation report.

At several places Macdonald refers to the changes that were made to the structure over time, as at the entrance to the *apodyterium*. He comments on the drain which starts in the *frigidarium* and flows out towards the *apodyterium* and into the drain of the latrine adjacent to the east wall of this room. There seems to have been a change in the direction of flow since the original drain flowed in the direction of the north-west corner. It would seem that new floors were laid in the hot rooms at this time, most probably because the original floors had deteriorated due to the heat from their hypocausts. There appears to have been evidence that at a later stage the drain area in the *frigidarium* settled and that repairs were made so that flow could be maintained to flush the latrine drain.

Evidence shows that the lintels of the doors between the *caldarium* and the plunge bath to its north were altered at some time. The floor of the *tepidarium* was also replaced and so was the roof of the hypocaust of that room. The floor of the *sudatorium* west of the *apodyterium* also was replaced. Little can be said about repairs or changes to the superstructure, other than about the lower parts of surviving walls. Although no dates are given by Macdonald, it is clear that many alterations and repairs were made over the useful life of the baths. Such repairs must have been standard operations at most military sites, and especially after there was a period of non-occupation.

2.3.2. Civilian sites.

Civilian baths had all three type layouts, but the larger baths seem to follow a linear complex layout. Some villa baths were of the complex block type layout, such as Great Witcombe, Darenth and Eccles.

The *civitas* capitals of Wroxeter (0.533ha), Leicester (0.42ha) and Silchester (0.069ha) had large *thermae* type baths. The baths at towns such as at Caerwent, Chichester, Dorchester and Winchester would have been classed as *balneae*, probably dictated by economic limitations preventing them from having *palaestrae*.

Large towns.

At **Wroxeter** the original three bathing rooms of the Hadrianic baths was of the row type (1)(Fig.5.5), with a pair of lobbies (6 and 7) separating the *frigidarium* from the *tepidarium*. During the later 2nd century, perhaps after the fire of c.AD 165-85 (Wacher 1995, 367), extensive alterations were made to the baths, with the addition of another *caldarium* (17), converting the baths into the complex type (3) layout. The second *laconicum* (11) was enlarged (shown as a *tepidarium* by Wacher, 1995, 47, Fig.11), and changes to the heating system was made to accommodate the additions. The bathing rooms all had rectangular plunge baths at both ends, and the new *caldarium* had both an apsed and a rectangular plunge bath. Why the second set of smaller baths were added is uncertain, but they may have been used to also accommodate bathing by women. How long the baths survived is uncertain but by the late 4th century the basilica had been dismantled, as was part of the baths. It is difficult to say whether the dismantling process was a deliberate act to destroy the structure, or whether the building had deteriorated to the extent that it became unsafe and had to be pulled down. The bath dating from the fortress period also had a linear type layout (Atkinson 1942).

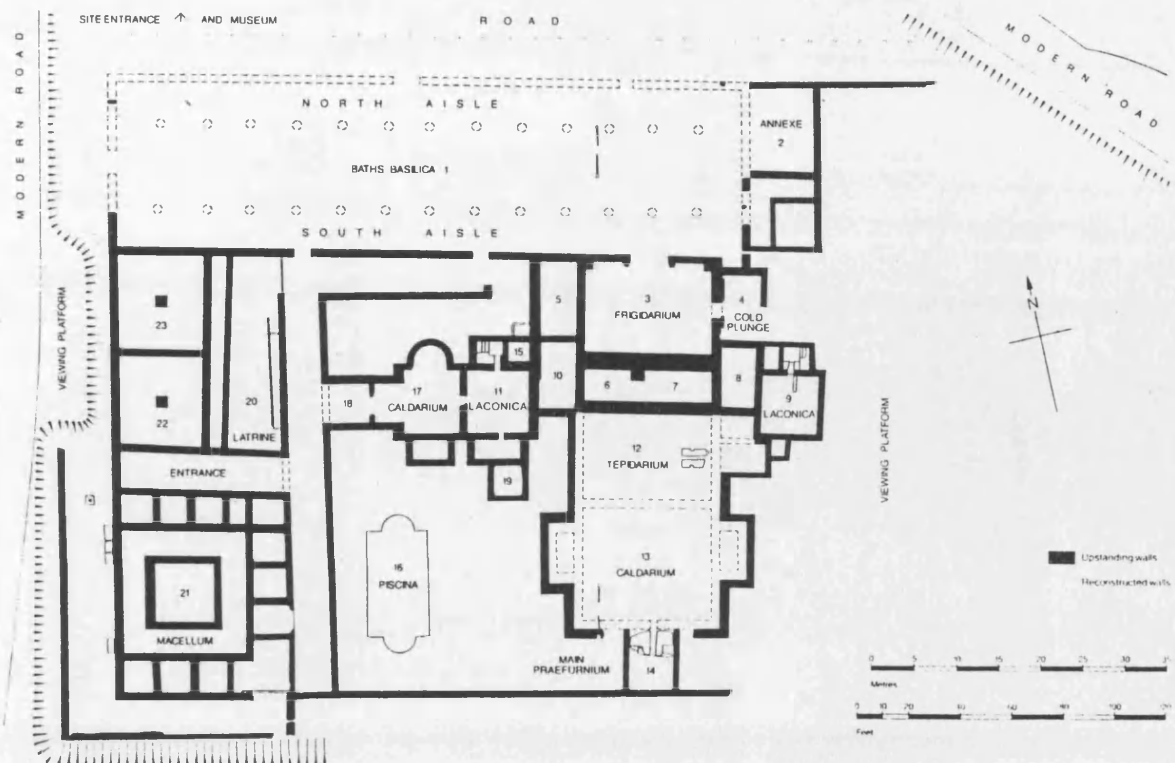


Fig. 5.5: Wroxeter baths layout (Webster & Barker 1991, 16-7).

The baths at **Leicester** were unusual for Britain (Fig.5.6), because even though the *caldaria*, *tepidaria* and *frigidarium* were in linear sequence, there was also a symmetrical lateral spread of three *caldaria* and *tepidaria* next to each other, giving them a type (3) layout. The excavators did not speculate on the reason for this triplication of the warm baths. They may have served different sections of the community, but there is nothing to suggest it. The two outside *caldaria*, each with an area of about 140m², had apsed plunge baths along their outside walls and at their west ends. The centre hot bathroom had a rectangular plunge bath at its west end. Each *caldarium* had its own furnace, which must have used an enormous quantity of wood fuel to heat them. Then follows a *tepidarium* and what appear to be two plunge baths at its north and south ends, and two *laconicae* next to them.

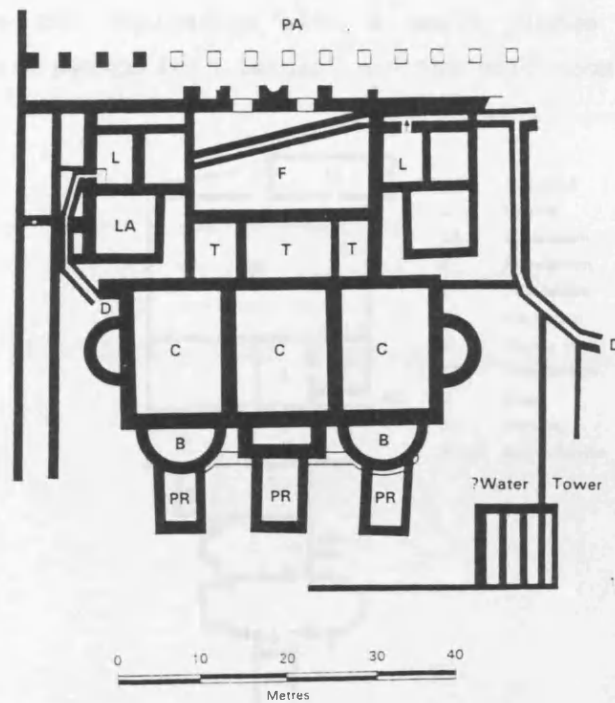


Fig. 5.6: Leicester baths layout (from Wachter 1995, 45, Fig.10(1)).

The *frigidarium* was a large room (c.220m²) whose entrance to the baths was from the west wall of the adjoining *palaestra*, of which the existing remains is known as the Jewry Wall. The baths seemed to have had an extensive drainage network with a major drain running along three sides of the complex. There is controversy over the water supply for this large bath complex, discussed in Chapter 3.

The **Silchester** public baths (Fig.5.7) were much smaller in total area (0.069ha) including its *palaestra* than the baths at Wroxeter and Leicester. Its baths also had a sequence of hot, tepid and cold rooms, but they were not in the true row type alignment as can be seen from the plan. The layout suggests that the original bath may have had the row type (1) layout, but subsequent additions and alterations converted the baths into a complex type (3) structure. The small *caldarium* may have been the original hot room with its furnace at the rectangular plunge bath end, but a later larger *caldarium* seems to have been added with a larger furnace. The room also had two plunge baths, but their positions have been reversed.

The plan shows the *tepidarium* with a small plunge bath, while the *frigidarium* had a plunge bath larger than the cold room itself.

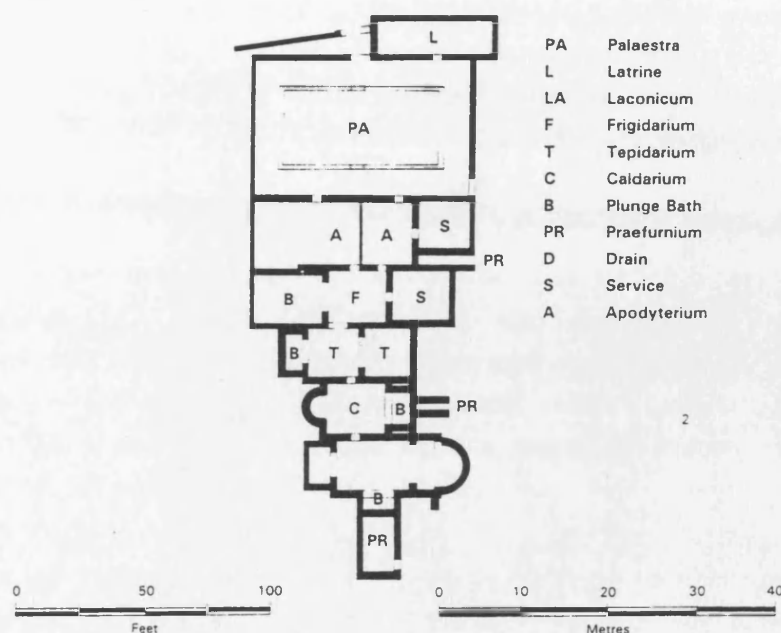


Fig. 5.7: Silchester baths layout (from Wachter 1995, 45, Fig.10(2)).

Next to the *frigidarium* is a room referred to by Wachter as a service room, which may at one time have been part of the *frigidarium*. The entrance to the baths was through the *apodyterium*, which was adjacent to the largest room, the *palaestra*.

The size of the individual bath rooms at Silchester was smaller than those of Wroxeter and Leicester, probably indicating that the number of people using the baths were not as numerous as they were at the other two towns, and/or that the town could not afford to have a larger public bath.

The evidence indicates that known civilian public baths were of the complex type layout, even though they may originally have had a linear layout. Some of the other larger towns have not been excavated sufficiently to indicate the layout of their baths, or not sufficient of their remains have survived. There is a need for more investigations of these sites to provide a better understanding of these complex structures.

Small centres.

The needs of small towns, settlements and villas would have been quite different to that at forts and large towns, and the smaller size of bathing areas indicates that at these sites much lower numbers of people used the baths at any one time. The baths were usually part of a single unit of buildings, seldom freestanding, especially at villas, and their size had to conform to the size of the rest of the buildings.

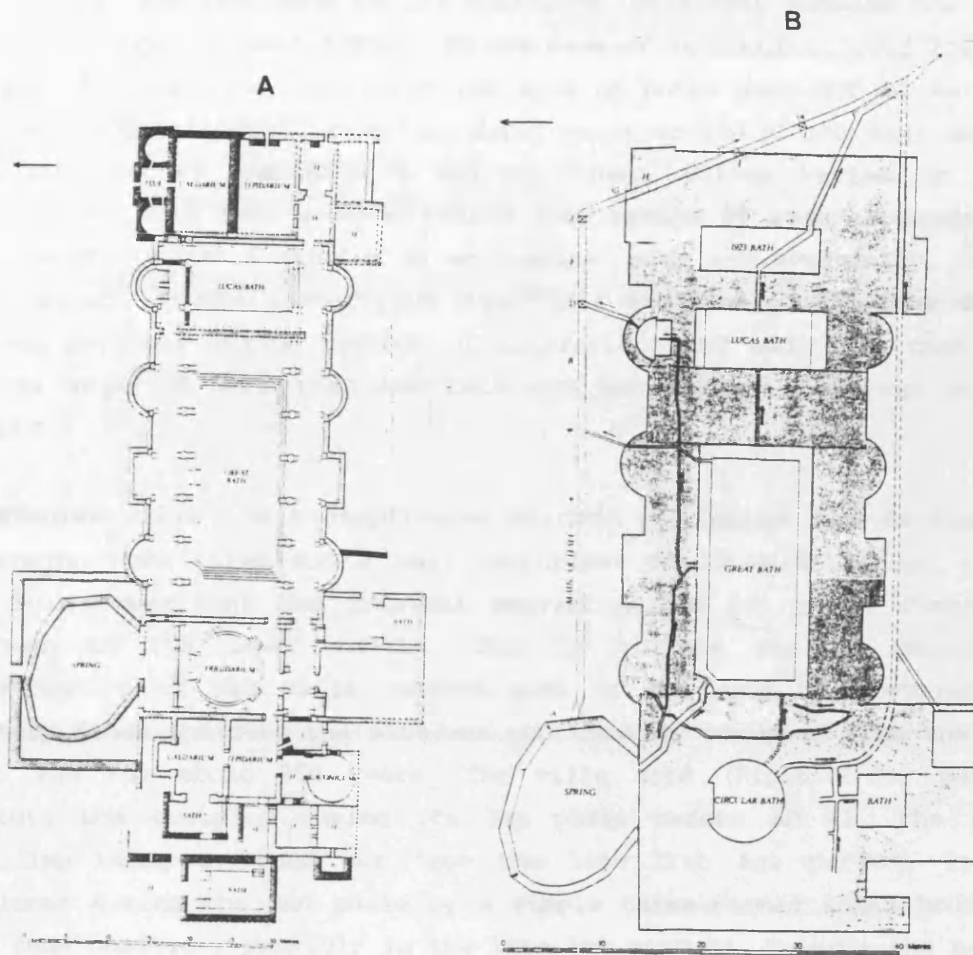
The small town of **Godmanchester**⁹ had a bath-building occupying an area of about 365m² and the bath-building at the small town of **Well**¹⁰ was even smaller (c. 190m²), although it had an aqueduct water supply. Neither of the baths at these two sites had anything more than the basic requirements for bathing. It is not clear whether baths in small towns were available to the inhabitants of the towns or whether they were the property of private owners.

An exception seems to have been the early bath at **Gadebridge Park** villa, which initially was separated from the main house, and later was linked with secondary rooms.

The baths at the small town of **Bath** were a special case. They developed as spa type baths and were probably run on a commercial basis. The baths were adjacent to the temple of Minerva, which was associated with hot springs with ritual connotations, which may have affected the status of the baths. The baths had a long history of development, there being four periods of major alterations. The bath started as a small spa at the west end near the spring end as a bath-suite with the complex block type (3) layout (Cunliffe 1984, 140, Fig.85) (Fig. 5.8a). Eventually the Great Bath was constructed with an area of c.300m² inside a hall with an area of about 875m². The hall was magnificently decorated with portico pillars holding up a high roof. A smaller bath was added east of the main bath, referred to as the Lucas bath. During the 3rd period a *caldarium* and *tepidarium* and other rooms were added at the extreme east end, which was of the linear type (1) layout. The total area of the bath complex during the 3rd period was about 0.22ha. The bath complex had elaborate water supply and drainage systems (Cunliffe 1984, 145), (Fig.5.8b). A lead pipe was still in place when found, which shows the soldered joint.

9 JRS 49, 1959, 116, Fig 13.

10 Gilyard-Beer R, 1951, *The Romano-British Baths at Well*, 11, fig 2.



Figs 5.8a, b: The baths at Bath, and their water supply and drainage systems, (after Cunliffe 1984, 140, 145).

Villas.

Villas developed from the early 1st century simple cottage type houses to the variations in sophisticated layout of the 2nd to 4th centuries, which would have depended on the wealth of their owners. The small villas of the early period would have had simple bath arrangements of one or two rooms. With the passage of time many villas would have developed into the elaborate layouts found all over Britain south of Durham, whose occupation extended into the 4th century, indicating the considerable wealth of their later owners. They, like other site types, went through continual change and this was reflected in the different phases of bath construction at many sites. Several villas of the later period had more than one bath-suite, for example, **North Leigh** had two (Wilson 1988, 128), and **Rockbourne** (Fig.5.9) had three, either because

more than one household lived on the site, or to separate the family bath-suite from that used by the workforce, or simply because the owner wanted an improved bath layout. In the case of Rockbourne, over its long period of occupation, the first two sets of baths went out of service. The more sophisticated layout and fancy construction of the east bath of the 4th century indicates a wealthy owner. Villas varied in their layout, but must have evolved over a long period at some sites such as Northleigh, where it started as an L-shaped site and eventually, in the 4th century, became a courtyard type villa enclosed on all four sides. It was probably during periods of alterations and additions that some villas acquired more than one bath and had mosaics laid out on the floors.

Rockbourne villa had a complicated history of changes and development extending over three and a half centuries. The RCHM(E) report (1983, 129-50) states that the original excavation did not reach everywhere through to the lower levels, that is to the earlier phases of construction of the villa, before much of the site was covered up. Pottery finds indicate the site was continuously occupied from the late Iron Age for about 350 years. The villa site (Fig.5.9 for partial layout) was occupied during its 1st phase before AD 43, the first building being a round hut from the late Iron Age period. It was replaced during the 2nd phase by a simple three-roomed Roman house at the same position, possibly in the late 1st century. Towards the north-east of this house there was evidence of an early bath, subsequently replaced by a later east range bath-suite (A). During the 3rd phase, c.AD 150 the west range house was constructed, and some time during the second half of the 2nd century a bath-suite (B) was added at the back of the new house. This bath-suite was a simple row type with small rooms of the order of about 12-14m², while the area of most of the house-rooms were at least of the order of 27-30m². Over a period the bath was modified (phase 4) with additional rooms added to the house and baths, and new arrangements for the furnace room. Later the old furnace room was recommissioned (5th phase) to provide heating for rooms to a modified house. During the late 2nd century or early 3rd (phase 6) development took place on the north range, and additions were made to the west bath.

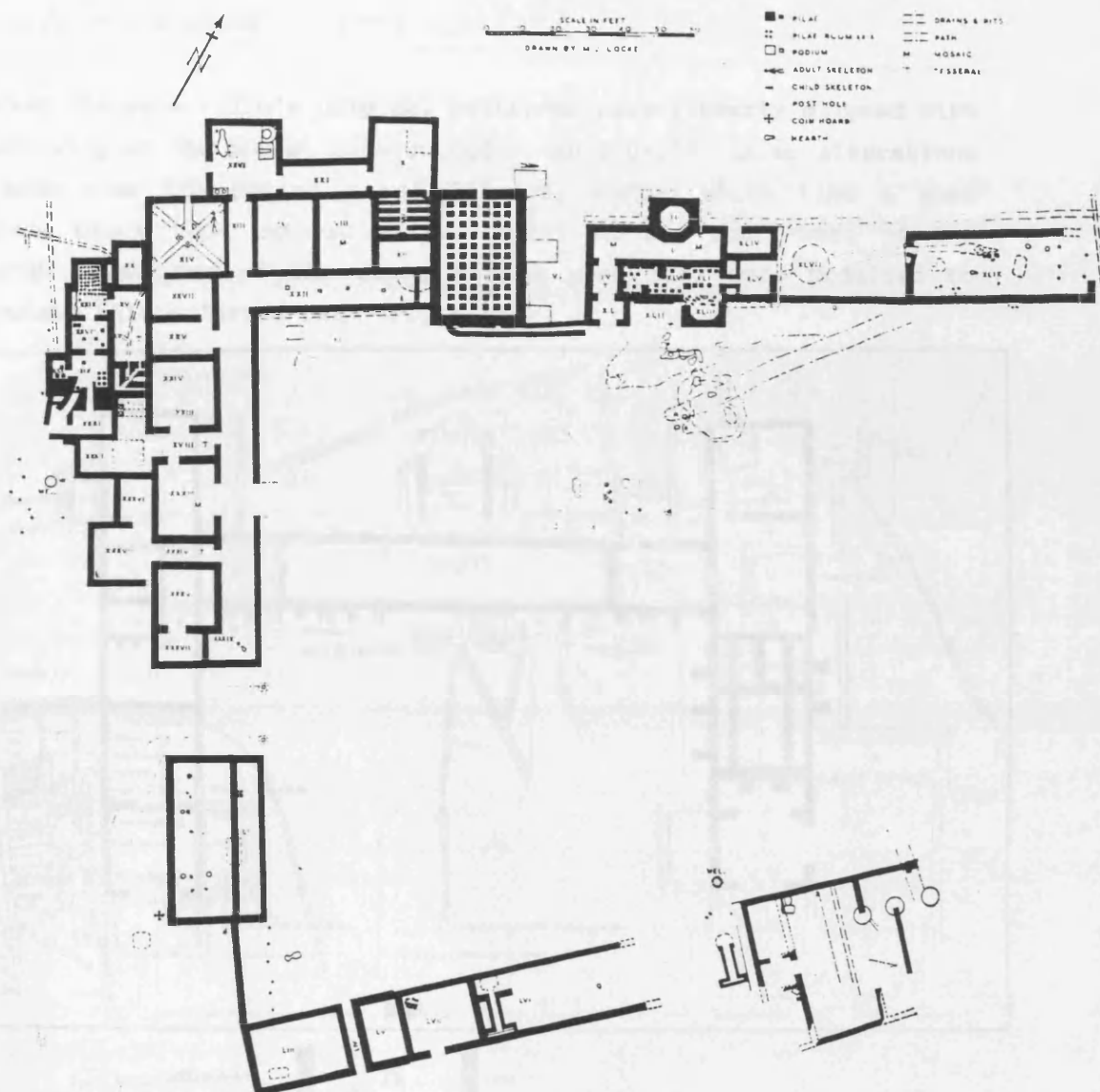


Fig. 5.9: Rockbourne villa, west and east baths (from RCHM(E) 1983, Fig. 2)

Extensive changes were made to the villa with additions to the south wing. New east baths (B) were constructed during the 7th phase (3rd century), and the west baths seem to have been abandoned by this time. During the 8th phase, probably during the 4th century, the east baths were extended with the addition of a plunge bath and drainage and an extension towards the east. This brief statement is intended to indicate the evolution of this villa site over time, for which there were a number of reasons, the most important being that the structures would have needed continuous repairs and replacement because of deterioration over the 300 years of Roman period occupation. Also, the villa came

The layout seems to be poorly planned and not squarely aligned with the rest of the house. The new *caldarium* (Room 5), within Room 4 of the original house, was constructed with a new entrance and the old one was blocked. It had no hot plunge bath. The original Room 6 now became the *frigidarium* with an apsed plunge bath (7) on its east side and a rectangular plunge bath (7a) along the south wall of this room, which was damaged by subsidence. The impression seems to be that the rectangular one was built first and when it was damaged the new apsed plunge bath was built. On the west side is a large *sudatorium* (10) with a hot plunge bath (11b). A large *tepidarium* (8) with a plunge bath (8a) is sandwiched between the *sudatorium* and the *frigidarium*. The space between the north-west wall of Room 4 and the *caldarium* was a latrine. The bath-suite had an overall area of about 290 m². At least four drains were associated with it. There is a change from the west baths linear type layout to a more complex one for the east baths. This was a major change to a private estate. Over a period of time other major alterations were made to the villa, including the addition of mosaics laid in four of the rooms, probably indicating the increasing wealth of successive new owners.

Gadebridge Park Roman villa was also a large villa estate developing through six phases from a simple homestead of only a few rooms. The original freestanding baths (Fig.5.11) of the linear type (1) were built during the 1st phase, and improved during the 2nd and 3rd phases. They were considerably enlarged during the 4th period in the late 2nd or early 3rd century and it was during this time that the house and bath were connected by other rooms. During the 6th period, c. AD 325 a large bathing pool was built approached from the baths.

They were in use for nearly 150 years; the excavator suggests that they may also have been used by the public¹¹. This would have been an unusual use of baths at a private estate, if the suggested interpretation is correct. The villa was served by a well water supply until the enlargement during the 4th phase, when the leat water supply from the 1st century was improved (Neal, 1970, 69-71).

11 Neals D S (ed.), 1974, 68-9, 73-75. At p.75 Neal says that "In the light of present evidence the pool can be assumed to have been for public use, but whether it had religious associations is far from clear".

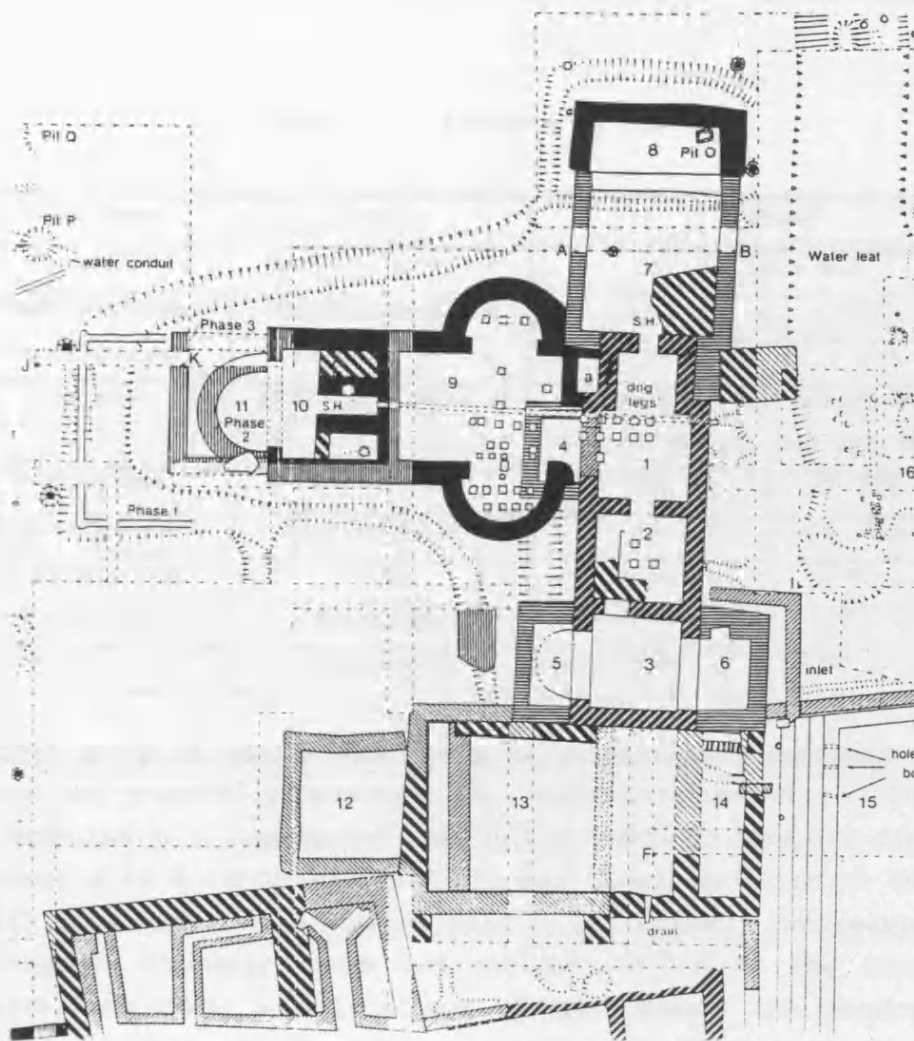


Fig. 5.11: Gadebridge Park villa baths (Neal, 1974, Fig. 8).
(Scale 1:200).

Gadebridge Park is another example of the evolutionary development of villas over an extended period, reflected in the changes to their baths. These developments are indicative of the changing life styles of a section of the Romano-British community. In this context, the Britons had their round houses and within a short period they adopted the linear form of Roman type housing, which finally culminated in the elaborate villas of the 3rd and 4th centuries, coincidentally from the no-bath situation during the PRIA to the elaborately complex Gadebridge Park villa (layout type (3)) of the 4th century. The major structure in each of the villas discussed, which were changed significantly, was invariably the baths, which reflects a progressive change in the social status of the inhabitants of the houses. Table 5.2 shows examples of

villas which started off as simple homes and developed into prestigious villas.

Table 5.2: Prestigious villas.

Site name	County	Dating
Chedworth	Gloucestershire	2nd to late 4th c.
Great Witcombe	Gloucestershire	late 1st c. - 5th c.
Woodchester	Gloucestershire	1st half 2nd c. - 4th c+.
Cosgrove	Northamptonshire	c. mid 2nd c.- progressive disuse during 3rd and 4th c.
Fishbourne	West Sussex	AD 75 - c. AD 280
Gadebridge Park	Hertfordshire	c. AD 120 - early 5th c.
Lullingstone	Kent	late 1st c. - 5th c.
Northleigh	Oxfordshire	late 1st c. - 5th c.
Rockbourne	Hampshire	mid-1st c - 4th c.

Of this group of villas Fishbourne is unusual as it started off as a palace and eventually developed the characteristics of a villa. These are examples of villas spread over southern Britain occupied for periods of about 2 to 4 centuries. They all show characteristics of increasing wealth generated on the estate. This is particularly noticeable in the development of their baths and the decorations of the floors with mosaics, and their wall paintings. To this extent the development of baths at villas can be taken as a measure of the "expressions of habitus" (Rippengal 1993, 100) in the social and economic development of rural communities and most likely also for other type sites. This seems to indicate a romanization process developed by the Britons themselves.

2.4. Comparison of baths in Britain.

To compare bath structures based on plans, often showing minimal remains of only foundations, is problematic, because what characterizes buildings are usually their outward appearance. However, from the floor plans of the remains of Roman baths some characteristics are apparent. All site types with baths showed the three basic room types of hot, tepid and cold rooms. The earlier baths for both civilian and military baths seemed to have had the row type layout, with or without plunge baths.

Military baths seemed to be built in rigid layout patterns of the row and block types with not much variation other than the size of rooms.

This suggests that military architects have arrived at sound working layouts of baths for military use, for which there was no need to change the layout and bring in the complications of recalculation of quantities and setting out procedures. The legionary fortress baths were generally large and the individual rooms were spacious.

A number of forts had internal baths of both the row and block types. Most bath-suites had changing rooms, although occasionally quite major baths did not have one, as for instance the legionary bath at Caerleon. Several fortresses and forts had facilities for exercise and sport within their bath complexes. Because of limited archaeological details of baths at the *coloniae*, not enough information is available to discuss their layouts.

The baths at the major towns generally had quite different layouts compared to the military baths. Their plans appear to be more bulky, and more ornamental than the plans of the military baths, partly because of their enlarged apsed plunge baths. They also often duplicated bathing rooms such as at Leicester, Silchester and Wroxeter. The military baths seem to have a rigid style of layout, while the civilian public baths seem to indicate an entrepreneurial freedom. The initial layout of the civilian Hadrianic baths at Wroxeter seem to be not very different from the earlier military baths described by Busche-Fox, both of the linear type. This may imply similar origins in the earliest plans of civilian and military baths. The duplication of bathing rooms may have been due to the continual changes that were made to the layout of civilian baths because of a demand for more bathing facilities, and also to create separate facilities for men and women. Except for the large legionary baths at Caerleon and Exeter, the bathing rooms of the civilian baths are somewhat larger than their military counterparts. When town public baths were modified they were often extensively altered, which do not seem to have been the case with military baths. Repairs seem to have been the main additional work carried out on military baths.

Baths at villas were generally small compared to those at military and town sites. The early villas started with simple bath layouts and they were often of the row type, but later they seem to expand into the complex type (3) layout as new owners reconstructed and made additions to them. A feature that characterized many villa baths were the beautiful mosaics on the floors. What is surprising is that so many have survived considering that they were often laid on floors that were heated. The changing style of bath layouts at villas suggests a parallel

change in the social structure of their successive owners. Many of the early owners of the 1st century adopted the Roman type housing, which, by the 2nd and 3rd centuries, developed a new élite who acquired a taste for the luxury of expensive baths, exemplified by the many luxurious villas. Bath style development could be a fruitful avenue of study for the development of society in Britain during the Romano-British period, because it particularly reflects a high style of living and changing economic circumstances of later owners. Many Roman baths have been excavated in Britain and their morphology needs to be analyzed. There is also a need to study their local context of interrelationships and setting within the Romano-British landscape, both regionally and for all of occupied Britain.

3. SEWERS AND DRAINS

3.1 Terminology.

Sewers and drains have specific functions in modern municipal technology. Usually two types of sewers are provided in municipalities: sewers for human and animal waste materials, and stormwater sewers; both types are usually in the form of under-ground conduits. The former are directed to sewerage treatment works where the waste materials are treated for health reasons and possible subsequent use. Stormwater sewers remove rainwater run-off or water flowing in urban areas which is not controlled and usually discharges into rivers, the sea or lakes, or specially controlled areas. By separating the two systems stormwater does not go through the costly process of sewerage treatment. This distinction was not made during Roman times.

Drains were local surface conduits, and were usually stone- or timber-lined in Roman times, to regulate rainwater run-off and surplus surface water flow in urban areas. In Roman times, drains were a common feature in fortresses, forts, towns, settlements and villas.

3.2 Roman sewers.

Sewers were standard structures at Roman military sites and towns for dealing with human and animal sewage. Twenty sites with sewers have been identified for Roman Britain.

Roman sewers normally had a basic rectangular channel shape, either built in stone or brick, generally lined with a sealing mortar, and usually had a vaulted roof; occasionally the channel was covered with

stone slabs, such as at York¹². The roof vault would usually be an arched design and the whole structure would be large enough to allow access for labourers to clean or repair them. Regular manholes were provided for entry into them and also for the escape of gasses that can develop in closed sewers, and to provide air and light for workmen.

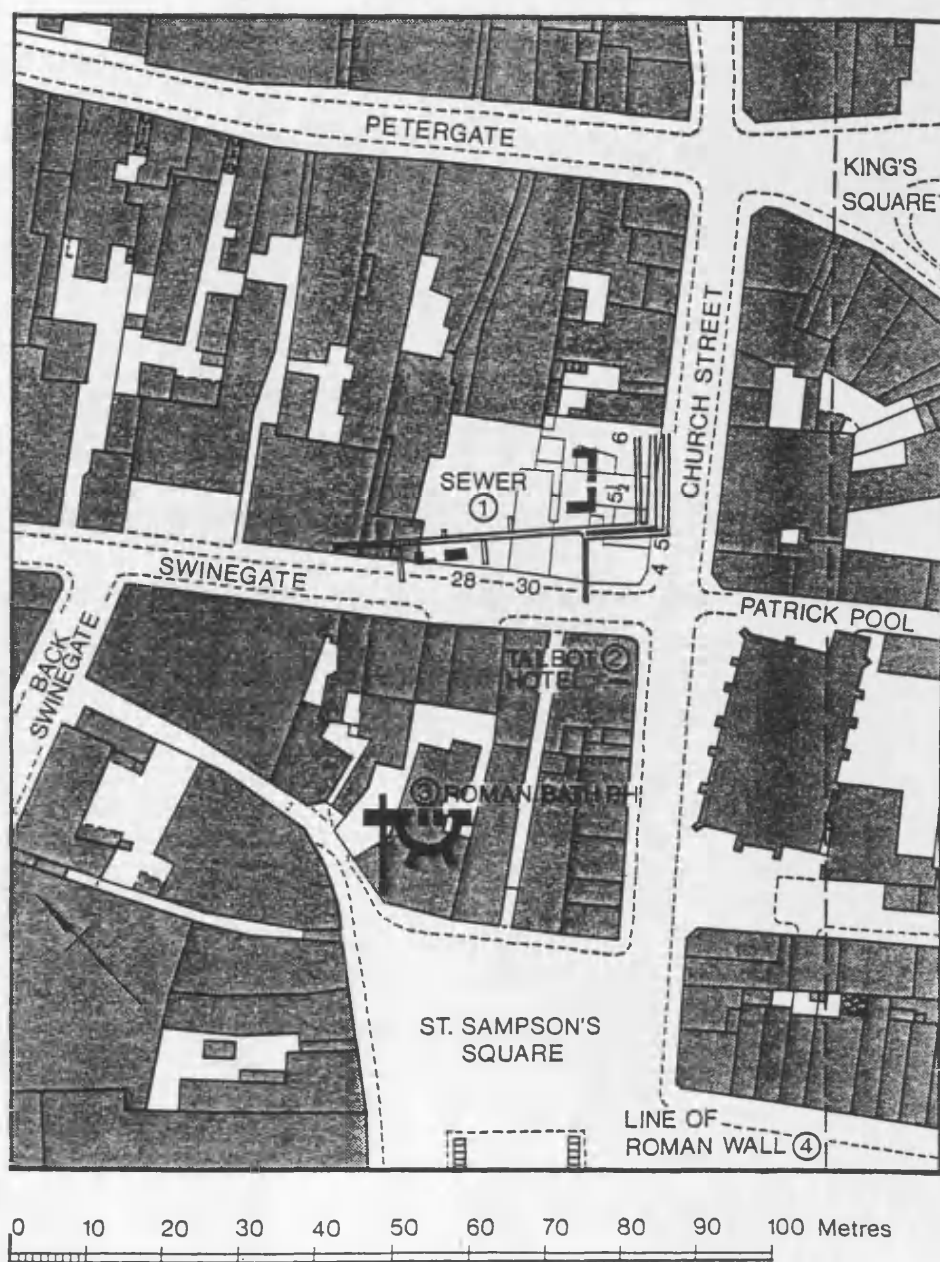


Fig. 5.12: York (Church Street) sewer system (after Whitwell 1976, 4, Fig. 2).

12 I have not seen the sewers at York, but have been in a section of the sewer at Colchester. This sewer was very well constructed and similar in shape to the aqueduct of Köln which was an arched structure.

Some military sites and towns of Roman Britain had major sewerage systems for the control of their sewage. The major sites where sewers have been found are at Bath, Caerleon, Canterbury, Chester, Chichester, Colchester, Dover, Lincoln, London, Wroxeter and York¹³.

At **York** an elaborate sewer system, referred to as the Church Street sewer, has been reported (Whitwell 1976)¹⁴ (Fig.5.12). The primary function of the sewer seems "was to drain the various services within a legionary bath building", (Buckland, 1976, 1)¹⁵. There were difficulties with dating material, but the excavator reports that it was probably constructed during the 2nd century while York was still a legionary fortress. Because the rescue excavation was limited, it was not possible to relate the sewer with other buildings, except to show that the branch sewers pointing to the west was in the direction of the baths. The floor of the sewer was built with Jurassic sandstone slabs laid closely together with joints sealed with mortar and set in clay. The channel was covered with Millstone Grit slabs, presumably for their strength. The walls of the sewer generally consisted of limestone ashlar also set in clay, to render the system water proof.

A large vaulted 'drain' at the fortress of **Caerleon** is shown in Fig.5.13. Zienkiewicz calls the *frigidarium* drainage structure a 'drain', which was in fact the Roman vaulted sewer. Both the Caerleon and York sewers were constructed with massive stone blocks, but the Caerleon sewer was arched in the standard military fashion, whereas the sewer at York had a roof of flat slabs.

13 References are given in order of site in text: *Brit.* 20,312: Hanson 1970, 181-3; *Brit.* 10, 335: 3, 313: 3, 350; 10, 332; 11, 398: 4, 304; 9, 451: 23, 306-7: Wachter 1992, Fig.10; 1995, 138: 8, 396; Kelsey, 1840, 138: 9, 438; 10, 297: 4, 281.

14 *AY* 3/1, 1976, 5-13, Figs.2 & 3.

15 'The Archaeology of York: The past Environment of York' 14/1, 1976, 1.



Fig. 5.13: Main sewer at Caerleon fortress (after Zienkiewicz 1986).

According to John Wacher, **Lincoln** "is known to have possessed one of the best developed sewerage systems in any town in (Roman) Britain", (1995, 138). Figure 5.14 shows the sewer lines and drains of Lincoln (Wacher 1992, Fig. 10).

The discovery of the sewers in Lincoln below the Bailgate was reported during the the 1850s¹⁶, but they have since been covered as a result of development in the area. The sewers varied in width from 0.71m to 1.22m

¹⁶ Arch. J. 19, 1862, 169; 40, 1883, 319; 103, 1946, 67; *Archaeologia* 56, 317; Hanson 1970, 54-5.

and were from 1.37m to 1.52m high. A series of cross sewers and small house drains discharged into them.

Bellairs reported on one of the "main sewers" of Roman **Leicester**, which ran from the Jewry Wall baths towards the north-west where it discharged into the river Soar.¹⁷ The sewer was first reported by Throsby in 1793, when sections of the sewer was still in place. Stukeley mentions that the ancient subterranean canals of vaults and arches of **Chester** were still perfect in his time (Hanson 1970, 190).

A number of sewers were reported for **London** by Richard Kelsey, who installed a new sewer system during the mid 19th century, when the Roman structures were discovered (Kelsey 1840; Hanson 1970, 29, 32). At Knightrider Street the remains of an arched brick sewer was found in good condition (Merrifield 1965, 146, Plate 56). However it has not been established whether an inter-linking network of sewers existed in Roman London or if sewers were constructed where a problem arose at any given time.

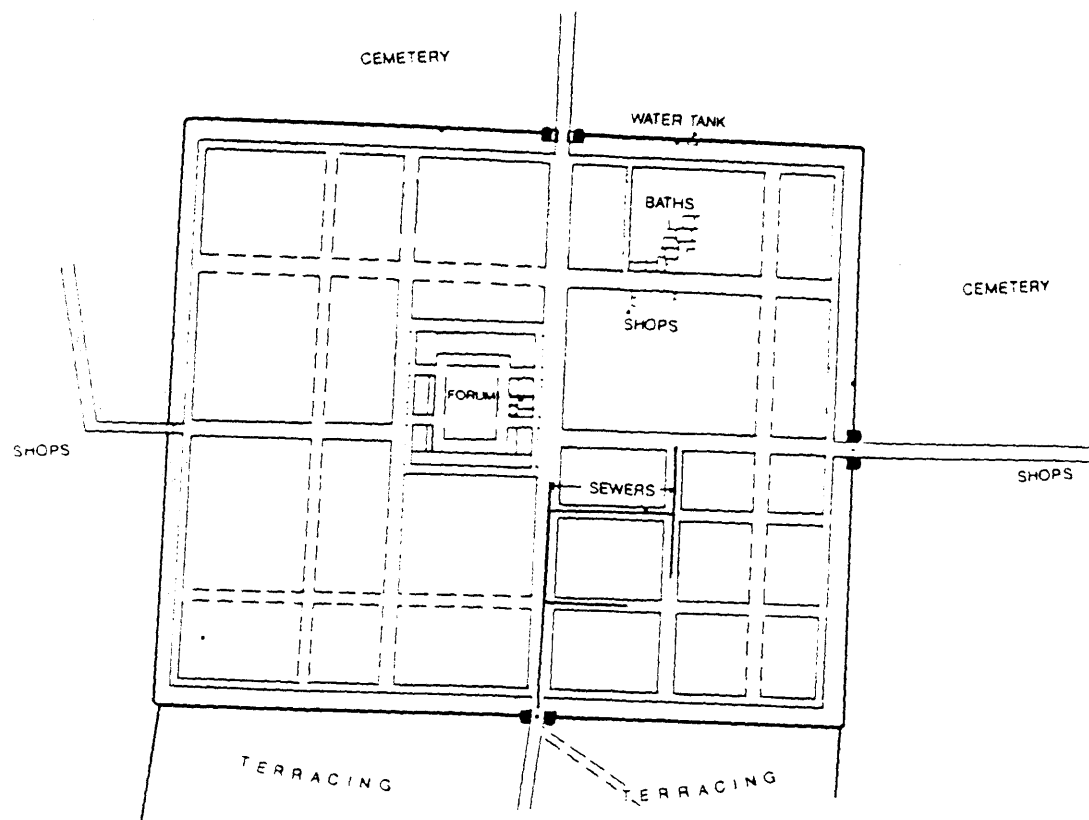


Fig. 5.14: Lincoln colonia sewer system (Wacher 1990, 24, Fig. 10).

¹⁷ Bellairs 1899, 40-44, and two figures.

3.3. Drains.

One of the prime purposes of specially constructed drains in forts, towns, villas and private homes was to remove water from baths and latrines and to control stormwater run-off. The drains were usually stone channels or timber lined gullies running along streets and buildings in forts, urban areas and in villas. Forts had elaborate drainage systems to dispose of rainwater run-off, and also to remove waste materials from latrines and from the stables where cavalry regiments were housed inside the forts, such as at Baginton.

Drains were used to control the flow of rainwater, and excess surface water from aqueduct supplies and waste materials of outflows from baths and houses, and were sometimes discharged into conduit-constructed sewers, or often into ditches. They were constructed as both open and covered channels, particularly along the outside of buildings and along streets. Inside buildings they were invariably covered with stone cover slabs. Some drains discharged directly into the sewers into openings provided for that purpose, while others terminated outside built up areas to discharge onto down-sloping ground, or were led directly into rivers or streams.

The 179 listed sites in the database where drains have been recorded seems to be too low for such an important feature. The drainage systems on military sites were particularly well developed and the army seems to have been aware of the importance of well-planned and well-constructed drains, such as reported for Inchtuthil. The *via principalis* on both sides had stone channel drains 0.81m wide and 0.81m deep. It would seem that water was collected from roofs and discharged into these drains which were then channelled into tanks. Along both sides of the officers' temporary compound were drains, and a stone-lined drain is shown leading from the latrine. From the bath-building an internal drain leads into an outfall timber drain towards the River Tay. Drains around the hospital also converge into a main drain (Pitts and St Joseph 1985, 191-4). The drainage at Housesteads was also designed to collect water from buildings in small drains which discharged into main covered stone-lined drains along the principal streets (*Arch. Ael.*⁴ 25, 1904, 211). A number of the forts on the Antonine wall from both the Antonine periods (c.AD 142-55, c.AD 158-63), had standard type drainage facilities, similar to those at the slightly earlier fort of Housesteads (AD 124-6), probably indicating that by the mid 2nd century most military masonry construction technical methods had become standardized. Figure 5.15 shows an open stone channel drain at Caerleon, typical of the drains

from military sites. A length of lead piping is also shown in the picture.

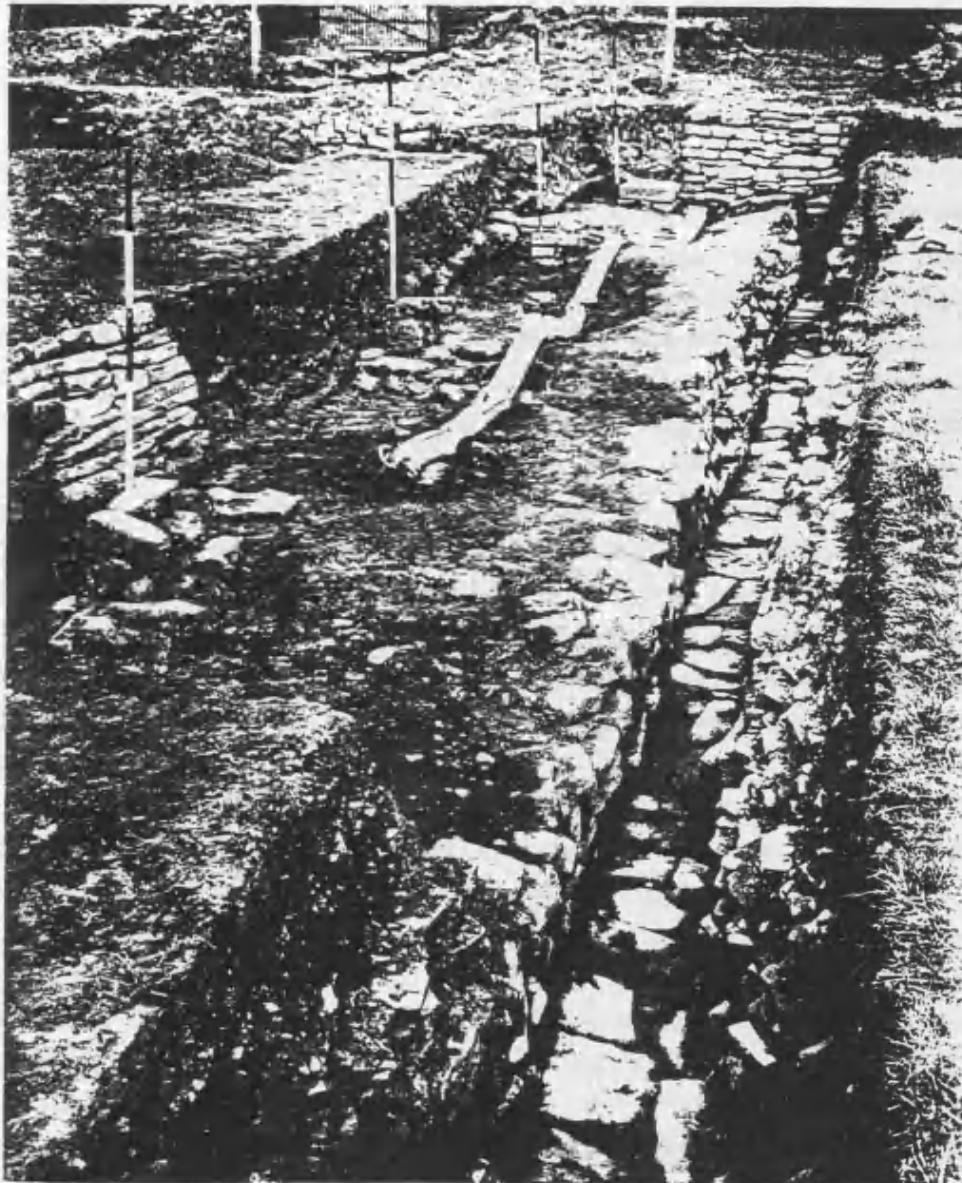


Fig. 5.15: Open channel drain and lead pipe from Caerleon fortress (after Zienkiewicz, 1986)

Complex drainage systems are also found in some towns, although several towns seem to have had poorly developed surface drainage, as for instance at Caistor-by-Norwich and Silchester, where the drainage consisted mostly of central street drains with no provision for drainage from private houses (Hanson 1970, 92, 132). Atkinson has reported on the extensive central town drainage at Wroxeter, but not much seems to be known about the drainage from private houses (Atkinson 1942, 56-58, 91).

Verulamium had a well-developed drainage system, where there seemed to be a preference for wood-lined drains. There seemed to have been a problem with drainage related to the flat topography of the site, which appears not to have functioned properly during the later 2nd century (Frere 1964, 104-5). It may also have been related to the deterioration of the wood, which seems not to have been replaced.

London is reported to have had a network of drains, with particular emphasis on removal of water because of an apparent rise in the water table during the Roman period (Merrifield 1965, 82). Open plank drains, brick and tile drains and some disused wooden distribution pipes used as drains have been found, (Merrifield 1965, 148; RCHM III, 1928, 111, 49). A brick drain was found on a chalk platform supported on wooden piles (Merrifield 1965, 149, Fig.29). This indicates the instability problems of the area that arose from strong seepage flow. The rising water level could have been due to land movements, but an important contributing factor must have been the continual construction and levelling of old sites, and rebuilding over them, which raised the level of the spring line. In one instance a low lying sewer had to be replaced by one exiting the town wall at a higher elevation (Merrifield 1965, 82). London obviously had as much of a problem of disposing of excess underground water as Silchester had.

Villas also had extensive drainage systems for removal of water from kitchens, baths, latrines, and for control of surface run-off of rainwater. Sixty-seven villa sites are listed in the database where drains have been found. Architectural variations in villa types would have dictated the sophistication of its drainage facilities. Some of the early villa structures, consisting of no more than a few rooms, referred to as 'cottage houses' by Hingley (1989, 36-9, Fig.15), probably only used cesspits for disposal of waste materials, whereas during the later phases of villa development they generally incorporated drains for the removal of waste products. An example of Hingley's second phase of development is Great Witcombe winged corridor villa, with a plan of its 3rd to 4th century bath and the remains of many drains (Fig.5.10). They may not all have been in use at the same time over the 150 years during the active life of the villa. The majority of drains on the site seem to run in a south easterly direction away from the villa, which would indicate the direction of fall of the land. If this is the case then the feature shown at the top of the page may well not be a drain, but could have been the water supply line towards the older bath-suite, collecting water from springs above the site. Lysons reported that the room (number

1 on the plan) adjacent to the baths was at a lower level than the rest and had a tank in its centre, which was fed by a pipe, indicating that the villa probably had a running water supply (*Antiq. J.* 19, 1939, 194). However, a detailed study of the contours and the juxtaposition between the villa site and the springs will have to be done to confirm this suggestion. A drain is shown to come from the latrine above the *caldarium* of the later baths, and also one from the latrine in the north-east range, both of which may have been small sewers. This may suggest that the two wings were originally independent and used by two families, hence the duplication of drains. All the drains were stone-lined. Another example is the villa at Rockbourne (Fig.5.9), for which the plan shows evidence of extensive drainage round the site, both for draining the three bath-suites and for controlling run-off from the buildings.

The evidence of such developed drainage systems at towns and villas seems to indicate an awareness of health considerations, which was a new concept to the indigenous people of Britain, particularly during the 2nd and 3rd centuries when considerable building development took place in the province. However, archaeological evidence seems to indicate that after a while, either because of lack of funds for maintenance, or indifference from inhabitants, at many of the sites drainage deteriorated. This is commented on by Frere (1972) for Silchester and Hanson (1970) for Caistor-by-Norwich. A serious consequence of poor drainage was that where wells were important water sources and at shallow levels, seepage into the permeable gravel and sand layers could easily contaminate well-water, such as at Caerwent (p.133), Caistor-by-Norwich (p.133), the *vicus* outside Newstead fort (p.123), and London (pp.130ff). In the absence of organized drainage at these places and other sites, it would be useful to study the contamination of well-water supplies for an understanding of water-related diseases during the Roman period.

Information about drainage is scarce for smaller centres such as *vici*, small towns and settlements. Lancaster is a good example of a site where the *vicus* settlements developed around all four sides of the fort in a haphazard manner and it is likely to have created a serious health problem because there appeared to have been no planned street network, and presumably therefore no planned drainage (Shotter & White 1990, 32). At Housesteads a *vicus* developed south and west of the fort, but there is no indication of whether it had an effective drainage system. The *vicus* outside Vindolanda had some street plan to it, and it is likely

that it had a system of street drainage. No mention is made of any drainage system related to the irregular street system on both sides of Ermine Street of the walled small town of Water Newton, even though it developed over a long period (Burnham & Wachter 1990, 81-91). The excavation report for Corbridge (Bishop & Dore 1988), a former fort and later a small town, says nothing about the extensive drainage system of the various phases of the forts and later town. However Fig.3 of the report shows a number of features which indicate drains, including those on both sides of the Stanegate and in West Dere Street. It is difficult to understand why there is this lack of information on the drainage of the smaller urban areas.

Military sites and early *coloniae* seem to have had the best constructed drains, mainly because they were constructed to fixed standards. They were generally incorporated during the planning stage and were constructed at the same time as the fortress or the fort was constructed. London and Silchester both had excess spring water to remove and the most suitable drain type that could serve the purpose was used. At sites where there were poor drainage systems there was the danger of pollution of wells from cesspits such as at Caerwent where there were no drains for private householders (Chapter 4, 128), Newstead (Chapter 4, 138), and London where pollution seemed to have been a major problem. It seems there was no systematic approach to construction of drains at non-military sites, probably because they were simple structures and their distribution on a site was often dictated by reconstruction as drains became necessary for new or the altered structures.

5. CONCLUSION

The importance of Roman baths as an institution in Roman Britain is demonstrated by the speed with which they spread as urban and rural development took place soon after the conquest. Every site type had baths, classified into linear, block and complex layouts. The military baths were mostly of the first two types, but civilian baths varied in style, particularly those constructed after the mid 2nd century. However not enough is known about these aspects of baths and whether there were any regional differences. It would seem that baths are very much underrepresented in the archaeological record. The number of sites with baths represented in the database seems to be too low compared to the total number of sites listed in the database, and much too low compared to the known number of sites where baths could be expected.

The army built baths at many military sites and made provision for efficient drainage, and disposal of sewage and stormwater. This was not always the case at non-military sites. The Britons were quick to adopt the style of housing and institutions, including baths. Large public baths were built in almost all the towns and many of the houses at villas had baths, even at the smaller cottage type houses, indicating that bathing became a voluntarily accepted cultural characteristic, not common before the Romans introduced them to Britain. How public baths were managed in Britain is not known, nor how frequently they were used by the public. However the number of public baths found seems to indicate that they were popular with the public. Drainage was an important form of control on all site types, although standards varied. However, by the late 4th century there was a distinct decline in the condition of bath facilities and drainage of towns, due to the lack of maintenance to these facilities.

Baths have been described in some detail for a few sites, but generally there is need for a synthesis of the context of baths and their setting in the Romano-British landscape. A particularly useful investigation would be the layouts and status of baths at all site types for Roman Britain.

CHAPTER 6.

THE DISTRIBUTION OF WATER-RELATED FEATURES IN ROMAN BRITAIN

1. GENERAL

I have traced 815 sites in the literature, but eight sites¹ on closer examination of the available information indicated that no water-related features have been proven at those sites. The final number of sites in the database with water-related features is therefore 807. Table 6.1² gives a breakdown of the number of sites with different types of structures. The percentages given are calculated on the total sample of sites listed in the database. They are not intrinsically important, but they do give a feel for the frequency of occurrence of the number of sites with the various types of water-related structures. The data is statistically biased and incomplete because of many factors (incomplete excavation, poor preservation, inadequate records, position, etc.).

Table 6.1: Distribution of number of sites with water-related features

Aque- ducts	Baths	Wells	Drains	Pipes	Springs	Tanks	Sewers	Total sites listed
134	488	350	179	84	47	102	20	807
16.7%	60.5%	43.5%	22.2%	10.4%	5.8%	12.6%	2.5%	

In comparison with the total number of sites in the database with water-related features, the number of sites for each type of feature is relatively small for each category of site. Aqueducts were recorded at 134 sites but seem to be under-represented in the archaeological record. Wells were the most common form of water supply (350 sites) for the Roman period but are also underrepresented, indicating that many remains of water supplies are still undetected. Even though springs have been included in the database as one of the sources for water supplies, only 47 sites associated with springs have been traced. One possible reason for this dearth of spring data compared to aqueducts is that only a few

1 The eight sites are: Ardoch, Limestone Corner, Neath and Whickham (forts); Coldharbour (settlement); Brantingham, Frampton and Kingscote (villas).

2 The information for Table 6.2 has been extracted from Table 6.1 and the other special tables.

aqueducts have been traced along their complete routes to their spring sources. Also, springs were usually outside the areas of excavation and may not have been recorded, particularly at villas and settlements, where they may have been the primary source of water supply. Springs were also used as sources of water supply within several sites, such as at Bath (Ch.5, p.162), London (Ch.4, Sect.6.2.1) and Silchester (Ch.4, Sect.6.3), and perhaps Colchester. Remains of baths were found at more sites than any other feature (487), although the total fell far short of the number that I would have expected. The total of 179 sites where drains are recorded is also low, perhaps because they are not always mentioned in reports, though in some cases I may have missed them in plans of the sites. The number of pipes is particularly low (84), but this probably can be ascribed to the fact that wooden pipes have long since rotted and the usual iron rings may have been robbed or have been completely corroded away; many lead pipes would also have been robbed, and ceramic pipes could have been reused or destroyed by later activities on the sites.

The information contrasts with Hanson's 65 sites³ (Table 2.1a) with water-related structures. For example, the number of aqueducts located by me in the literature is more than double the number known to Hanson. She reported aqueducts at 42 forts (29 certain, 13 conjectured), while the number of forts that had aqueducts recorded in my database shows an increase of 24 sites. She reported five forts that had internal water pipes which may have indicated running water supplies. She also referred to 18 other sites (17 towns and 1 villa) that had aqueducts. Her primary purpose was to look at the known aqueduct water supplies for military and town sites and thus there are some omissions in her work regarding rural sites.

Table 6.2 gives a summary of all the sites for the eight water-related structure types. The different fort categories have collectively been referred to as forts, though in the text fortresses, auxiliary/cavalry forts and fortlets will be referred to separately as it becomes necessary. From this table are derived other tables in the text which amplify specific issues of the analysis.

Major and minor towns, settlements and villas were invariably situated south of Hadrian's Wall, but features such as aqueducts,

³ Hanson 1970, 358-74; Table 2.1a, p.28.

baths and wells were also found at forts north of Hadrian's Wall. This is shown for the distribution of sites with baths in Figs.6.6 to 6.10. (Note: All distribution Figs.6.1-6.15 are given at pp.239-253).

Table 6.2: Distribution of site types with water-related structures at listed sites

Data type	Fortes	Coloniae	Municipia	Civitates	S-towns	Settlements	Villas	Total
Aqueducts	66	4	1	11	8	19	24	134
Baths	85	3	2	13	30	49	305	487
Wells	43	4	2	10	52	135	104	350
Drains	52	3	2	8	17	30	67	179
Pipes	28	3	1	7	3	8	34	84
Springs	10	2	2	2	3	6	23	47
Tanks	32	2	0	6	8	16	38	102
Sewers	10	3	1	4	1	0	1	20
Number Sites	137	4	2	14	66	212	372	807
AQ + BA	45	3	1	10	5	4	16	
AQ + W	16	4	1	7	2	2	5	
AQ + TA	23	2	0	5	1	2	9	
AQ + WP	27	3	1	5	0	1	10	
AQ + DR	22	3	1	5	2	1	14	
BA + W	26	3	2	9	18	10	55	
BA + TA	24	2	0	6	3	4	30	
BA + DR	31	3	2	6	11	7	57	
W + TA	19	2	0	4	7	9	13	
AQ + BA + W	14	3	1	7	3	2	3	
AQ + WP + W	9	3	1	4	0	0	2	
AQ + SP	7	2	2	1	1	1	7	
BA + SP	10	2	2	1	4	2	15	

*Note: The numbers indicate sites where a particular feature or combinations have been found. The symbols are as defined in Chapter 2, for Table 2.1a.

No water supply source has been recorded for 258 sites with baths (53% of all sites with baths). Similarly, no baths have been recorded at 231 of the sites (67%) where wells have been noted, while 50 sites with aqueducts have yielded no trace of baths (37% of all sites with aqueducts). These figures show up a complex problem in the archaeological record, emphasizing the incompleteness of the records due to factors relating to coverage of a site by excavation or disappearance of remains of particular features over time.

Table 6.3 gives the numbers and percentages of sites that had the different categories of water-related features for each type of site. Care has to be taken in the interpretation of these percentages for two reasons: firstly, where there are only a small number of a

particular site type and the same feature has been found at all the sites, the proportion is given as 100%. The data is not from a statistically normal population, because there is a bias in the sample of data represented by the listed sites in the database compared to all known sites. This is due to the lack of information about features found at sites for a variety of reasons, hence the data cannot be used for standard statistical analysis.

Table 6.3: Comparison of known water structures and listed sites

	Forts	Colo- niae	Muni- cipia	Civi- tas capitals	Small towns	Settle- ments	Villas	All* sites
Aqueducts	66 48%	4 100%	1 50%	11 78%	8 13%	20 9%	24 6%	134
Baths	85 62%	4 100%	2 100%	13 93%	30 45%	49 23%	305 82%	488
Wells	43 31%	4 100%	2 100%	11 78%	52 79%	135 63%	104 28%	350
Drains	52 38%	3 75%	2 100%	8 57%	17 24%	30 14%	67 18%	179
Pipes	28 20%	3 75%	1 50%	7 50%	3 4%	8 4%	34 9%	84
Springs	10 7%	2 50%	2 100%	1 7%	3 4%	- -	23 6%	47
Tanks	32 23%	2 50%	- -	6 43%	8 12%	16 8%	38 10%	102
Sewers	10 7%	3 75%	1 50%	4 75%	1 1%	- -	1 <1%	20
Total sites	137	4	2	14	66	212	372	807

*Note: The column for forts include fortresses. The 'all sites' in the last column represents all types of sites where each category of feature have been found. The 'total sites' in the last row represents the total number of each type of site in the database.

However, inspection of these percentages provides some insight into the likely relationships between the types of features and the total number of sites on which the database sample is based. They also indicate that there is a bias in how the information was obtained and what archaeological information was available to be recorded. Also, the sample of sites recorded in the database bears no relation to the actual total number of archaeological sites that have been found to

date because of lack of information about remains of water-related features.

An analysis of the distribution of the different water features follows. Each type of site will be treated separately, but there may be some overlap in comment because of the geographical relationships between certain types of sites. Forts are a special category of site, because as military sites, the water-related features were intimately bound up with their administration and would have been financed at provincial level, or their funding may have come from the military accounts for a particular fort. This was not so for towns, perhaps other than *coloniae* which may also have been financed by Rome.

2. DISTRIBUTION OF WATER-RELATED STRUCTURES AT FORTRESSES⁴ AND FORTS.

The Ordnance Survey map of *Roman Britain*, 1991, lists 235 Roman forts and 75 fortlets. Jones and Mattingly (1990, 91, Map 4.24) show 9 legionary fortresses (for a total of 10 if Inchtuthil is included), and 16 vexillation fortresses and 6 possibles. With allowance for new discoveries, this gives a total of c.350 military establishments known in Roman Britain, though they were not all active at the same time. Only c. 40% of these forts (137) have yielded specific evidence of water-related features, the remaining 60% of known sites are unaccounted for in my database. The 85 baths found at military sites represent only 25% of the total known military sites, which seems low.

Table 6.4 gives a summary of the information of all the features at forts. Of the 137 sites where forts are listed in the database, 66 sites (48%) are recorded as having had aqueducts out of the total 134 sites with aqueducts. At 28 forts, water pipes of some kind have been found, in every case at sites also having aqueducts.

Table 6.4: Fort sites with water-related features

Aque- ducts	Baths	Wells	Drains	Pipes	Springs	Tanks	Sewers	Total sites
66	85	43	52	28	10	32	10	137
48%	61%	31%	38%	19%	7%	23%	7%	

4 A special problem arises when fortresses and *coloniae* are discussed, because the four *coloniae* developed on the same sites as the fortresses or adjacent to them. However I shall make it clear when it is a fortress or *colonia* that is being discussed. The same problem occurs with some *civitas* centres, such as Exeter, which I have entered as a fortress, but it eventually became the capital of the *Dumnonii* as *Isca Dumnoniorum*.

It is not always clear whether these pipes formed part of the aqueduct, or whether they were part of a distribution system within the fort. The reported records do not always indicate what type the aqueduct was. Where possible I have indicated in the table Appendix 1 what the aqueduct type was. At some forts it is mentioned that evidence of a water pipe was found at one of the gates, implying that the pipe was the aqueduct. Both Hanson (1970) and Stephens (1985b) mention instances where the aqueducts consisted of water pipes, e.g. Balmuildy (clay water pipes), Brough-on-Humber auxiliary fort (water pipeline entering west gate), Caernarvon (3rd c.) (wooden pipelines), Chester (clay pipe along line of aqueduct), Fendoch (aqueduct channel carrying a pipeline), Pen Llystyn (wooden pipeline), and so on. Some military sites had stone channel aqueducts such as the fortress at Exeter and the fort at Lanchester.

I traced 8 forts which were reported to have had leat aqueducts: Bowes, Burrow-in-Lonsdale, Dalginross, Dalswinton, Great Chesters, Tomen-Y-Mur, Trawscoed and Wetwang, and there may have been more. The aqueducts serving Chesters most likely were leats but they may have been stone channels or even pipelines. Because of its high elevation, Housesteads was not served directly with an aqueduct (*Arch. Ael.*⁴ 12, 1935, 243-4), but it has been suggested that a leat brought water from the north to near the site of the external bath, from where it was raised by unknown means to the fort (Birley 1961, 181). Leat aqueducts are normally major earth moving construction projects for which the military engineers would have been responsible at forts and they would probably have assisted in the planning of leats at towns. The stone channel aqueduct at Halton Chesters was reported by Bruce (1867, 134) and is shown on the OS map of Hadrian's Wall (1989) as being about 1.5km long. Stone channel aqueducts, such as the three channels at Lanchester, would also have been major construction projects. For these large quantities of dressed stone would have been necessary, generally obtained from Roman stone quarries. Leat type aqueducts may have been resorted to during the 2nd century for water supplies because of the high cost of quarried stone and particularly that of transport. Even so, the comparatively high number of forts with aqueducts indicates significant military investment in a running water supply.

Figure 6.1 shows the distribution of the 66 forts with **aqueducts** as listed in the database. These sites seem to cluster in three regions. There are 12 widely spaced sites south of the central Wales-

Birmingham axis. The remainder all lie from north Wales to as far as the Antonine wall with a concentration of sites round Hadrian's Wall.

The chronological distribution of forts and fortresses changed considerably from the pre-Flavian (AD 43-68) through the Flavian (AD 70-96) period to the third century (Jones and Mattingly 1990, 89, 98, 100, 132), but the distribution given in Fig.6.1 shows all the sites with recorded remains of aqueducts for the whole of the occupation period. They appear to be evenly spread over Roman Britain with the largest concentration of sites in the middle north, the military zone.

The distribution of forts with **baths** (Fig.6.6) divides between three regions: a northern region concentrated in the area of the Agricola conquest (c.AD 79-85) and later Antonine frontier (c. AD 138-61), a region around Hadrian's Wall (c.AD 117-38), and a southern region south of Hadrian's Wall. For this latter region baths would have been constructed over the period from the later 1st century to the early 4th century, depending very much on when forts and fortresses were first commissioned. Some sites received additional baths at later periods, as for instance a bath was built in the early 4th century in a barrack at Housesteads.

I have recorded **wells** at only 9 of the possible 32 fortresses⁵ which were active at various times (of which 4 became *coloniae* later). Although most of the fortresses eventually had running water supplies, it would be expected that every fortress would have had a well in the *praetorium* or at least one well within the walls of a fortress. The missing ones may be due to them not having been found yet, or they may have been destroyed, or I may have missed them in the reported literature. Wells were traced at 35 of the auxiliary forts(10%), which also seems low, considering the c.350 known forts.⁶ Fig 6.11 shows the distribution of sites where wells have been found at military sites

5 There were 10 legionary fortresses and 22 (16 plus 6 possibles) vexillation fortresses (Jones and Mattingly, 1990, 91, Map 4.24; OS Map, *Roman Britain*, 1991, lists only 12 vexillation fortresses). Not all the fortresses operated at the same time, however when they were established well water or some other source would have been necessary before a running water supply was provided.

6 The OS Map *Roman Britain*, 1991, records 235 forts and 75 fortlets. This gives a density of about 13 forts per 100km square grid, based on an estimate that Roman Britain covered roughly 18 grid squares of 100km². All the forts would not have been operative at the same time, and some may have been abandoned for a period and then reestablished at a later date. Others may have been abandoned permanently well before the Romans left Britain in the early 5th c.

listed in the database including the 4 *coloniae*. Five are in the north, 6 are associated with forts along Hadrian's Wall and 2 along the west Cumbrian coast. Seven were in Wales and the remaining 15 are in England south of Hadrian's wall. I only traced 2 fortlets with wells. Why so few wells are recorded in the literature for military sites is difficult to understand, because we are considering wells within the fort walls.

2.1. Dating of water-related features at military sites.

This raises the issue of when did forts acquire their aqueducts? An aqueduct at a fortress/fort suggests that they may have originally been planned as permanent bases, as would well-built defences and buildings with stone foundations. Some of the larger forts of greater strategic importance and were expected to be held for a considerable period, may have had their aqueducts constructed soon after the fort itself came into operation. Forts of comparatively short occupation which were served by aqueducts must have had them built during that time. Thus we can date a number of Flavian aqueducts; similarly the three forts of Balmuildy, Mumrills and Inveresk from the Antonine wall (c. AD 142-55) would have had their aqueducts constructed during this phase of occupation. With long occupied forts precise dating is much more difficult and a further complication is that some forts went through several phases of occupation and abandonment, and the date of first provision and the possible maintenance of running water supplies is unclear.

It is not generally known when the aqueducts and baths at forts were constructed. From the evidence at Inchtuthil where construction started c. AD 83, a bath, *praetorium* and an aqueduct were planned. Although sites appeared to have been reserved for them (Pitts and St Joseph 1985, 189), the building of the first two structures had not yet been started and it is suggested that "work on the contour course of the channel had already begun" after most of the rest of the fortress was completed (Pitts and St Joseph 1985, 31, 191). Precedents for this delayed approach to the building of such stone structures at fortresses were at Caerleon, where the baths and *praetorium* were erected on 'reserved plots' (Boon 1972, 30), and the same may have applied to the *praetorium* at Chester (Pitts and St Joseph 1985, 189). The planned bath at Inchtuthil would have been built in stone and would have had to be large in order to provide bathing facilities for a whole legion. However, before these three structures could be built the order was given to demolish the fortress in c. AD 85.

If a fort or fortress had a substantial bath-building, such as at Chesters, then an aqueduct may have been built at a time closely related to that of the building of the bath. It would appear, for instance, that the construction of the baths at Exeter and Caerleon fortresses commenced soon after the forts were established. At Exeter the legionary fortress was established in c. AD 55, and its bath appears to have been built contemporaneously (Bidwell 1979, 1980). It would seem that there was an earlier aqueduct servicing this bath, but there is some uncertainty about it. The legion stationed at Exeter moved to Caerleon c. AD 75. The first buildings at Caerleon were built of timber during about AD 74 or 75 and were gradually replaced by stone structures during the AD 80s and 90s. The fortress baths were probably also started at this time (Arch. in Wales 1978, 51-2; Zienkiewicz 1986). The first running water supply seems to have been a lead water-main, which was later replaced with a stone channel (Zienkiewicz 1986, Fig 10). The same conclusion can probably be drawn for the leat aqueduct at the Great Chesters fort on Hadrian's Wall, which was constructed soon after AD 128. The fort had baths which were supplied from a water tank into which the aqueduct discharged. These three water supplies can be reasonably dated, but this is not the case with many of the other running water supplies. The date of construction of wells at forts is not known. Often only a *terminus post quem* can be established based on the small finds found in them, which indicates the start of their infilling and their likely abandonment.

Many forts from the more southern region would have been established early as the occupation progressed northwards and provision for either well or aqueduct water supplies would have been made at or soon after their establishment. Black reports 24 military sites that had *mansiones*, and they always had baths, implying that they had some form of a water supply (1995, 118). Most of these sites seem to be dated from the second to fourth centuries, probably indicating that some forts also would have acquired their running water supplies at a late stage (Black 1995, 13-16).

The inscription *RIB* 1049 (see Chapter 3 p.79) found at Chester-le-Street fort, mentions the building of a bath-building for the troopers of the cavalry regiment including a water supply, and *RIB* 605 found at Lancaster refers to the rebuilding of a bath-house for cavalry troopers, both under the governorship of Sabinus, dated between AD 263 and 268

(Salway 1993, 179). This provides positive dating for when these two baths were built or restored.

2.2. Problems with records for water-related structures at military sites.

Although I have listed only 137 forts in my database, they represent only sites at which I traced water-related features. Of the total number of military sites (341) 66 (19.3%) have yielded evidence of aqueducts, 43 (12.6%) sites had wells (of which 16 were associated with aqueducts) leaving 27 with wells only. Thus a total of 93 forts has a proven water supply, while at 248 sites this is unaccounted for. In other words, for 72.7% of the number of known military sites no water supply has been recorded. Clearly this shows that for water-related features there is a distinct bias in the record, which could be due to any of the following reasons.

1. The historical background of excavation at sites would be an important element. It could be that only the fort defences have been excavated in some instances.
2. During excavation water-supply features may not have been found.
3. In many instances the external and internal remains of water-related features have been irretrievably lost.
4. Some forts did not have an aqueduct water supply, though in many cases also no evidence for any other form of supply has been identified.
5. The excavation within a site was constrained to limited areas so that remains still extant have not yet been found.
6. Many of the sites have not been excavated at all, and are known by means other than excavation (such as air-photography) and water-related features have not been observed or reported.

Based on the little available information for forts where a water supply has been found, there is an expectation that the others would have had either a running water supply or at least a well because water is such an important commodity. In the database 34 forts had baths without a running water supply. Forts could of course easily have functioned without a running water supply, but it would have produced problems with the various facilities normally requiring water. The fort at Housesteads is an example.

At Housesteads, a large fort (2.1ha, occupied 2nd to 4th c.), no running water supply nor any internal wells have been found, though two external wells have been recorded. Five large tanks have been

found (one each near the North and South Gates, one at the north-east angle and a large one at the south-east angle, and one in the commanders quarters), but how they were filled is not known (Arch. Ael.³ 25, 1904, 248-9). Inside the commander's house was a small bath for his personal use, and a bath was built during the 4th century in one of the barracks. An external bath-house existed near the Knag Burn west of the fort, which must have been used by both the 1,000 soldiers and the inhabitants of the vicus. In addition to the two wells it had been suggested that a spring, which appears to have been converted into a well (Fig.6.16: OS Pathfinder 546 map at easting 379,180m, northing 570,940m), near the external baths north-east of the fort, was the water source for the baths, since a workman had seen a pipeline from the spring towards the bath (Arch. Ael.³ 25, 1904, 253-4).

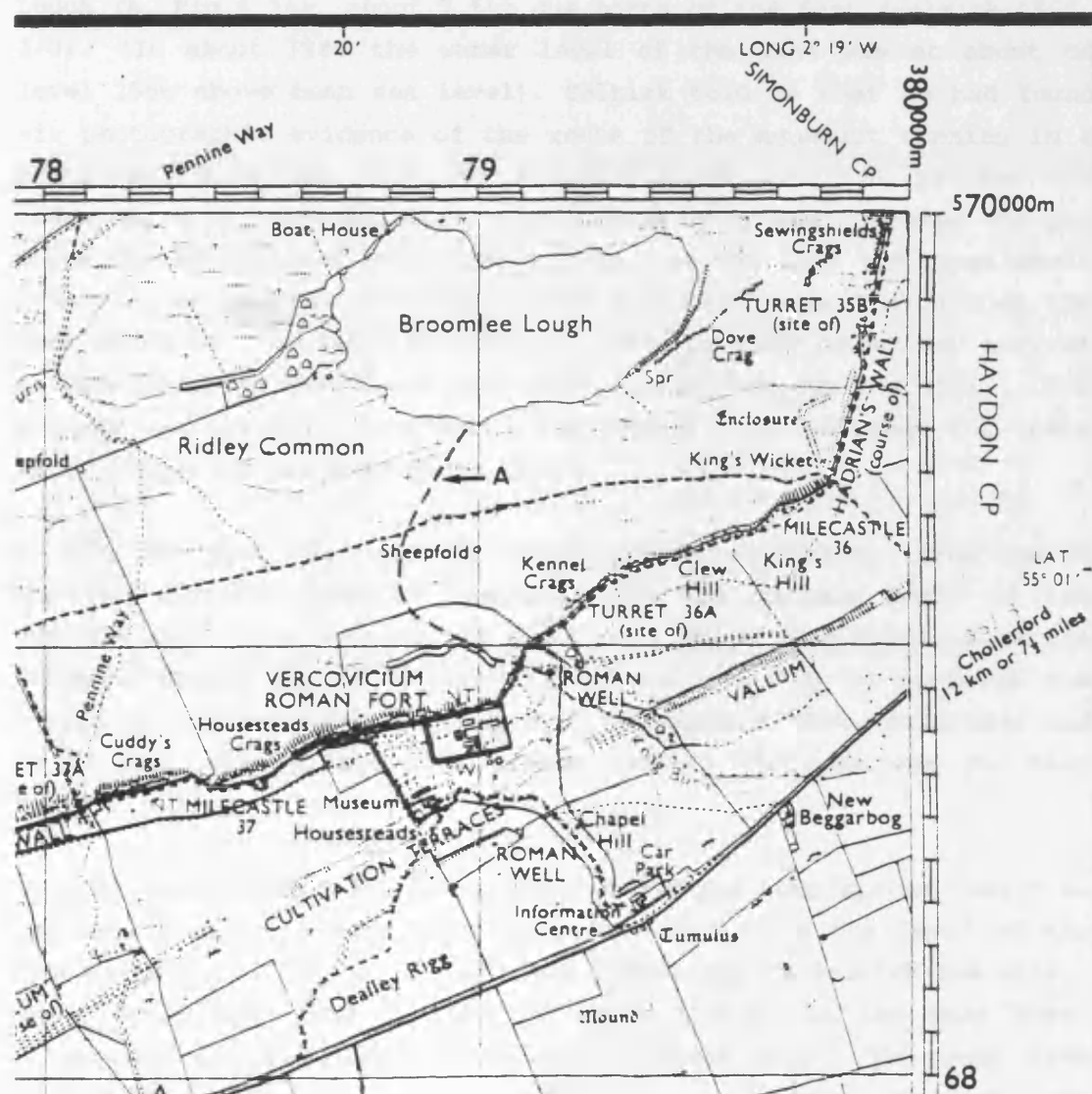


Fig. 6.16: Map of Housesteads-Broomlee Lough area: suggested route of R Selkirk's aqueduct (*Anglia Archaeology* No.5, 1995, 2-3, with figure). (OS Pathfinder Map 546).

Bousanquet suggested that the Romans chose the site because of the ready availability of water (Arch. Ael.³ 25, 1904, 207) and Eric Birley suggested that water was pumped up from the Knag Burn (1961, 181). Manning suggested from finds of iron-pipe collars and the fact that the fort had a range of water related structures (a fountain, an internal bath for a period and an external bath-building) that the fort must have been served by an aqueduct (1976, 40.151, Fig. 24.151). However, no evidence of an aqueduct has been found. The piping may have been water distribution pipes from one or more of the 5 tanks found in the fort.

Raymond Selkirk (an Air Survey Pilot) has now claimed that he has found the aqueduct for Housesteads with its source being Broomlee Lough (A, Fig.6.16), about 7.5km due north of the fort (Selkirk 1995, 2-3). (In about 1980 the water level of the lake was at about OS level 255m above mean sea level). Selkirk told me that he had found air photographic evidence of the route of the aqueduct running in a south-west direction from the Broomlee Lough until it reaches the ridge north of the Knag Burn, then turned south-east towards the gap where the Burn passes below the wall east of the fort (OS level about 245m). Based on this evidence he and his associates "calculated the spot which would entail the shortest possible bore" When they arrived at this position they found the "huge cutting through the hill....Its purpose was obvious - the Romans had tapped Broomlee Lough for their water supply to the Knag Burn" (p.2).

He does not give the depth or the length of the cutting. From the OS map the contours seem to indicate that the maximum depth of the cutting would have been of the order of 5 to 8m (Fig.6.16). From the Ordnance Survey map (1:25,000) it is not possible to estimate the length of the suggested cutting for the aqueduct that would have had to be made through the high ground between the lake and the Knag Burn.

He also describes an intricate water-wheel and pump system, which he suggests could have been used to raise water from the level of the Knag Burn to the fort c.15-20m above. According to Selkirk the water-wheel would have been rotated by water flowing in the Knag Burn, activating a "Ctesibian double action Roman pump". The pump drew water from a sump, which he suggests was the supposed Roman well and it pumped water some 20m up to the fort. As discussed in Chapter 3

for the pump solution on the Lincoln aqueduct, it is highly unlikely that a Roman type pump could push water up a pipe for a distance of 20m.⁷ He does not mention water being diverted for the external bath-building which was located near this well. The route of the aqueduct he proposes would need to be investigated more thoroughly, to substantiate his claims. It certainly is true that the building of such an aqueduct would have been within the capabilities of the Romans. It is surprising with the depth of study and archaeological investigations of the Housesteads fort that such a feature has not been detected. However, the conception is quite novel and it would be of interest to have the opinion of an archaeologist, after inspection, of Selkirk's suggested aqueduct route. I have not therefore included it in the database as an aqueduct site.

Distribution of water-related features within forts has been difficult to assess, because the subject of water supply is seldom dealt with in reports. At the fort of the Lunt there was no external source of water supply. Six wells have been reported, and water may also have been drawn from the river. In the 2nd Interim Report 15 tanks are mentioned and a plan shows that 7 were located within barracks, 4 were inside a building south of the *gyrus*, and external tanks were distributed round the site (Hobley 1973, 35-8, Plan). The tanks outside the buildings were either filled by water carriers, or from rooftops, evidence for which was found of a gutter-fed tank from the north-west granary roof with an overflow into another tank. Possibly some of the tanks within the barracks could also have had catchment arrangements, but this is not mentioned in the report. One of the wells was situated between the *gyrus* and the rampart, and another well was located near the north-west angle of the fort. The fort was active from c. AD 60 to AD 74, and was demolished in AD 75 (Hobley 1973, 15), a short time for such an elaborate establishment, indicates the pragmatic approach of the Roman army to its military needs.

The military camp of Lyne is reported to have had an aqueduct, probably a pipeline from springs about 1.5km north of the camp, which

⁷ If these pumps were indeed used to remove water from Roman ships, the height that water would have had to be lifted would not have been more than a couple of metres. J P Oleson (1984), in his book on remains of 'Greek and Roman Mechanical Water-Lifting Devices', does not give a single example of the type of "Roman pump" Selkirk refers to and shows in his article. It seems that Roman pumps had to stand in the water source to draw water into the cylinders by the action of the pistons. There has been no record of a Roman pump with a suction pipe attached to it to draw up water into a cylinder from a source as shown by Selkirk.

fed 4 ground level tanks (Richmond 1941, 42). The main tank outside the headquarters building had a capacity of about 65,000 litres and together with the other three tanks would have supplied the camp with about 100,000 litres of water. The early excavators interpreted the stained remains of the pipeline as a drain, but later excavation showed them to be parts of a wooden pipeline. There is no indication of a bath at the site.

The case studies mentioned above indicate some of the problems of sites where features have been lost or have not been found. Whatever the present understanding of the water related problems of Housesteads are, the fort functioned for a long time, so that a water supply system existed that worked, however awkward it may have been at times for the 1,000 soldiers. The remains at the fort of the Lunt indicates that it functioned with a water supply system of 14 tanks and 6 wells. In the case of the fort at Lyne there seems to have been an over-supply of water and no bath has been found. These are contradictions in demand versus supply of water, indicating the problems facing archaeological investigations relating to water-related features.

3. TOWNS - COLONIAE, MUNICIPIA AND CIVITAS CAPITALS

Remains of baths have been found at most of the chartered towns and civitas capitals. At the *colonia* of Colchester a single bath has been found, and at Lincoln and York remains of two baths were found. At Gloucester there is evidence of hypocausts and lead piping suggesting the possible presence of a bath, but there is still some uncertainty (McWhirr 1981, 23-4). Here, as is so often the case, modern development has prevented excavation of large parts of the ancient site. Both the *municipia* had baths, London with at least 4 baths, and 2 have been found at Verulamium. The large *thermae* bath at Huggin Hill (site 14, Fig.6.19), built during the Flavian period (AD 69-96), was demolished in the 3rd century because it became flooded, and the bath at Cheapside (12), probably dating from the late 1st century, went out of use during the 3rd century, which may have been related to its water supply. The bath at Billingsgate (39) was constructed before the 3rd century and was still in use in the late 4th century, while the bath at Pudding Lane (38) constructed in the 2nd century was still in use after AD 370 (Rowsome 1995, 418, 420). All 13 listed *civitas* capitals had public baths.⁸ At Exeter remains of two baths have been found, one was the

⁸ Exeter is listed as a fortress in the database, but later it became the *civitas* capital of the *Dumnonii*.

fortress baths, and the other one was probably public baths built after the town obtained *civitas* status. Wroxeter had a large second bath built (A, Fig.6.17) during the Hadrianic period and expanded during the late 2nd or early 3rd century (Webster 1965). Atkinson reported an earlier bath (B) which was built soon after AD 60, but was abandoned during the AD 90s, and was demolished during c. AD 120 to make room for the Forum (1942, 25-54).



Fig. 6.17: Roman Wroxeter showing baths (A, Hadrianic, and B, from AD 60) and wells (circles), and aqueduct C. (Barker 1990, Fig. 3).

At Canterbury and Dorchester remains of two baths were found at each site. The large baths at Wollaston House, Dorchester, either Flavian-Trajanic or Hadrianic in date, were extensively altered c. AD 300 and seem to have gone out of use during the mid 4th century (Wacher 1995,

325-6). Silchester also had two baths, the public baths in the south-east of the town (insula xxxiii), and the *mansio* with its baths, located in the south near the south gate (Archaeologia 59(2), 1905, 133-4).

3.1. *Coloniae*.

A major problem with archaeological evidence of remains is that it often only covers relatively small areas of ancient sites, because frequently modern development overlies the sites, and this particularly applies to the four *coloniae*. The water supply for each of the four *coloniae* also presents special problems because for three of the towns (Colchester, Gloucester and York) their aqueducts are only inferred from evidence of piping near the entrance gates to the towns or from distribution systems within them. For Lincoln (Chapter 3, section 11.2) there is the problem about the source of the earthenware aqueduct from the north. Little is known about the second aqueduct, of which minor remains have been found east of the lower town. A discussion of the water supply of the *coloniae* follows.

Colchester *colonia* and its surroundings with contour levels is shown in the plan Fig.6.18. There is speculation about Colchester's water supply, particularly because of the water pipes found at the Balcerne Gate. Geographically the Roman site was located at too high a level relative to the surrounding country-side to have had a gravity flow type aqueduct.

Figure 6.18 (Crummy 1984, Fig.14) shows that the *colonia* of Colchester lies between the 8m contour along its northern wall and rises above the 30m contour to the highest point at the Balcerne Gate. A large part of the town lies above the 23m contour (hatched on the plan), with the highest point at about 30-32m near the Balcerne Gate. For the Romans to have been able to provide a running water supply to the town, water must have been brought to at least a higher elevation than the 30m level. Remains of six separate water mains consisting of wooden pipes, held together with iron bands, have been found at the Balcerne Gate (1984, Figs.14, 107, 108), but from which direction outside the town they came is not clear. If the pipes originated north of the Balcerne Gate, their grade would have been uphill, and this would imply some system that could force water up the pipes, of which no evidence has been found. In the excavation Reports 3 and 6 (Crummy 1984 and 1992), reference is made to water mains at several places within the *colonia* (1984, Figs.84, 90, 91;

1992, Fig.13, 109). This seems to suggest that when the fortress was replaced by a *colonia* (c.AD 50-55), the *colonia* developed an internal water distribution system, implying that there must have existed an effective running water supply. How water would have reached the Balcerne Gate site has not been resolved, however some possibilities are discussed below.

About 450m to the west outside the Balcerne Gate are the strong springs at Chiswell meadow, which were the source of water for later Colchester.

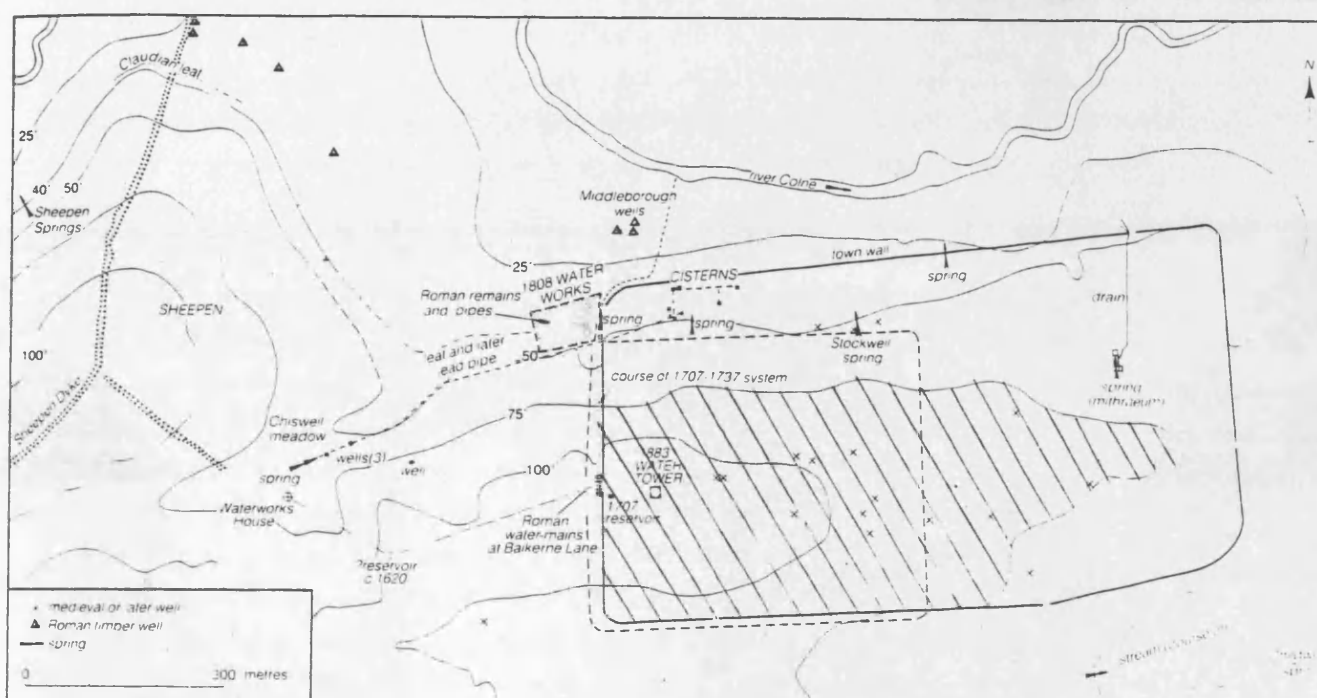


Fig. 6.18: Colchester *colonia* showing site and Roman wells (after Crummy 1984, 27, Fig. 14)

Crummy suggests it could also have been used by the Romans to bring water by means of an aqueduct to the west wall at about the 15m contour level. From there it could have been raised into a tank placed on top of a tower near the Balcerne Gate, the highest point in the town, from which water would have been distributed to the lower parts. However, here there seems to have been the same problem that existed at Lincoln, how water was raised to a tank about 15m above the delivery point of the aqueduct. This tank would have had to be

higher than the tank at the Balkerne Gate. No evidence has been found of either the means of raising the water or of raised tanks.

Crummy discusses the water supply of Colchester in some detail, suggesting two alternatives (1984, 26-8). Firstly, he suggests that an aqueduct may have brought in water from the upper part of the Roman River about 11km to the west, but this certainly would have required an inverted siphon to traverse lower ground near the town. No evidence has been found of either. In his recent book 'The City of Victory' (1997), he gives an illustration of the town as it was likely to have appeared in the 2nd century. Below the Balkerne Gate is shown a conjectured elevated aqueduct delivering water to a distribution tank inside the town east of the west wall. This is based on his discussion of the water supply for the town in Report 3 (1984, 27-7). A second suggestion is, that the water supply may have been from wells. Nine Roman wells are shown on his plan located from north of Sheepen to the three wells at Middleborough north of the north-west corner of the *colonia* wall. No Roman wells have been found within the walls, though a number of Medieval ones are shown on the map. This suggestion does not take account of the evidence for a water distribution system within the town, because it is unlikely that a central distribution tank would have been filled by carrying water from the wells outside the walls.

An aqueduct is recorded at the outlying suburbs of Sheepen, where there were pottery works, and another has recently been noted at Gosbecks. A short length of the "Claudian leat" at Sheepen is shown to run from the north-west along the 12m contour in a curve from the Sheepen springs towards the *colonia*. The contour (40ft) is shown to continue to the north-west corner of the *colonia*, and at this point on the plan it refers to "Roman remains and pipes" and "leat and later lead pipe" (Crummy 1984, 27, Fig.14). This seems to indicate that the Romans brought water to the north-west corner of the early fortress (c.AD 43-60/1). The plan shows there are 5 springs within the town walls (possibly more), three along a spring line at about the 15m contour, one about 4m higher near the north wall, and another at the *mithraeum* at about the 21m level. How much water would have been available from these springs is questionable, because the catchment area is relatively small - smaller than the *colonia* area. Considering springs as a major water supply during the town's period of prosperity in the 2nd and 3rd centuries is doubtful.

In summary the evidence for the water supply at Colchester *colonia* is:

- 1) 6 water mains found at the Balcerne Gate at about the 30-32m level,
- 2) water mains found at several places within the *colonia*,
- 3) a leat from the Sheepen springs seems to run towards the fortress,
- 4) an aqueduct from the Chiswell springs to the west wall at 15m level,
- 5) 9 Roman wells outside the *colonia*,
- 6) at least 5 springs within the *colonia*.

If item 1 was part of an aqueduct system, there are two possibilities: firstly, an elevated aqueduct of substantial height (of order 15m+) brought water from some distance away in the west (the Roman River has been suggested as a possible source). However, no evidence for such a major structure has been found, either as a wood trestle support for a conduit, or as stone or earth constructions. Secondly, an inverted siphon, also from the west, may have brought water to the Balcerne Gate. The 6 wooden pipes found at the Balcerne Gate, could have been part of an inverted siphon, but again there is no evidence for pipes found further west outside the town. The area is extensively cultivated, so that any evidence of a wooden pipeline would have been destroyed. Also, wooden pipes used in an inverted siphon would have presented problems of bursting under pressure, unless they were encased in concrete, or well protected in the ground.

The evidence of water mains elsewhere in the *colonia* is very suggestive that a running water supply did exist, but from where it was distributed is unclear. Items 3 to 6 have been discussed above with their limitations in view of the evidence of distribution water mains in several parts of the town. It seems to me there is sufficient evidence to accept the theory that the *colonia* did have an aqueduct water supply, even if it was not brought to the highest point, for distribution to some of the lower parts of the town. However, much more study is required to resolve the uncertainties surrounding its source of water, route and type of conduit, where it entered the town and how it was operated.

At **Gloucester**, as at Colchester, an aqueduct is also presumed because of the evidence of remains of collars of wooden pipes near the east-gate, and several wooden pipes which formed the distribution system

within the *colonia*. There is also a record of two wells, which hardly seems to represent the number that should have been available for a large town. Hanson suggests that the source of an aqueduct could possibly have been the springs near Matson on Robinswood Hill about 3km south of the town (1970, 367). Wachter adds the suggestion that an aqueduct supply could also have come from north of the city (Wacher 1995, 159). It has been reported that a large "9m-wide tank has been located in the fortress" and he suggests that this may have been the terminal reservoir for an aqueduct (Stephens 1985b, 223; JRS 1967, 195). Other tanks have also been found. A bath-house is implied from remains of an apsidal hypocaust at Westgate Street, but the limits of excavation on the site prevented more of the structure being revealed (Wacher 1995, 158). The *colonia* had a sewer, but it is not clear how extensive it was, and this would probably also point towards a running water supply. It would seem that not sufficient archaeological evidence is available from outside the *colonia* to confirm a running water supply, but, as for Colchester, internal evidence seems to indicate the town did have an aqueduct.

The problems of the aqueduct water supply at **Lincoln** have been discussed in detail in Chapter 3 section 11.2). A summary of the evidence for the water supply of Lincoln follows:

1. Sections of an earthenware pipe encased in concrete was found as indicated on Fig.3.7a (p. 76) between points B to X (about 96m); point X is the most southerly position where piping was found, about 0.5km from the north-east corner of the town wall.
2. The aqueduct was a rising-main of about 2km length from the Roaring Meg stream towards the *colonia*, with a difference in elevation of about 21m to 24m, depending on at what point water was delivered at the town.
3. Immediately south of the Roaring Meg, 11 foundation bases were found.
4. Early antiquarians of the 18th and 19th centuries reported having seen a tower with a tank near the Roaring Meg stream.
5. In 1786, a Swiss artist, Grimm, drew two sketches (now in British Museum) of a bridge structure that coincides with the position of the foundation bases; they show the line of the aqueduct pipe on the structure (Thompson 1954, Pl.VII A, B).
6. At base VIII nearest the Roaring Meg (E, Fig.3.7a), Thompson reports finding in the filling of the construction trench 'a rustic ware cooking-pot of late 1st or early 2nd century' (1954, 117) (possible dating evidence for construction of the aqueduct).

7. A short length of earthenware pipe (E) encased in concrete found east of the lower part of *colonia* above the spring line (F) (Fig.6.19; Lewis 1984, 71).
8. Two water tanks - one next to the north wall near the Newport Arch (B, Fig.6.19), and the other next to the east wall near the East Gate.
9. Two wells - one within the Forum east range (H) (Chapter 4, p.122, Fig.4.5), and the other near the West Gate (I) (not yet reported).
10. Two baths - one south of the north tank (A), and the other in the lower part of the *colonia* (K).
11. A fountain (J) with inlet and outlet pipes found near the lower bath.
12. An extensive underground sewer system (G) was found during the 19th century in the upper part of the town, the main sewer running along the Bailgate.

The evidence of items 2 to 5 seems to indicate that a) the source may have been at the Roaring Meg; b) that there was some evidence of a substructure carrying the concrete encased pipe to near the Roaring Meg stream, and c) that there was evidence of a raised tank that supplied water to the rising main, forming a pressure system in the form of an inverted siphon (the probable reason for a concrete encased pipe). Two main problems, as yet unsolved, are firstly, was the Roaring Meg stream the water source for the postulated inverted siphon, and if so, how was the system supplied with water? Thompson (1954) discussed these issues proposing possible solutions on the basis that the Roaring Meg was the water source. Suggestions have been made that the water source was further north (Chapter 3, section 11.2, Fig.3.8).

Limited further investigation was carried out during the early 1980s in the vicinity of the masonry piers, but nothing new was discovered (personal communication from Mick Jones, May 1997). The public bath (A) (Fig.6.19) in the *colonia* near the presumed *castellum aquae* (B) about 100m east of the Newport Arch (C), seems to confirm that the aqueduct (D) was aimed in the direction of this tank. It has been suggested by Lewis that water may not have flowed in the aqueduct (D), based on the fact that no encrustation shows in the ceramic pipe (Chapter 3, p.86), which would have been expected from the lime-rich water coming from this limestone region (Lewis 1984, 68-9). It is uncertain whether the second earthenware pipe (n.7 above) was in fact an aqueduct supplying water to the lower part of the *colonia*.

From its position it seems unlikely that it could have supplied water to the northern part of the lower town, which may have obtained its water from the upper *colonia* aqueduct and that in turn would require an effectively functioning upper aqueduct.

There are other indicators which demanded a plentiful running water supply such as evidence of an elaborate sewer system (G) in the upper town and possibly a water distribution system. However, as discussed in Chapter 3 (pp.82-6), calculations, based on delivering water from the Roaring Meg stream (OD level 39.5m) to a tank near Newport Arch (OD level 65.5m), show that only about 72,000 litres of water per day was likely to have been supplied by this aqueduct. The distribution of this quantity of water between two baths, a fountain, sewers, other public buildings and to a domestic distribution system, seems unrealistically low. Whitwell has suggested that "The system of water supply to the town would have been based on fixed hours during which the water was pumped up to storage tanks, and similarly regulated periods when the water was available to the various consumers, public and private" (1970, 33). There is no evidence for such a control system, but it is likely that the Romans had developed water regulating systems.

If the observations by the early antiquarians and Grimm's drawings are acceptable as evidence for a tower structure near the Roaring Meg and that the aqueduct's intake was in the vicinity of this tower, as suggested by Thompson (1954), then it implies that the Romans created an elaborate water raising facility in the vicinity of foundation VIII. These early sources do not describe the tower or the material of its construction. In my calculations (Chapter 3, pp.82-6), I considered a single chain and bucket arrangement to lift water to a tank on a tower high enough to allow water to flow along the pipe to the delivery point in the *colonia*. If there existed a battery of 3 or 4 bucket and chain systems to deliver water to the tank, the water supply to the town could possibly have been sufficient for the basic needs of the *colonia* if supplemented by wells.⁹ However, wells would have had to be of the order of 16m deep, cut through the Jurassic ridge limestone to reach the water table; this complication may have been the reason for building an aqueduct.

⁹ Even 4 systems would have delivered only a little more than one quarter of a million litres per day, which is still many times less than what the aqueduct at Dorchester delivered per day.

Notwithstanding much of the negative aspects related to the source of water and the operation of the aqueduct, the Lincoln *colonia* must have had a working running water supply, because the town was still economically active up to the mid-fourth century (Wacher 1995, 149). Further investigation is necessary to resolve uncertainties about the water supply of Roman Lincoln, and in particular to re-examine the early evidence.

York is built on a gravel and sand layer which overlies clay formations, similar to the formations at London and Silchester, and is reported to have had several wells and springs (RCHM(E) 1962, 59). Well-water could therefore have been a significant source of water for the Roman town. Only two wells have been reported.

An aqueduct for York is only inferred from evidence of other remains such as a fountain, a bath (of which only a small part has been found because of the limited area of excavation) and lead pipes leading to it, and a massive lead pipe crossing the River Ouse (RCHM(E) 1962, 49-51; Wacher 1995, 176, Fig.79). The fountain was in the shape of a 1m square tank fed with water from a pipe in a vertical slab at its back, with an outlet pipe (75mm diameter) in the right wall. This implies a constant supply of water, and therefore it is accepted that the *colonia* at York must have had an aqueduct water supply, but no other evidence for it has been found, other than that the town had a public bath, said to have had the largest *caldarium* in Britain (Richmond 1946, 76-7).

3.2. *Municipia*.

Roman **London**, built on the gravel terraces above the Thames River, developed around the Walbrook valley where springs and wells were the principal sources of water supply (Fig.6.20) (Wilmott 1984). Wacher, however, has advocated an aqueduct as an additional water supply, to have come from Highgate or Heampstead (1978, 104-8), because he considered that the bath-houses of London would have required large volumes of water (Chapter 4, section 6.2.1). As evidence he cites the wooden water-pipes found at the Bank of England site (20) and those found in the Walbrook valley (26, 28), and also near the forum (36), implying some form of a water distributive system (Wacher 1995, 90, 101) and hence an aqueduct system. He does not refer to the pipes in relation to either springs or wells. Wilmott states that "these pipes make it unlikely that they were used for anything other than the water supply of fresh water, but there is no need to assume that they

were aqueduct fed" (1984, 241). This would imply that the pipes could have collected water from either springs or wells, in what Wilmott refers to as "intermural aqueducts" (1984, 242). Grimes (1968, 97) believed the wooden pipes to have been used for drainage, which seems to have been a costly way of providing drainage (Wacher 1995, 101).

Because of a rising water table, a major problem was the disposal of excess water, not collection. Both Wilmott (1984, 241) and Merrifield (1965, 146) argue that the evidence for the well and spring water supply for all London's needs outweighs the evidence for an aqueduct system. Wilmott (1984, 239) convincingly argues that all four of the bath-houses (Cheapside 12, Huggin Hill 14, Pudding Lane 38, Billingsgate 39) were close to a spring-line, which would have facilitated the provision of their water requirements by "intramural aqueducts" collectors. This leaves the question of an external aqueduct unresolved with the balance of present opinion that it would have been a superfluous addition to the water supply of London. The control of excess water due to the high water table seems to have been closely related to the development of the area around the Walbrook valley.

Wilmott reports 51 wells found within the walled area of Roman London (1982a, 1982b, 1984, 1991), shown on Fig.6.20 (Wilmott 1982b, 235, Fig.1). Except for three reported wells to the east of the forum, all the wells were found along a central band mostly west of the Walbrook stream, with concentrations in the Queen Street area (sites 25 and 26) (1982a, 20 wells) (Fig.6.21a and b, and Table 4.4), and Middle Walbrook area (10 wells). In the latter area at Bucklersbury and Compton Court (28), 5 barrel-lined and 5 box-lined wells were found (Wilmott 1991, 20-52, Fig.7 & 22)¹⁰. Later another 5 wells were reported, bringing the total in this general area to 35 (Wilmott 1984, 7). The remaining 16 single-well sites suggests that they may have belonged to private homes or business enterprises.

¹⁰ Wilmott's 1991 paper is to some extent a summary of the three CBA Research Reports Nos.69, 70 and 88 on the Archaeology of Roman London in the Walbrook valley area.

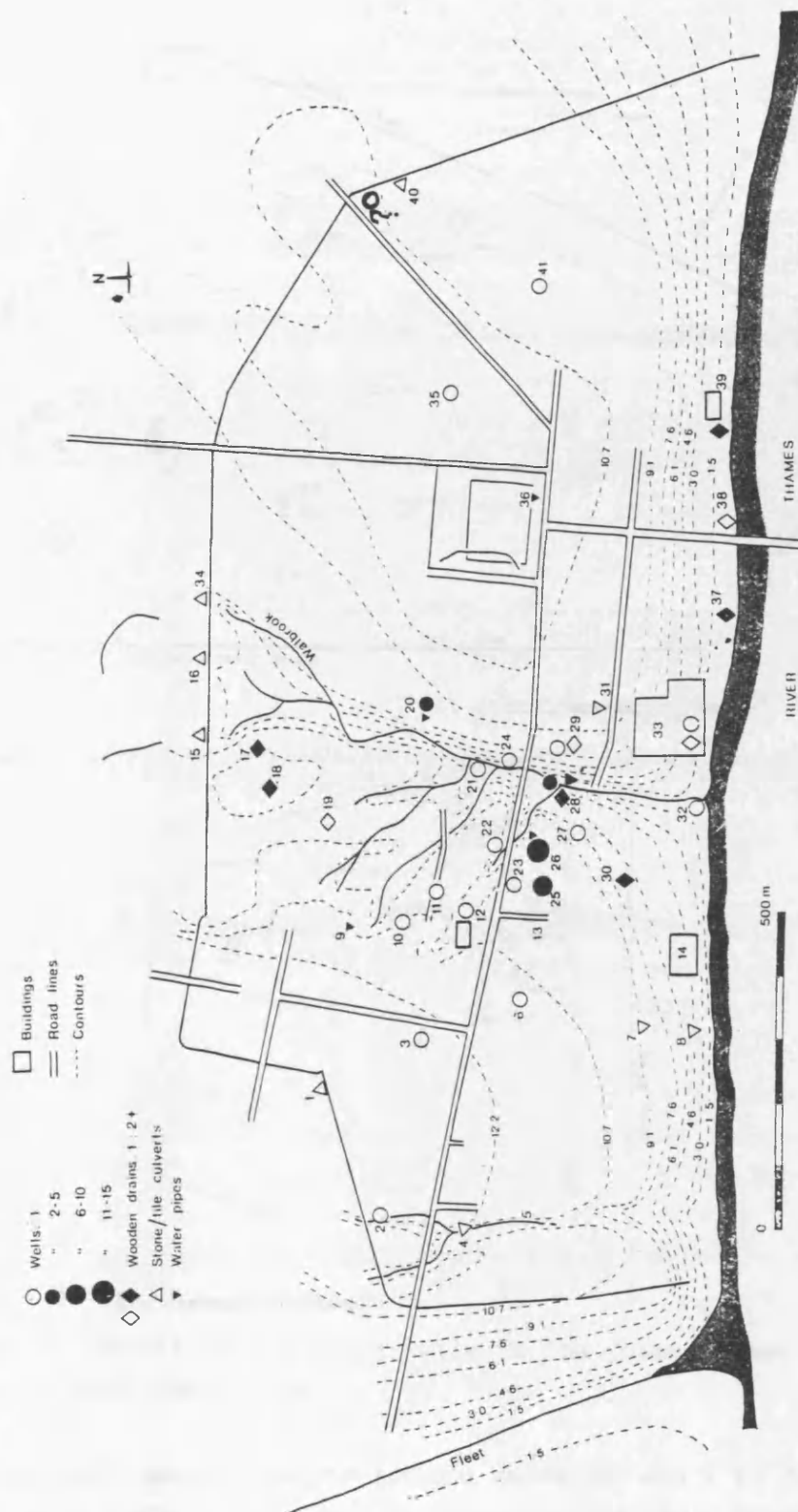


Fig. 6.20: The wells and other water-related features of Roman London (after Wilmott 1982, 235, Fig. 1).

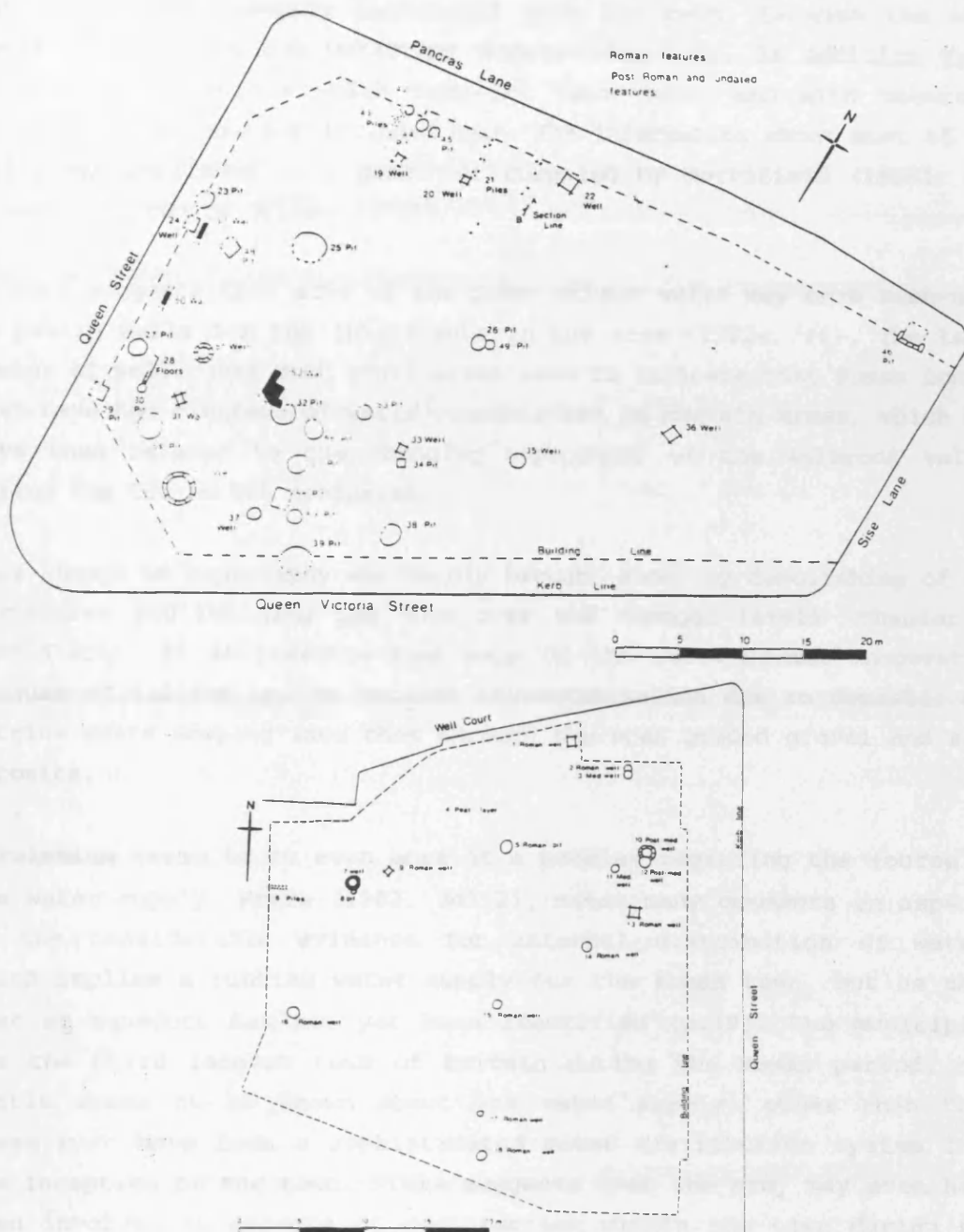


Fig. 6.21a and b: Localities of Roman wells in the Queen Street area, London, (after Wilmott 1982a, Figs 5, 6).

Thirteen of the wells dated from the 1st-2nd centuries and 9 to 3rd-4th centuries (Wilmott 1982b, 240), and the remainder of this group with less secure dating. Whether the later wells were new because of additional requirements, or whether they replaced some of the earlier ones that may have become disused or polluted needs further study. A well is shown within the supposed Governor's palace area (Wilmott 1982b, 235, Fig. 1 Site 33), the only building shown to be associated with a well. Near the Cheapside bath a well is shown, but it is not clear

whether it was directly associated with the bath, because the bath seems to have its own watertank supply (Fig.4.8). In addition there were other wells/pits which have not been dated and with uncertain origin, so they are not included here. The information about most of the wells was published in a gazetteer compiled by Merrifield (1965), and others reported by Grimes (1968).

Wilmott suggests that some of the Queen Street wells may have been used as public wells for the inhabitants in the area (1982a, 16). The large number of wells over such small areas seem to indicate that Roman London must have had clusters of wells concentrated in certain areas, which may have been related to the changing topography of the Walbrook valley during the 1st to 5th centuries.

This change in topography was mainly brought about by demolishing of old structures and building new ones over the changed levels (Chapter 4, sect.6.2.1). It is possible that many of the wells became inoperative because of silting up, or because of contamination due to domestic and latrine waste seeping into them through the open graded gravel and sand deposits.

Verulamium seems to be even more of a problem regarding the source of its water supply. Frere (1983, Vol.2), makes many comments on aspects of the considerable evidence for internal distribution of water, which implies a running water supply for the Roman town, but he says that an aqueduct has not yet been identified (p.19). The *municipium* was the third largest town of Britain during the Roman period, but little seems to be known about its water supply, other than that there must have been a sophisticated water distribution system from the inception of the town. Frere suggests that the army may even have been involved in aspects of construction within the town during the early phases (Frere 1964, 104-5). The geological conditions did not favour wells as an easy way of obtaining water, as at London or Silchester. Frere mentions that "Verulamium contained a number of wells, e.g. Insulae IV, XIV, XXVIII (p.20), but only describes a well in Building 3 in Insula XXVIII (1983(II), 242-3), and one well was abandoned before it reached the water table (Hanson 1970, 70).

Wheeler identified a wooden pipeline by a number of iron collars along Watling Street at Chester Gate in the north-west of the town (Wheeler, 1936, 70), and later Frere found two tile-lined conduits at the Monumental Arch on Watling Street, one a sewer and the other

presumed to have been a water main (Frere 1962, 154). Further along in Insula XVII a stone conduit was discovered by Richardson (1938, 85-6), who suggested it may have been the water supply that came from higher up the River Ver that flows along the north-east boundary of the town (Hanson 1970, 70). Whether there is a connection between the conduit found by Frere and this latter one is difficult to say, because not sufficient excavation has been done in between to confirm it. Near the centre of the town evidence of a number of wooden pipelines have been found, which implies a running water supply for the town. Regarding the discovery of the iron collars of a wooden pipeline in Insula XXVII (Frere 1983, 236, Fig.89) dated to the 5th century, Frere comments, that even at such a late period "we find that the technical skill necessary to maintain the city's aqueduct and to install a piped supply from the *castellum divisorum* was available" (Frere 1960, 20-1). This probably represents a new internal distribution pipeline, indicating a continuation of the urban water supply at a very late date. The water source for any aqueduct that may have brought water to the town has not been identified during the periods of major excavations in the 1950s and 1960s.

3.3. *Civitas* capitals.

Eleven of the major towns of *civitates*, are recorded as having had aqueducts and 10 sites had both aqueducts and baths. No evidence of aqueducts has yet been found at Chichester and Silchester although both towns were important, well-laid out urban centres with baths (Wacher 1993, 264, Fig. 117, 274, Fig. 123), while at most of the other listed *civitas* capitals they have been found. The supply of water to Leicester is also a problem because of the uncertainty about the Raw Dykes being an aqueduct and to the baths. It is perhaps significant that at Chichester and Cirencester only 4 wells had been found at each town, which may be due to the level of excavation of the towns. In contrast where excavation covered almost all of a town site, as at Silchester, 76 wells were found (Hanson 1970, 124) and at Caerwent 16 wells were found (Hanson 1970, 84). Most of the wells at both towns seem to have been associated with private houses. Caerwent has evidence of an aqueduct and also had an elaborate water distribution system in the mid-north part of the town. Some of the town sites may have had aqueducts during their certain or suspected military phases and therefore did not have to rely only on wells during the town phases, such as at Aldborough and Carmarthen, and at the capital of the *Iceni*, Caistor-by-Norwich. On the other hand,

remains of wells have not yet have been found because of insufficient detailed excavation. No wells have been recorded for Carlisle. At Canterbury, Dorchester, Leicester and Winchester¹¹ wells have been recorded but the archaeological indications do not show that they had many wells, suggesting that wells were not their principal form of water supply. For Wroxeter, Atkinson reported on the distribution of pipelines in the town dating from the later 2nd century, but the evidence is not sufficient to associate them with distribution for domestic water supply (Atkinson 1942, 122; Hanson 1970, 140). Bushe-Fox discovered 11 Roman wells during the 1912-1914 excavations at Wroxeter, and Atkinson reports a further 6 wells during the excavations of 1923-7 (1942, 114-22). This suggests that even though the town had an aqueduct water supply, for a number of private residences wells may have been the main water source. There seems therefore to be evidence that some towns had combined aqueduct and well water supplies, though the data is not clear as regards the balance between the two.

Caerwent (*Venta Silurum*) and Silchester (*Calleva*) are two contrasting *civitas* centres as revealed by their water supply and drainage systems. Silchester (40ha) is more than double the size of Caerwent (18ha). The larger town had a well-established drainage system even though it did not have a running water supply, where Caerwent seem to have had poorer public drainage facilities, with many houses having to dispose of their own waste water and sewage into cesspits. Silchester had a large public bath, whereas the public bath at Caerwent was more modest (Wacher 1995, 45, Fig.10.2 and 47, Fig.11.4), though it appears not to have been completely excavated. At Caerwent a second bath-house is shown in the south-east, but it is not clear to me whether it was also a public bath. Three houses in the south-west where wells have been found also had baths, which seems to imply that some other private houses may have had baths, but have not been identified as such from their remains. Caerwent was close to the fortress at Caerleon and several scholars have commented that the facilities at Caerwent, in particular its water supply and public and domestic distribution system may have been influenced by the availability of army engineering personnel¹². The town streets seem to have developed over a period well into the late second

11 At Winchester the water table is so high that it has hampered excavation of the Roman remains below the Medieval period remains.

12 Millett is critical about the suggestion that military engineers were involved in the construction of *civitas* capitals (1984; 1990, 69-75; Blagg 1980, 1984).

century (Brewer 1990, 75), so that it must be assumed that the distribution system also expanded with the street development (*Britannia* 16, 1985, 201-2). Whether the aqueduct supply was modified as the town developed is not recorded.

4. SMALL TOWNS

The 66 small towns listed in the database with water-related features represent 68% of the total number of 97 suggested by Burnham (1986, 187). Of the 9 which had aqueducts, only two are recorded as also having had wells. The aqueducts at Dolaucothi, Kelvedon and Nettleton are leats, and that at Bath is a lead pipe, and that at Chelmsford a wooden pipe. The aqueducts at Godmanchester, Wall and Wilderspool are undefined and the aqueducts of Corbridge are also not known though it is suggested that they were either channels or leats. Fifty-two sites had wells and 30 had baths, five of the small towns had aqueducts and baths and 18 had baths and wells. Most of the small towns show only one well, but Tiddington had 14 wells, Scole and Tripontium each had 7, and Ewell 6, Ancaster and Heybridge 5 each. Wells were the preferred water sources at many small towns, but it cannot be ruled out that some residents drew water from nearby springs or streams. Thirty sites are recorded as having had baths, of which some were associated with *mansiones* (Black 1995, 118)¹³, but given the dearth of excavation information of small towns in Britain it is quite possible that this figure is too low.

5. SETTLEMENTS

Settlements are defined in this thesis as sites which do not fall within the other six types of sites. However, when I started with the analysis of site types in relation to the water related features found at them, it became clear that some sites which I have listed as settlements may need to be examined in greater detail for possible reclassification. Hingley states that few settlements have been excavated extensively and "in enough detail to provide comprehensive and reliable evidence for the form and chronology of a settlement" (1989, 75). Below I give some reasons why I consider some sites should be considered for reclassification.

Of the 212 sites listed in the database, 135 (63.7%) had wells. As minor sites, I did not expect them to have had aqueducts, though 20

¹³ Black (1995) refers to *vici*, many of which are classed by Burnham (1986) as small towns.

were recorded, of which 8 were leats. In most cases these were presumably simple channels bringing water from springs or streams at not too far a distance from the settlement. Only 4 sites with aqueducts also had baths, whereas 10 sites had baths and wells. The implications of these combinations are discussed below.

An important problem is when we consider the recording of a bath and/or an aqueduct at a settlement, which is associated with a villa. It may not be clear whether the bath and/or aqueduct belonged to the settlement or to the villa (Hingley 1989, 102-3, Fig. 55). There are however settlements where certain water-related structures have been found, which were unlikely to have been built without some urban type infrastructure having been responsible for their planning and construction. This is exactly what a small town is considered to have had and rural settlements supposed to have lacked. For the types of urban or rural communities we are looking at, wells would not necessarily be an indicator of a special organization during the Romano-British period. But the presence of a bath-building of some size (the standard three-roomed bath-suite) and/or an aqueduct immediately suggests that there must have been some organization responsible for their planning and construction or that the owners were wealthy enough to be able to afford such luxuries. It certainly is unlikely that a loosely nucleated group of rural small households would have invested in such expensive structures. Of the 212 settlement sites initially listed in my database, there were 69 sites with major structures (Table 6.5) (20 with aqueducts, and 49 with baths). Four of these, had both - Grafton Estate, Ivy Chimneys, Prestatyn and Southwark Street. Some of the baths are described as being small baths in private homes, but it is not always clear whether the larger baths were public baths or private ones. Table 6.5 gives a summary of the aqueducts and baths at settlements.

Table 6.5: Settlements with aqueducts and baths

Settlements with aqueducts	20	9%
Settlements with baths	49	23%
Settlements with both aqueducts and baths	4	2%
Settlements with either aqueducts and/or baths	69	32%
Settlements with aqueduct only (20 - 4)	16	8%
Settlements with bath only (49 - 4)	45	21%
Total settlement sites	212	

What needs to be established is where these settlements were situated in relation to forts, because if the settlements were *vici* outside the forts then it is likely that the baths would have been used by both the soldiers and some of the *vici* residents. The status of baths at settlements seems not to have been studied, so that it is not clear whether any settlements had public baths.

The question arises whether these so-called settlement sites with aqueducts and/or baths should still be classed as settlements, since the inhabitants apparently did not have an outward structured political or economic organization, or should consideration be given for at least those which may indicate group action to be reclassified as small towns? The evidence seems to suggest that the four sites with both an aqueduct and a bath were planned by group action and should be given the status of small towns. I suggest that if a settlement had an aqueduct, usually a reasonably expensive structure, it would indicate some political organization which could make communal decisions for the construction and management of an aqueduct, and therefore such sites should be accorded small town status. The problem settlement sites are those with baths only, which need to be examined whether the indirect evidence could indicate whether the baths were public or private.

Of the 64 settlement sites at which either aqueducts or baths were found, at least 20 should be classified as small towns, on the basis that 16 had aqueducts and four sites had both an aqueduct and baths. It is possible that some of these aqueducts were rather minor structures, in which case they need not have involved group action. For the remaining 41 the evidence of the baths need to be examined in detail to determine whether any of them should be reclassified.

Burnham discusses the morphology of 'settlements' (item 3(a)) where they are classed as major or minor towns. At items 3(c)-(h) and 4(a)-(d) he lists the requirements that were necessary to classify a settlement as a small town. An important component would at least be a "restricted range of building types", but no mention is made of either baths or aqueducts as parameters in his classification. I consider that these two structural types should be included as parameters defining a small town.

In Appendix 1, the 41 sites classified as settlements with baths (marked with a + sign) are given in Table 6.6, but in Chapter 2 it

was indicated that because of problems with their descriptions in the literature, they need to be examined more closely where they have baths. If a site is a simple farmstead consisting of only a few rooms and a bath is listed in the literature, this bath may not be the three-roomed type referred to in Chapter 5. However, if the baths at a settlement site were of the sophisticated three-roomed type, the site type may also be more than a simple settlement, and could fall in the category of a villa. Several of the sites are listed in Eleanor Scott's 'Gazetteer' (1993) on villas, though with no definitive statement that they were villas. However it would be sensible to assume that some of these were indeed villas, for instance High Ham, Rowlands Castle, Sandringham and Stonesfield. Because of the element of uncertainty I entered them as settlements. Sites at Lyminge, Orton Longueville and Scawby, based on Scott's descriptions, could be either settlements or villas, but insufficient information is given to be certain about their classification, so I have listed them as settlements. A number of sites started off as settlements during the early Roman period and later developed into villa estates, as at Boreham, Durham, Haddon(?), Somerford Keynes and Yarwell, but I have listed them as settlements, because of the uncertainty. Others were *vicus* sites associated with forts where the baths were outside the forts, and it is most likely that the baths here were public. Whether these *vici* later developed into settlements or towns in their own right, as is known happened to some *vici*, especially when the associated fort moved or ceased to function, needs to be investigated. Two examples are the *vici* of Leintwardine and Romford. Some of the other settlement sites, particularly those with *mansiones* may also have started off as *vici*, for example Chigwell, Cold Knapp Point, Romford and Tilston. Many settlement sites are associated with villas and it is clear that the villa had a bath. However some of the settlements near villas had their own baths, usually small baths with only one or two small rooms, such as at Aldbourne, Asthall, Castor(2), Pulborough and Salford Priors. The remaining sites were settlements as listed in the literature and had baths, but with no clear indications of the sizes of the baths or whether they were used only by the household members of the houses located in those settlements. Those sites which are listed in the literature as villas, should be given that classification unless it is proved otherwise. The sites which started off as settlements and later developed into villas (or may be even towns) are probably likely to have had their baths built during the later Roman period.

Vici often had *mansiones* and hence would have had public baths which were used by the *cursus publicus* officials (Black 1995, 14, 118, 120). The *vici* baths were most probably built by the army if they were built soon after the associated forts were built. Both Leintwardine and Romford *vici* are likely to have had official *mansiones* with baths, also constructed by the army. Chigwell, Cold Knapp and Tilston also fall in this category. Settlements near villas probably had private baths in individual houses. The remainder are settlements which seemed to have developed from very simple nucleated communities to more elaborate urbanized settlements and consideration should be given to raise their status to a higher category such as small towns or villas rather than simple settlements. Both Chigwell and the site of Castor(2) (my database number), a suburb of Durobrivae, situated at Normangate Field, were classified by Rodwell & Rowley (1975, 3) as small towns, while all the other sites are not listed as small towns by either Rodwell & Rowley, or by Burnham. Although the literature refers to them as settlements, some reports pre-date the debate about how to define 'small towns'.¹⁴

In Table 6.6 I propose that the sites listed should be classified as shown in the first column.

For the database record these settlements should therefore probably be entered as villas, though because of the uncertainty I have recorded them as settlements until more rigorous study can positively determine their status.

¹⁴ Todd 1970, 114-30; Rodwell & Rowley (eds.), 1975, several authors; Rivet 1975, 111-14; Brown (ed.), 1995, several authors, in particular Burnham, 1995a, 7-17.

Table 6.6: Settlements with baths - classification

Proposed classification:	Site names:
as villas: (previous as settlements)	Badbury, High Ham, Rowlands Castle, Sandringham, Stonesfield, Wootton Hill, Yarwell, Lyminge, Orton Longueville, Sambourne, Scawby.
as villas: (settlements that later may have developed into villas)	Boreham, Durham, Haddon(?), (later Roman), Somerford Keynes.
vici:	Leintwardine, Romford.
vici + mansiones:	Chigwell, Cold Knapp Point, Tilston.
settlements: (near villas)	Aldbourn, Asthall, Castor (2), Pulborough, Salford Priors.
Settlements: without a particular association (16 No.)	Aldermaston, Blyborough, Bromham(2), Coleshill, Garden Hill, Great Bulmore, Higham Ferrers, Landwade, Long Melford, Oakridge, Paulton, Pentre Ffwrndan Farm, Staden, Stonea Grange, Weston Underwood, Wyck.

A perplexing question is, how one would determine whether the communities at these proposed reclassified settlement sites, in fact, had the organizational and political structures to make decisions on spending money for public facilities? It is possible that at least at some of them there would be additional indicators, such as other building structures of a public nature, or evidence of a common approach to agriculture, which could also imply a more sophisticated community than mere loose farmsteads close to each other. This would require detailed study of the evidence for each site, which I have not done. Condrón has made a detailed study of both small towns and settlements in the East Midlands (1996) and in her Figure 2.1 (p.28) she shows the distribution of as many as 1850 sites in this region. There is little reason to suppose that settlement distribution over other regions of Roman Britain was significantly less densely populated. Rodwell refers to Richmond's comment on "the enormous

number of settlement sites" in the Essex region.¹⁵ Many of these numerous settlements were probably simple farmsteads with little pretension (Hingley 1989, 75), which produced only sufficient for their own needs. Many British settlements would have produced surplus crops which would have been available for distribution to markets, or may have been associated with villas to whom they supplied their excess products.

It seems clear to me that in order to determine the status of the minor settlements, not only must their social and economic circumstances be studied but also the sophistication of the buildings which comprises a settlement, and baths would be an important element in such a study.

6. VILLAS

Of the 372 villas recorded in the database 305 had baths (82%), but even this seems to be low considering that there were probably about 2000 known villas. The remains of villas with baths are spread over the whole area of Roman Britain, the most northern one being at Holme House in County Durham. The large number of villas recorded to have had baths seem to indicate that many more must have had them.

Table 6.7 shows that 104 villas listed in the database had wells and 24 had aqueducts. This represents 34.4% of the sites for which some information is available on water-supply structures. Comparing my Fig.6.15 of the distribution of villas with baths with a general villa distribution map (Jones and Mattingly 1990, 241, Map 7:6), it is apparent that the sites with wells are fairly evenly spread over the area of Roman Britain where villas have been found. From descriptions of villas in excavation reports the differences between villas where wells have been found and those without wells are similar, so their water needs could have been the same. It would seem reasonable therefore to conclude that since the 104 sites with wells were randomly scattered amongst the population of known villas, the likelihood is that most of the other villas also had wells. The 305 baths (82%) at villas (Fig.6.10) represents the most prolific feature at all the sites recorded in the database and the same conclusion is likely to be true about their distribution as was suggested for wells.

¹⁵ Rodwell W, 1975, *BAR* 15, 'Trinovantian Towns and their Setting: A Case Study', 85; Richmond I, *VCH Essex*, iii, 1963, 55-6.

Table 6.7: Distribution of water-related structures at villas

Aqueducts	24	6%	AQ + BA	16	4%
Baths	305	82%	AQ + W	5	1%
Wells	104	28%	AQ + TA	9	2%
Drains	67	18%	AQ + WP	10	3%
Pipes	34	9%	BA + W	55	15%
Springs	23	6%	BA + TA	30	8%
Tanks	38	10%	BA + SP	15	4%
Sewers	1	<<1%	W + TA	13	3%

Total number of villas: 372

The recorded number of springs associated with villas is very low considering the abundance of springs in Britain. The main reason may be that excavation did not generally extend outside the villa building areas, and probably also because the excavators were not particularly concerned with the water supply problem of villa sites. The number of tanks are also low. The sewer that is indicated at Great Witcombe is queried and I wonder if it was not an elaborate drain referred to as a sewer.

The relatively low number of villa sites (about 5%) where remains of wells have been found compared to the postulated order of 2000 (Scott 1993, 5) seems unrealistic. If the number of villas with wells are compared with nucleated settlements with wells, the difference also seems unrealistic. To what extent there were real differences in many of the farmstead settlements and the minor villas would require special study. One of the reasons why the figure for wells at villas is low relates to the past history of villa excavation, which has concentrated on the main building and its mosaics, and other features. Rarely has extensive excavation been carried out around villas, investigating subsidiary structures, yards and associated features such as wells and aqueducts (Hingley 1989, 55).

Some villas had relatively large bath complexes such as at West Park villa near Rockbourne with 2 baths and 2 wells¹⁶, and Northleigh had 2 baths and 3 wells. At Fishbourne villa (palace) an aqueduct was found (*Britannia* 25, 1994, 289). It is likely that at a number of sites where at present there is no evidence of water supplies, future excavations may discover such features.

¹⁶ *Archaeol. J.* 140, 1983, 129-50.

Figures 5.9 (Rockbourne) and 5.10 (Great Witcombe) show villas with their baths and it is clear that they are much less complex than the larger baths, but they still have some of the main elements of the larger baths such as the *caldarium*, *tepidarium* and the *frigidarium*, and the usual hypocaust. Great Witcombe is a large villa with an original bath complex in the west range dating from c. AD 250-270, and a second more complex bath-suite was added c. AD 270, which lasted till c. AD 400. This bath had a hot water tank which supplied heated water to the hot plunge bath next to it. There are existing springs above the site, which may have been the source of a water supply to the villa during the Roman period. Excavations at Bignor villa, with two bath-suites (Frere 1982) and two fountains have so far revealed no water supply. There appear to be no springs nearby which could have been a source, though any springs that may have existed could have disappeared because of intensive cultivation in the area. At this site there are large areas which have not yet been excavated, so that its water supply may yet be found during the ongoing excavations.

7. SITES WITH COMBINATIONS OF BATHS, AQUEDUCTS AND WELLS.

The relationship between baths and their water supply was an important aspect, but about which there is uncertainty in many cases for all types of sites. Below the implications of associated features at sites are discussed.

7.1.1 Combinations of water-related features at military sites.

The table of Appendix 1 shows that at many sites several different categories of water-related features were found at the same site. Table 6.8 gives a summary of water-related features at forts and shows various combinations of features. There are other groupings, but I have chosen the ones listed below which had a special interrelationship with each other.

More than half the fort sites with baths also had aqueducts, whereas only about one quarter of the forts had both baths and wells. This may suggest that the army preferred to have a running water supply rather than relying on wells. Nearly half the listed forts had aqueducts of one or other kind, which contrast with only 31% with wells and 61% with baths. These figures seem to indicate several anomalies, which are discussed below.

Table 6.8: Combination of water-related features at military sites

Aqueducts (AQ):	66	48%	AQ + BA:	45	33%
Baths (BA):	85	61%	AQ + W:	16	12%
Wells (W):	43	31%	BA + W:	26	19%
Wells only:	26	20%	AQ + BA + W:	14	10%
Pipes (WP):	28	20%	AQ + WP:	27	20%
Tanks (T):	32	23%	AQ + W + WP:	9	7%
			TA + W:	19	14%
			AQ + TA:	23	17%
Total number of forts with water-related features:				137	
Total number of sites with aqueducts:				134	

The probability must be high that most auxiliary forts with baths had running water supplies. Along Hadrian's Wall, the forts at South Shields, Benwell, Halton Chesters (with an elaborate bath), Corbridge, Chesters, Vindolanda, Great Chesters and Birdoswald, all had aqueducts. It would therefore be unusual for the forts at Wallsend, Rudchester, Carrawburgh, Carvoran, Old Carlisle and Bowness-on-Solway also not to have had running water supplies. Housesteads was an exception because of its high elevation. There are indications that the forts on the west coast at Beckfoot and Maryport had aqueducts, but positive evidence is lacking. On the Antonine Wall there are also forts with aqueducts at Inveresk, Mumrills and Balmuildy, but at the forts of Crammond, Falkirk, Rough Castle, Castlecary, Cadder, Bearsden and Duntocher (there is a suggestion of an aqueduct here) only baths have been recorded. Again, why not aqueducts at these sites? The same situation probably prevails at many of the other forts. The lack of consistent distribution of water-related features seems to indicate that fort excavation has generally concentrated on the defences and internal buildings. Structures such as aqueducts in the surrounding areas may therefore in many instances not have been investigated even if their remains are still extant.

Of the 43 listed forts that had wells, 16 (12%) of them were also associated with aqueducts, so that 27 (20%) listed forts had only wells as a means of water supply. The data indicate that about one third of the forts had wells, but, again, since few sites have been extensively excavated, it is likely that many more wells may originally have existed at fort sites. Only 9 forts are recorded in the database with wells not associated with either baths or aqueducts. Nine forts (7%) were associated with aqueducts, wells and

water pipes. The pipes could well have been part of the aqueduct systems. Thirty two (23%) forts had tanks of which 22 (16%) sites were associated with aqueducts and 16 (12%) with wells. Five forts and a fortlet had tanks which were not associated with any other form of listed water supply. This indicates to me that these forts would have had either wells or aqueducts, if not both. Three of these tank sites were associated with baths and therefore strengthens the impression that they should have had water supplies.

Remains of 85 baths were found at forts (61%), but only 45 (33%) sites had both aqueducts and baths. This indicates that 39 of the listed forts had baths without running water. Twenty-two forts had both baths and wells, and only 13 had baths associated with both aqueducts and wells. If the actual bath tubs (*labra*) were not too large then well water supplies would have been adequate. However, forts would usually have had bath complexes that were large enough so that they could provide bathing facilities for anything from about 80 to 500 soldiers, suggesting that baths would have had to be more than mere tubs. At a number of forts, baths were located in the associated *vici*, though no doubt these were used primarily by the soldiers, but perhaps also by the inhabitants of the *vici*. Some *praetoria* would have had bath arrangements for the commander, but these do not seem to have been listed separately as baths at forts. Some of the smaller forts did have internal baths for the soldiers, but they do not seem to have been large and could have had their water supply from wells. However army policy would seem to have favoured running water supplies, especially at fortresses and larger forts with baths.

The 45 sites that had both baths and aqueducts at military sites seem to confirm that aqueducts were the preferred form of water supply, though there are still a large number of sites listed in the database where evidence for both baths and aqueducts is lacking. Wells are poorly represented and this is surprising, because I believe that many more forts would have had them and especially if a site also had a bath.

7.1.2. *Combinations of features at villas.*

Table 6.7 also shows combinations of different water-related structures for villas. Two-thirds of the villas that are recorded to have had aqueducts also had baths, and this may indicate that the baths were quite substantial or the owners of these villas were wealthy. The relatively low figure of 55 sites (18%) with both baths and wells, considering that both features by themselves represented

high numbers for villas, probably indicates the selective excavation of remains.

In the database 24 villas had aqueducts of which 16 had baths associated with them. Nineteen settlements are listed as having had aqueducts, but only 4 are associated with baths. By contrast, I have found only 8 listed small towns with aqueducts and 5 associated with baths. I discuss the implication of this anomalous situation for the settlements and small towns below.

7.3. Analysis of combinations of water-related features.

For the seven site types Table 6.2 shows the number of sites with the eight typographical features recorded in the database and also combinations of these. Some of the combinations do not have particular interest, however the combinations of aqueducts and baths, wells with baths and aqueducts with wells or the combination of three structural types are significant, because they suggest some anomalies in the archaeological record. What also is of interest are the numbers of sites which do not have any of the above mentioned combinations by calculating the difference between the total number of sites of a particular feature and a combination of two feature types. The difference will give the number of sites with the chosen feature.

Table 6.9 shows a summary of some of these combinations and also other associations.

Table 6.9: Summary of associations of water-related features

	Forts	Colo- niae	Munici- pia	Civitas capitals	Small towns	Settle- ments	Villas
AQ + BA	45	3	1	10	5	4	16
AQ + W	16	4	1	7	2	2	5
AQ + TA	23	2	-	5	1	2	9
AQ + WP	27	3	1	5	-	1	10
BA + W	26	3	2	9	18	10	55
BA + TA	24	2	-	6	3	4	30
W + TA	19	2	-	4	7	9	13
AQ+BA+W	14	3	1	7	3	2	3
AQ+WP+W	9	3	1	4	-	-	2

The combinations of features are particularly clear for forts and villas, but is applicable for all the data. For instance, using the data from Tables 6.2 and 6.9 for forts, and calculating differences

by taking associations of two features at a time from amongst aqueducts, baths and wells, and subtracting the number of sites with that combination from the total number sites of each type, will give the number of sites with each feature. There are 6 permutations for the three features:

- (1) $AQ_{total} - (AQ+BA) = AQ_{only}$, i.e. $66 - 45 = 21$, and
 $BA_{total} - (BA+AQ) = BA_{only}$, i.e. $85 - 45 = 40$;
(2) $BA_{total} - (BA+W) = BA_{only}$, i.e. $85 - 26 = 59$, and
 $W_{total} - (W+BA) = W_{only}$, i.e. $43 - 26 = 17$;
(3) $AQ_{total} - (AQ+W) = AQ_{only}$, i.e. $66 - 16 = 50$, and
 $W_{total} - (W+AQ) = W_{only}$, i.e. $43 - 16 = 27$.

The same calculations can be made for the villa data, for example, for features of aqueducts and baths, the following information is given:

$$24_{AQ \text{ total}} - 16_{AQ+BA} = 8_{AQ \text{ only}}, \text{ and } 305_{BA \text{ total}} - 16_{AQ+BA} = 289_{BA \text{ only}}.$$

In summary, Table 6.10 for forts and villas shows the differences between the associations and the totals for aqueducts, baths and wells. The last column shows the totals of each type of structure. The associations for the other sites are not as significant as for forts and villas.

There are other associations, such as combinations of all three features, that is $AQ+BA+W = 14$ in the case of forts. The calculations will be similar to those for only three associations, so that the number of forts with AQ_{only} , BA_{only} and W_{only} will be 52, 74 and 29 respectively.

Table 6.10: Number of fort and villa sites with aqueducts, baths and wells only.

	(1)		(2)		(3)		Totals	
Forts:	AQ_{only}	21	BA_{only}	59	AQ_{only}	50	AQ_{total}	66
	BA_{only}	40	W_{only}	17	W_{only}	27	BA_{total}	85
							W_{total}	43
Villas:	AQ_{only}	8	BA_{only}	250	AQ_{only}	19	AQ_{total}	24
	BA_{only}	289	W_{only}	49	W_{only}	300	BA_{total}	305
							W_{total}	104

Tables 6.9 and 6.10 show that there are anomalies in the excavated data for forts and villas, and would also apply to the other site

types, but not sufficient data is available for them to make this type of analysis meaningful. For forts the figures indicate to me that there is information missing in the record I traced, because it is unusual that in group (1) 45 sites should have had both aqueducts and baths, but 21 sites had only aqueducts out of the total of 66. Similarly, 40 sites had baths only while there were 66 aqueducts and 85 baths recorded. The same questions are applicable to group (2): 26 sites were recorded as having had both baths and wells, yet out of the 85 baths and 43 wells recorded, 59 had baths only, and 17 had wells only. For group (3): 16 sites had both aqueducts and wells, but only 50 sites had aqueducts and 27 had only wells. Although this analysis is based only on the sites I traced, it shows the biased nature of the data. Of the 137 military sites recorded in the database, at 71 no aqueducts were found and at 94 no wells were found, indicating that at more than half the military sites no water supply had been found. There is clearly data missing, even if it is argued that for some of the sites water could be obtained from a spring or stream. At only 10 forts were springs recorded. It would have been out of character for military sites not to have had provision for some specific water supply. These 137 military sites represent only about half the known number of sites, which would imply that only about a quarter of the known sites had aqueducts and about one third had baths. This seems doubtful, but difficult to prove in the absence of archaeological evidence.

The information for villas in Table 6.10 also shows that there is a lack of data in the archaeological record which can be due to some of the reasons given in section 2.2. Of the 305 villas sites where baths were recorded 289 sites were not associated with aqueducts and 250 were not associated with wells. Also, $182 \{305 - (104+19)\}$ were not associated with both aqueducts and wells, which shows that more than half the villas listed in the database had no water supply, unless they all were supplied by springs, which are then also grossly underrepresented in the database.

This type of analysis can be done for all the other types of sites, but they will not be as obviously significant because of the small numbers involved. Clearly the record, based on the available information, indicates that there are many anomalous gaps in the record, which needs to be investigated further.

A discussion of the geographical distribution of water-related features follows.

8. AQUEDUCTS

The data indicate that aqueduct water supplies to military sites in Britain were common (48% of my sample), indicating a rational military planning approach to water supply for forts. Forty-five of the listed 66 forts with aqueducts were located in the northern half of Roman Britain (Fig.6.1), where much of the army was deployed especially from the early second century AD onwards. The highest concentration was associated with Hadrian's Wall. The remaining military sites with aqueducts were all located south of Hadrian's Wall. The other types of sites with aqueducts were geographically mainly concentrated south of the military zone. A possible conclusion is that aqueducts were rare in the initial phases of the conquest, and much more common in the long-term military deployment, and at civil settlements during the century after the conquest.

Where aqueducts formed part of the water supply system of fortresses and forts, they would have been constructed soon after the sites became fully operational. A number of these would date from the Agricolan period during the later first century, but those along Hadrian's Wall would have been constructed between c.AD 122-38, such as the aqueducts at Chesters, Great Chesters and Halton Chesters. The chronology of the fort at Vindolanda is fairly well attested because of the numerous writing tablets that have been recovered in the last two decades. The first timber fort at Vindolanda appears to have been constructed c. AD 85, and rebuilt twice in timber from about AD 95 to 102. When Hadrian's Wall was started the fort was again rebuilt (c.AD 122-30) and was capable of housing 1,000 men. It may have been during this period that the stone channel aqueduct to the fort was constructed (Birley 1931, 188; Hodgson 1840, 195), but there is no firm evidence to confirm this date. During the early AD 140s the first stone fort was constructed on the same site, but it was smaller than its predecessors. A probable reason why the forts were reconstructed so often was that the wood did not last for more than about 10 to 20 years. Around AD 220 the fort was rebuilt for the last time, which is the remains that are now visible. It seems that at this time a civilian population also grew up outside the western wall and a *mansio* with a bath was also constructed, which obtained water from a tank at the terminal end of the aqueduct and from a well near the tank.

Aqueducts were found at 16 (of the major town sites out of the 20 listed (4 *coloniae*, 2 *municipi* and 14 *civitas* capitals), which with the 66 at forts, accounts for 61% of the total number of sites where they were found. The proportion of sites with aqueducts at all the known forts (341) and major towns (20) amounts to 22.7%. As mentioned above (p.225), it is considered that many more forts would probably have had running water supplies, so that the 22.7% proportion at both forts and major towns underestimates the likely real situation.

In contrast to forts and major towns, comparatively few small towns, settlements and villas have been listed as having had running water supplies, representing only 8% for all those site types (650) in the database.

The small number of only 8 small towns with aqueduct remains (Fig.6.3) is low considering that 30 sites had baths. Of the 97 listed small towns (Burnham 1986, 187), 8 had aqueducts and 52 had wells, of which only two were recorded as having had both. A number of small towns had *mansiones* for which well water supplies would have been adequate, as is suggested by the 18 sites at which both wells and baths are recorded whereas only 5 sites had both aqueducts and baths.

Settlements also had a low number of aqueducts (20), but that is to be expected. I have not included aqueducts for agricultural purposes.

The 24 villas (6.5%) that had aqueducts also indicate a low proportion and that aqueducts were not the normal form of water supply to villas, since only 6.5% of the 372 listed villas had them. It is likely that only the more prosperous owners would have gone to that expense. However, whether the low figure represent the real number of villas that would have had running water supplies is uncertain. Many villas may have been sited to exploit localized spring sources, requiring only minor constructions to canalise them and thus leaving little or no trace archaeologically.

To what extent private home owners in Romano-British times had access to running water supply is not well established. The most common water supply to private establishments is wells as is found at Caerwent, London and Silchester. Even at towns which had aqueduct water supplies as at Dorchester and Wroxeter, wells have been found at private homes.

As elsewhere in the Empire, running water supplies appear to have been limited to only a small number of the richest houses.¹⁷ I have found only 22 sites with running water supply to private establishments for Roman Britain, for example such as at the villas of Woodchester (Clarke 1982, 216-7) and Fishbourne. In the detailed excavation report on the houses in Roman Cirencester there is no comment on water supply for the houses investigated (McWhirr 1986). The house or villa at Colliton Park in Dorchester probably had a running water supply, presumably coming from the distribution conduit branching from the Dorchester aqueduct, and it also had a well.¹⁸ Many rural sites in Britain were probably privately owned, like the villas and farming settlements along the Lower Nene valley river system (Jones & Mattingly 1990, 248, Map 7.13), which would not generally have had aqueduct water supplies.

9. BATHS.

Baths were the most common single type of water-related structure in Roman Britain (and also one of the most archaeologically visible), representing 60.3% of the total number of recorded sites in the database. Not unexpectedly 62% of military sites had baths, and a quite staggering 82% of villas had them.

The distribution of the 85 fort sites with baths is grouped in three regions: the Scottish region north of the Tyne-Solway isthmus, a band in the frontier zone concentrated around Hadrian's Wall, and the remaining sites spread widely south of this zone.

Thirty of the 66 small towns listed in the database had baths, and it is likely that most of the others had baths too. Only 5 of the sites with baths are associated with aqueducts, whereas 18 sites had both baths and wells, which seems to confirm that wells were the more commonly utilized water supply. Except for Corbridge, all the small towns with baths, wells or aqueducts were situated below the Humber-North Wales axis.

Eighteen villa sites in the database indicate two baths and three sites, Grimstead, Littlecote Park and Northleigh, had three baths

17 For example at Rome and Pompeii, and Ptolemais in Libya (Ward-Perkins 1986, 109-53) and Volubilis in West North Africa (Wilson 1995, 52-6). Wilson comments on the importance of social status that provision of running water supply brings to owners of houses.

18 *RCHM* 1970, 534, 587, (533-89). The report of the villa excavations (1961-3) does not mention any aspect of the water supply of the villa. Not even the well (*Pro. of the Dorset Nat. Hist. & Archaeo. Soc.*, 1982, Vol.104, 'Excavations on the Library Site, Colliton Park, Dorchester, 1961-3', by G & N Aitken).

each, though at none of these have any form of running water supply been found. At Grimstead the only water-related structures recorded are the three baths, whereas both Littlecote Park and Northleigh had in addition three wells each.

10. WELLS

Some aspects of the problem of wells at forts have already been referred to in relation to associations with aqueducts and baths. Many forts had at least one well in the *praetorium*, but it hardly seems possible that it would have supplied all the water required for the establishments of 500 and 1000 soldiers. At 18 of the 43 forts where wells have been found more than one well has been recorded: 4 had 2 wells, 3 had 3 wells, and 5 records merely show more than one well. The fort at Templeborough had 5 wells, and Derby and the Lunt each had 6 wells, while Newstead had a record 107 wells/pits already discussed. The *coloniae* had wells which may have been dug when they were still fortresses. The 43 fort sites where wells have been found underestimate the number of forts which would have had wells.

Wells were found at all four *coloniae* and the two *municipia*, and at 10 of the *civitas* capitals, and the implications associated with their water supplies have been discussed above. For the *civitas* capitals 7 out of the 14 sites had aqueducts associated with wells and 9 sites with wells were associated with baths. At some of the *civitas* capitals very few wells were found in contrast to those at Caerwent (16), Silchester (76) and Wroxeter (17). There are several reasons why wells may not have been found, such as unsuitable geology and therefore the hydrology of the site, hence a greater reliance on aqueducts, springs, river water and rainwater. Usually wells were of a sufficient depth that they would have been difficult to destroy completely by human activity other than quarrying, so that remains of many wells still remain to be discovered.

Table 6.2 shows that wells were the most important form of water source at small towns (52), settlements (135) and villas (104), and this trend would likely be even more pronounced if more data at sites on wells were available. Aqueducts clearly were not the preferred water supply for villas, indicated by only 24 sites that had them whereas 104 (28%) wells were found, but even this is unrepresentative for the large number of known villa sites. Many villas with wells seem to lie in a broad band along the Jurassic Ridge from the East Midlands to the Gloucester/Cirencester area (Fig.6.15). Whether there

is any specific significance in this distribution is not clear, other than that limestone deposits are often water-bearing because of their fissured nature. But the spread of other villas indicates that there are other environments, and other factors which must have determined their localities. Comparing the distribution of the 305 baths listed (Fig.6.10) with that of wells, the spread of sites is more even and more dense south-east of the Severn River/East Midlands axis. The distribution of all villas would be much more densely spread if the assumption is made that many more sites would have had wells and baths, which seems to be confirmed by the data of Table 6.10 for the limited sample of sites in the database. There were 182 villas with baths which were not associated with either wells or aqueducts. It seems to me that there were many sites that had both baths and wells but they have not been found for any one of the reasons given in section 2.2. Springs may have been an important source of water for many villas, but they have also not been recorded, and the conduits linking them have disappeared.

The distributions of sites with wells for forts, small towns and settlements (Figs.6.11, 6.13, 6.14) also indicate that they were topographically uniformly distributed over Britain when compared with the distribution of all sites for Roman Britain. Comparing Fig.6.11 with Fig.12 (Millet, 1990, 47) for forts and Fig.6.13 with Fig.6.1 (Millet, 1990, 143) for small towns, indicate that these sites with wells were also uniformly spread over the landscape, so that it would be reasonable to assume that many of the other sites were also likely to have had wells. This also applies to the *civitas* capitals. The distribution of Romano-British settlements is uniformly spread over the whole of Britain and Fig.6.14 showing settlements with wells match this uniform spread. So it is reasonable to say that many of the sites where no water supply has been found are very likely to have had wells but they remain undiscovered.

11. WATER PIPES

Considering the total number of sites listed in the database, the 84 sites listed with water pipes is very low. Water pipes were associated with aqueducts and distribution systems within forts and towns, and are also found at settlements and villas. The materials for pipes (see Chapter 2.5.5 and 1c-f p.30) were wood, lead, ceramics and stone. Stone pipes were not used in Britain, presumably because of cost and the skill required to manufacture them. Ceramic pipes were used as aqueducts at Chester, Lincoln and Netherby, and were

also found at Bath, Chichester, Inchtuthill, and Newstead. Evidence of lead pipes were found at 7 sites and lead would appear to have been used to repair other forms of pipes. Lead pipes were most commonly used in inverted siphons (but apparently not in Britain) and often encased in concrete, probably because they could be hermetically sealed (difficult to accomplish with other forms of piping), which was important for pipes forming a pressure system. It was also an expensive material to use and costly to manufacture pipes. Lead pipelines are reported for Beaufort Red House, Carpow, Chester, Hardknot Castle and Winchester, and for internal distribution at Caerleon, Chester and York (Stephens 1985b, 223-9).

Wood was the most common form of pipe, partly because it was readily available and relatively cheap. To bore out lengths of wood 1m to 3m long must have been quite an art, because the drill bits are inclined to wander off-line during the process. At several sites in the record it is mentioned that a stone channel carried a wooden pipe aqueduct. Stephens lists 20 sites where wooden pipes were used either as aqueducts or in the internal distribution systems (1985a, 198-202; 1985b, 222-30). He listed only pipes at towns and forts, whereas pipes have also been found at 3 small towns, 8 settlements and 34 villas.

Distribution water pipes must have been one of the most vulnerable features on all types of ancient sites because of the continuous phases of reconstruction of structures along street fronts where piping existed. Wooden pipes would generally have had a limited service life before they needed replacement and evidence has been found of repairs to wooden pipes, as at Caerwent (Chapter 2, p.26). Lead piping would have been robbed for its material value. Later development would also have removed traces of piping, hence the comparative lack of evidence of internal distribution pipes. Where they do occur they suggest that a running water supply existed, but it has been difficult to associate some of these distribution systems at sites that also had aqueducts. At Wroxeter where distribution pipes have been found and it is known that the town had an aqueduct, it has not so far been possible to directly link the two systems.

12. TANKS AND CISTERNS

The terms cistern and tank do not seem to be used consistently in the literature. Hodge defines a cistern as a masonry tank used to store rainwater either from roofs or from surface run-off. However tanks

were also constructed of wood (Beauport Park and West Wickham), and wood-lined (Chichester and Littlecote Park), and in lead (Ashton and Icklingham), and at Gatcombe a metal-lined tank was found. Tanks for rooftop catchment (and wells) may have been used predominantly to store drinking water. They were built above ground level or immediately below and were usually either round or oblong, fed from the top (1992, 58). In Roman Britain tanks were as a rule above ground level both at forts and elsewhere, however some sunken tanks have been reported, such as at Lyne.

At Colchester five tanks have been found, two clay-lined tanks were at private dwellings outside the Balcerne Gate (Report 3, 1984, 141-2), and three are reported at building sites inside the *colonia* in Report 6 (1989): a timber-lined tank (89-90, Fig.3.48), a tile-lined tank (89, Fig.347, 255), and a lead-lined tank (355-6). This variety of tanks at one site is unusual. Figure 4.8 shows a timber-lined water tank from London.

Tanks cannot really be regarded as primary water supply sources, except perhaps those in some of the minor forts and milecastles on Hadrian's Wall and poorer class housing, where the volume of water demand was comparatively small. However some tanks have been found that were at the terminal end of a running water supply, such as the very large tank at the North Wall Gate of the Lincoln upper *colonia*. At Housesteads fort, five tanks were found of which one was a well preserved large tank associated with the latrine at the south-east angle. Roof-top runoff was probably a major means of filling the tanks. The fort at the Lunt had 15 tanks of which some were probably filled from rooftops for drinking water supply.

The more simply constructed tanks in Britain where they were at the terminal end of an aqueduct, served the same function as the *castellae* of towns in Gaul, Italy, Spain and North Africa. However their relatively small capacities did not allow for back-up storage if an aqueduct was damaged or out of service.

Tanks used as catchment for rainwater were probably more common than the archaeological record indicates because excavators cannot always be sure whether a tank near a building received its water from a rooftop. Although 102 sites with tanks have been listed in the database, 70 of them were at forts(32) and villas(38), the remaining 32 were divided amongst all the other site types, they are under-

represented in the record. Daily availability of water must have been an absolute necessity at forts, certainly for drinking and cooking purposes, so that the lack of evidence of more fort sites with tanks indicates a problem of tank survival. Similarly, of 212 settlement sites recorded in the database only 16 had tanks, with no obvious indication from the evidence that the less Romanized sites such as farmsteads and minor villas had tanks. This may be due to insufficient site exploration or poor preservation of tanks at these sites. However it cannot be ruled out that stored water in tanks may have been a normal source for the smaller settlements and villas. Before the construction of structures in stone became the accepted construction material in Roman Britain it is likely that water was stored in clay-lined pits or in some form of ceramic container. Wooden barrels could also have been used extensively as water butts, but would normally leave no traces in the archaeological record.

13. DRAINS AND SEWERS

Drains in towns can be broadly classed as street drains and drains which removed water and waste products from domestic properties. However at some sites drains are shown to cut across a plan of a site, which is interpreted as belonging to an earlier phase of the site. Remains of drains have been found at most site types. They were used for the control of run-off from buildings, squares and roads, and excess overflow from fountains, waste water from baths and often from latrines, especially where no sewers existed for that purpose, and from domestic waste water outlets. Whether they were called drains or sewers depends largely on how the excavator defined drains. Generally a drain would be used to remove surface water at ground level. Drains from homes, baths and latrines often were channels covered with stone slabs, and they often discharged directly into street drains¹⁹. This is an indication of a lack of understanding of basic hygiene principles as we understand them, which is surprising considering the desire to bath regularly and to have clean water from spring sources.

Drains were recorded at 179 sites. Remains of drains are usually found in association with baths and latrines, and between barracks in forts. In towns, drains sometimes were in the centre or along the sides of streets. Forts would have had a network of drains, especially at Chesters which also housed a cavalry unit.

19 Etienne 1960, pl.II; Adam 1984, 262, pls.612, 613).

Sometimes drains were stone-lined and covered with slabs, especially along town streets and in forts; plank-lined drains have been found at London, Melandra, Strageath and Verulamium. At Corbridge the remains of elaborate stone channel drains were found along both sides of Dere Street, and the Stanegate running through the town. When drains were along the centre of streets they were sometimes provided with a kind of stone grating with openings cut into a paving slab so that water can flow directly into the drain below. A number of such gratings have been found, examples of which are shown by Hodge, including a grating slab from Housesteads (Hodge 1992, 342, Fig.238). It is likely that most of the sites where drains have not been recorded, had some form of drains but they have not been found or shown on plans, most probably because they are no longer visible.

Roman sewers were generally major structures and have been traced at 20 sites. They are recorded as having been found at most of the site types, but sometimes it is not clear whether the excavator actually referred to the major sewer type of arched structures, such as found at Caerleon, Chester, Lincoln, Verulamium or York, or to large open drains. For instance at Great Witcombe villa a sewer is mentioned, but it is probably a large drain. Hanson (1970, 254) refers to the "stone-built latrine trench or sewer, 3 feet (0.9m) wide by 2.5 feet (0.75m) deep" at Housesteads. This is an open drain and not a conventional sewer. Sewers were usually closed structures, but this is not always clear from reports.

Dating construction of sewers in towns is a problem, because they were often cleaned out, so that datable finds of pottery or coins may not necessarily reflect the earliest deposits in the sewers closer to the time when they were constructed. The sewers at Caerleon, Chester, Colchester, Lincoln and York were major underground arched stone structures large enough for them to be inspected and cleaned out by maintenance workers. At York, the remains of an elaborate main sewer system with minor sewers along side streets received run-off water and sewage from side drains, presumed to be house drains, which in turn discharged into a main sewer as shown in Fig.5.12 (Whitwell 1976, 4-5, Figs. 2 & 3). The plan (Whitwell, 1976, Fig.3) shows the main sewer (which was high enough for a person to walk through) and its branch lines. The sewer system, probably constructed during the early part of the 2nd century, was modified by AD 170, because of problems associated with flooding of the River Foss, into which it is suggested the outfall of the sewer is likely to have discharged

(Whitwell 1976, 23-5). Branches 2 and 6 of the sewer may have formed part of the draining system of the baths about 40m south of the main sewer.

The remains of the main sewer at Lincoln now lie buried below the present Bailgate, (Wright 1852, 235-6). Plans of the sewer system usually show two branch sewers running into the main sewer (see Fig.6.19) and one sewer parallel to the main sewer along a street to the east of Ermine Street. Figure 6.22 shows a sketch T. Wright made of the sewer and the linking sewers from cross-streets (Whitwell, 1970, 33, Fig.2). Lincoln became a *colonia* during Domitian's reign (AD 81-96), so it is likely that the sewers may have been constructed during this period or early during the 2nd century. The distribution of these sewers in the town implies that the running water supply at Lincoln was able to provide sufficient water to flush the sewers. Atkinson (1942) refers to the 'main sewer' at Wroxeter, and so do reports in *Britannia* (8, 1977, 323-4, 394-6; 10, 1979, 297-8). I have not been able to establish whether it was similar to the ones at Lincoln and York, or whether the reference is to the large open drain along Watling Street through the town between the forum and baths *insulae*.

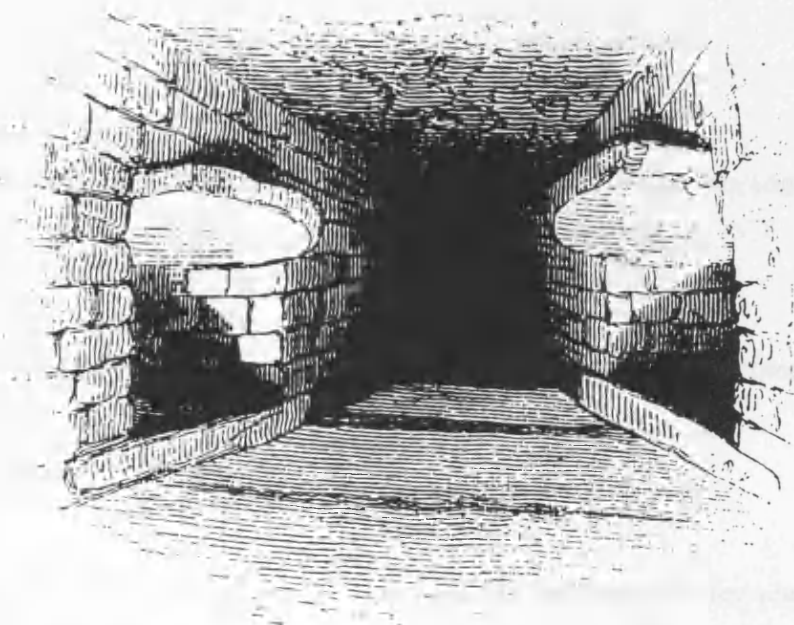


Fig. 6.22: Sketch of Lincoln main sewer (after Whitwell 1970, 33, Fig. 2, from original by T. Wright 1852).

A probable reason could be that some sites were occupied initially for short periods before a start could be made on such large construction works, or that when the later forts were built the inclination to build such costly structures seemed less necessary. Why so few *civitas* capitals had sewers is also puzzling. The four sites listed all had military origins, which probably accounts for them having had sewers. Cost may also have been a factor for not building them as their funding would have had to come from the inhabitants of the towns, and sewers did not really contribute to the status of the community or town.

It is not clear to me whether the drainage channel from the spring reservoir at Bath was a sewer or an elaborate drain. Cunliffe does not refer to a sewer, but refers to a "permanent main drain from the spring" which was arched (1985, 39), and drained into the main outfall drain (p.53). Its main function seems to have been to dispose of large volumes of water from the springs. Similarly, the reported sewer at the Great Witcombe villa was most likely a major drain rather than a conventional sewer.

Table 6.11 gives a summary of the listed sewer sites.

Table 6.11: List of sewer sites

- Fortresses:** Caerleon, Chester, Exeter, Malton, York.
- Forts:** Chester-le-Street, Dover, Housesteads, Piercebridge, Vindolanda, Lyne.
- Coloniae:** Colchester, Lincoln.
- Municipium:** Verulamium.
- Civitas capitals:** Canterbury, Chichester, Leicester, Wroxeter.
- Small town:** Bath.
- Villa:** Great Witcombe.

The sewers were always large stone-built arched structures at some of the military sites and *coloniae*, but there seem to be some uncertainty about the so-called sewers at other sites, which needs to be investigated (Chapter 5, sect. 3.2).

14. CONCLUSION

The distribution of water-related features implies that many more sites with aqueducts, wells, baths and the other features are still to be found. The record also indicates that many sites have been found with some features but that associated features are missing, such as baths without a water supply. It is also shown from the limited sample of sites listed in the database that the favoured means of water supply for forts and *coloniae* were aqueducts. Wells were the preferred water supply at small towns, settlements and villas, although they were also found at many military sites and major towns. In some towns such as London and Silchester wells appear to have been the only form of water supply. Springs may have been more widely used as water sources at all types of sites than indicated by the record. Baths were found at sites of all types, though they appear to be underrepresented at forts, small towns and settlements, and even at villas where many sites have been found with baths, they are few compared to the known number of villas. Evidence seems to indicate that water catchment from rooftops may have been common, implying that roofs must have had gutters. Tanks were a simple and effective way of storing water, so that the low number of sites recorded with tanks seems to be unrepresentative. Water pipes at many sites indicate their wide use, but they are underrepresented in the record. Drains are also poorly represented at all sites considering the importance attached to the control of rain water and effluent. Sewers were specialized structures, mainly constructed at military sites and the larger towns.

Dating of structures has been difficult because of lack of information. Some structures, especially at military sites can be dated related to military deployment and a few inscriptions.

The main conclusion is that there are serious gaps in the knowledge relating to water-related structures.

Distribution of Aqueducts: Figs. 6.1-6.5, 239-243.

Distribution of Baths: Figs. 6.6-6.10, 244-248.

Distribution of Wells: Figs, 6.11-6.15, 249-253.

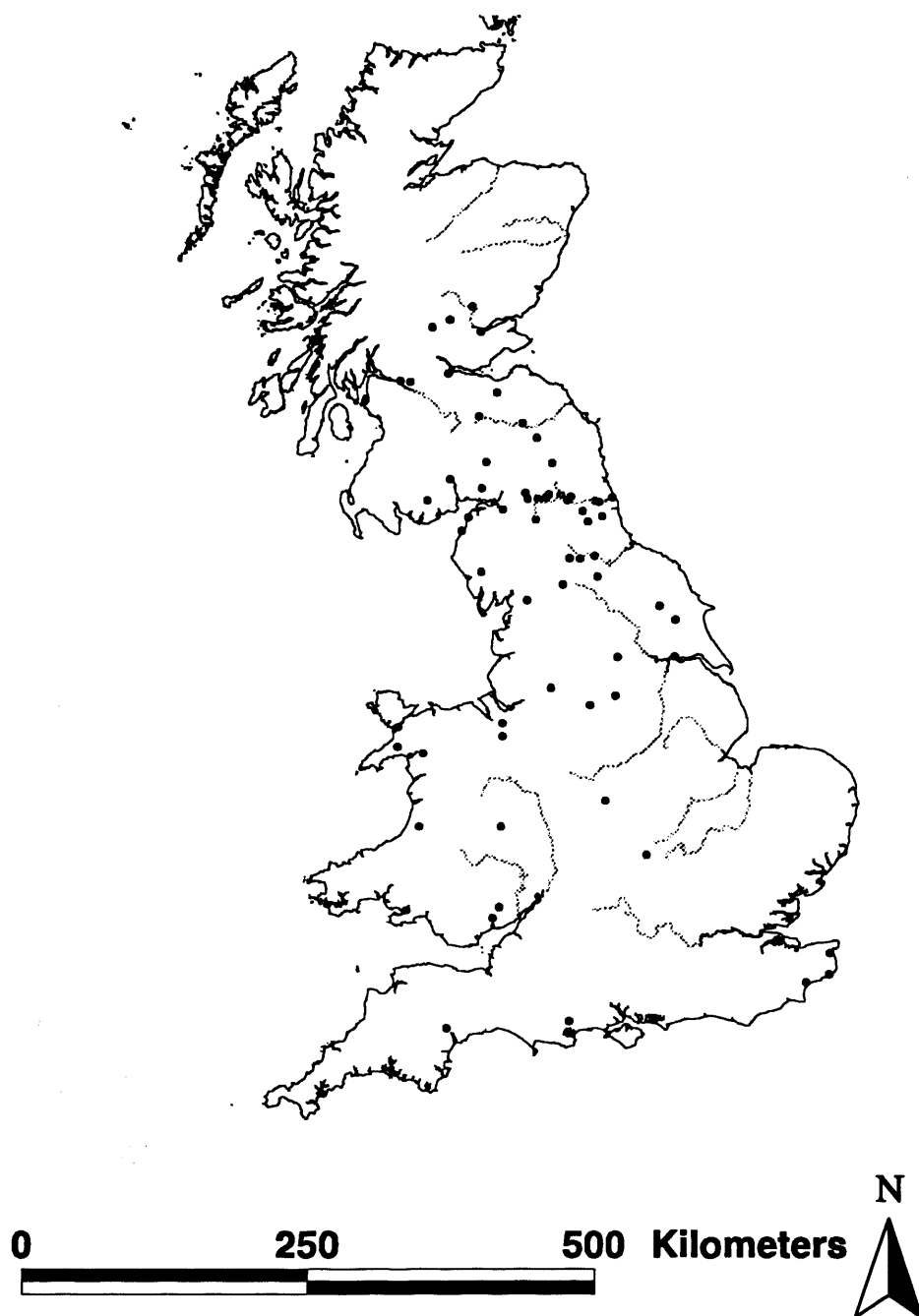


Fig. 6.1: Fortresses and forts with aqueducts

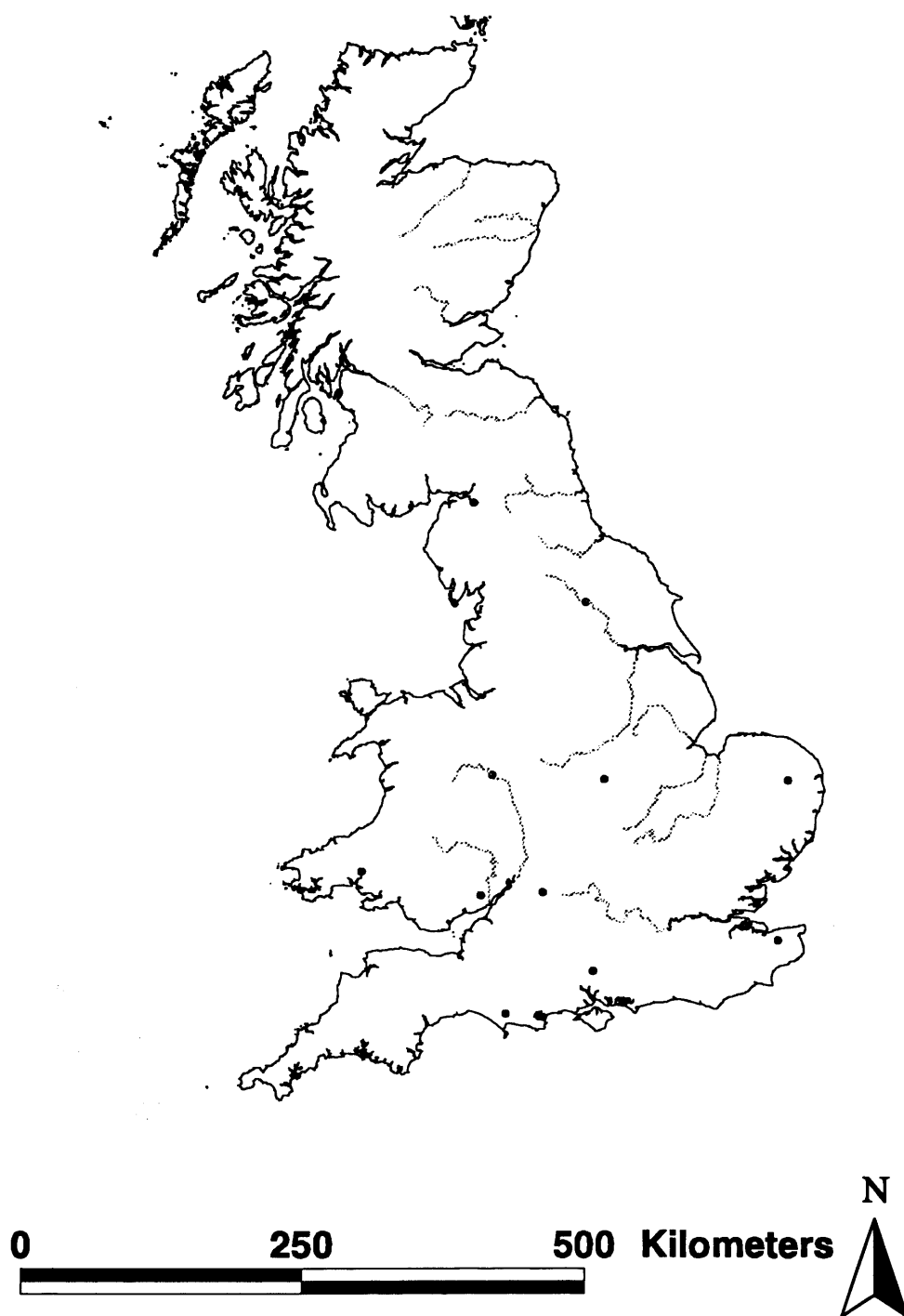


Fig. 6.2: *Civitas* capitals with aqueducts

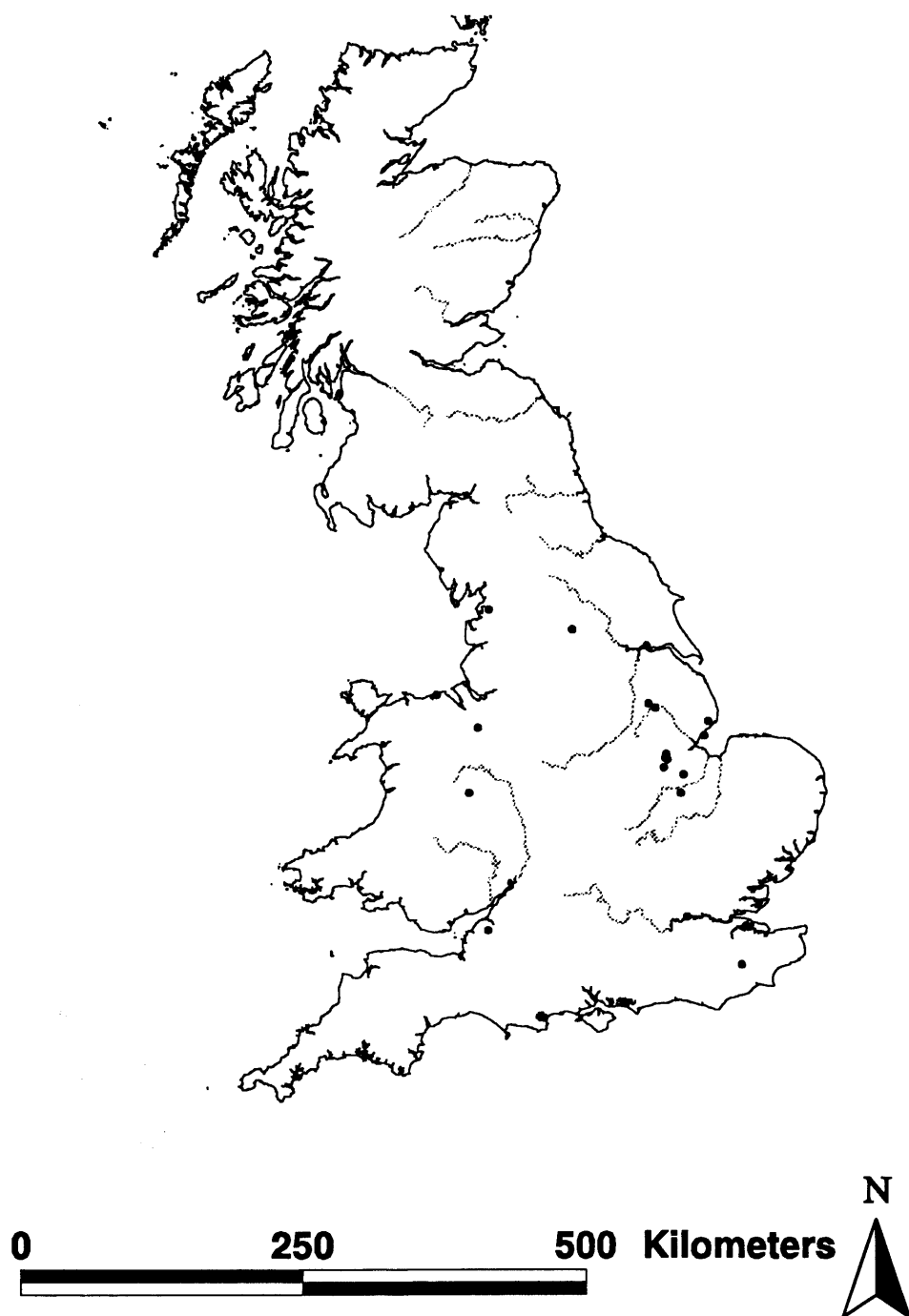


Fig.6.3: Small towns with aqueducts

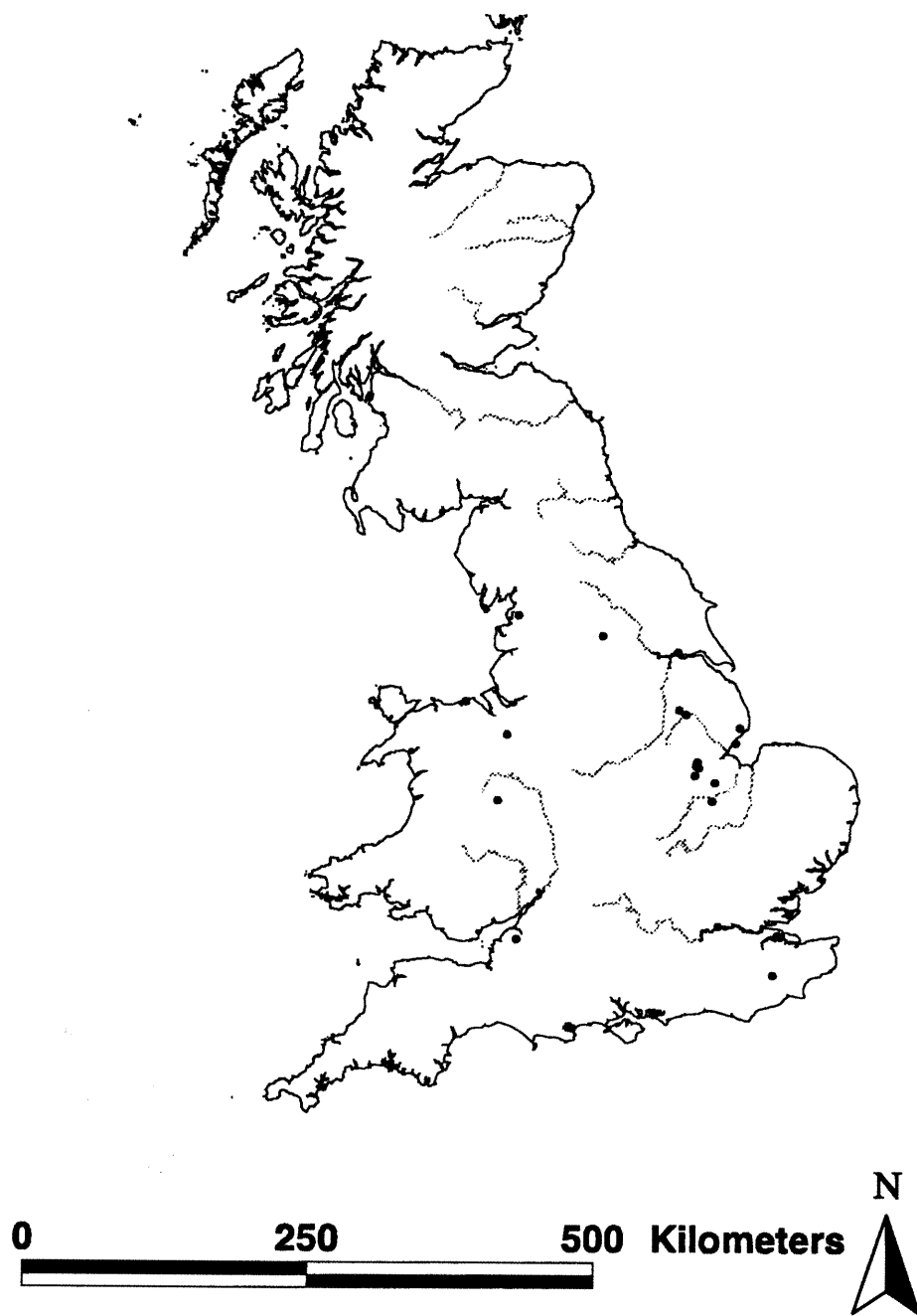


Fig. 6.4: Settlements with aqueducts

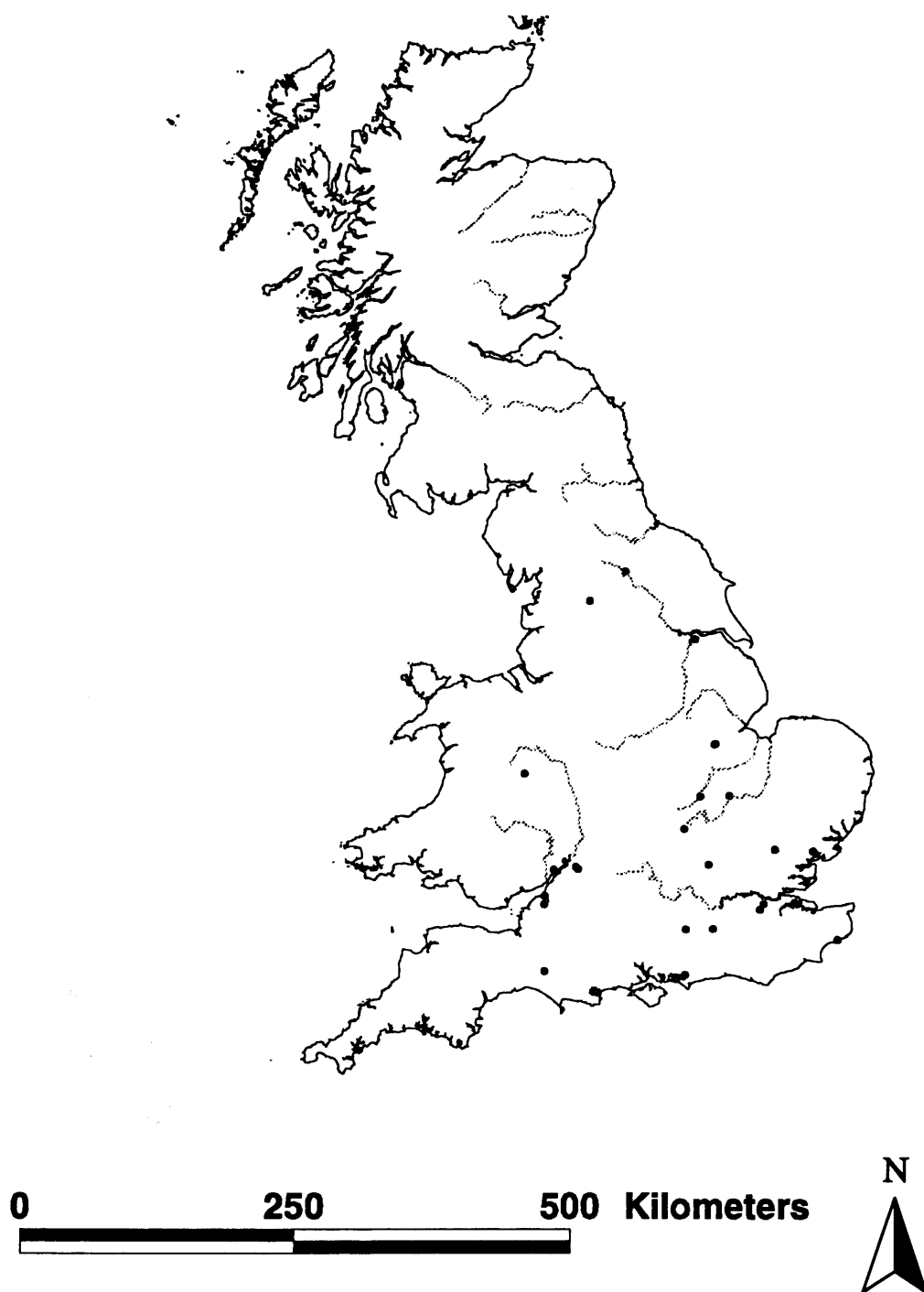


Fig.6.5: Villas with aqueducts

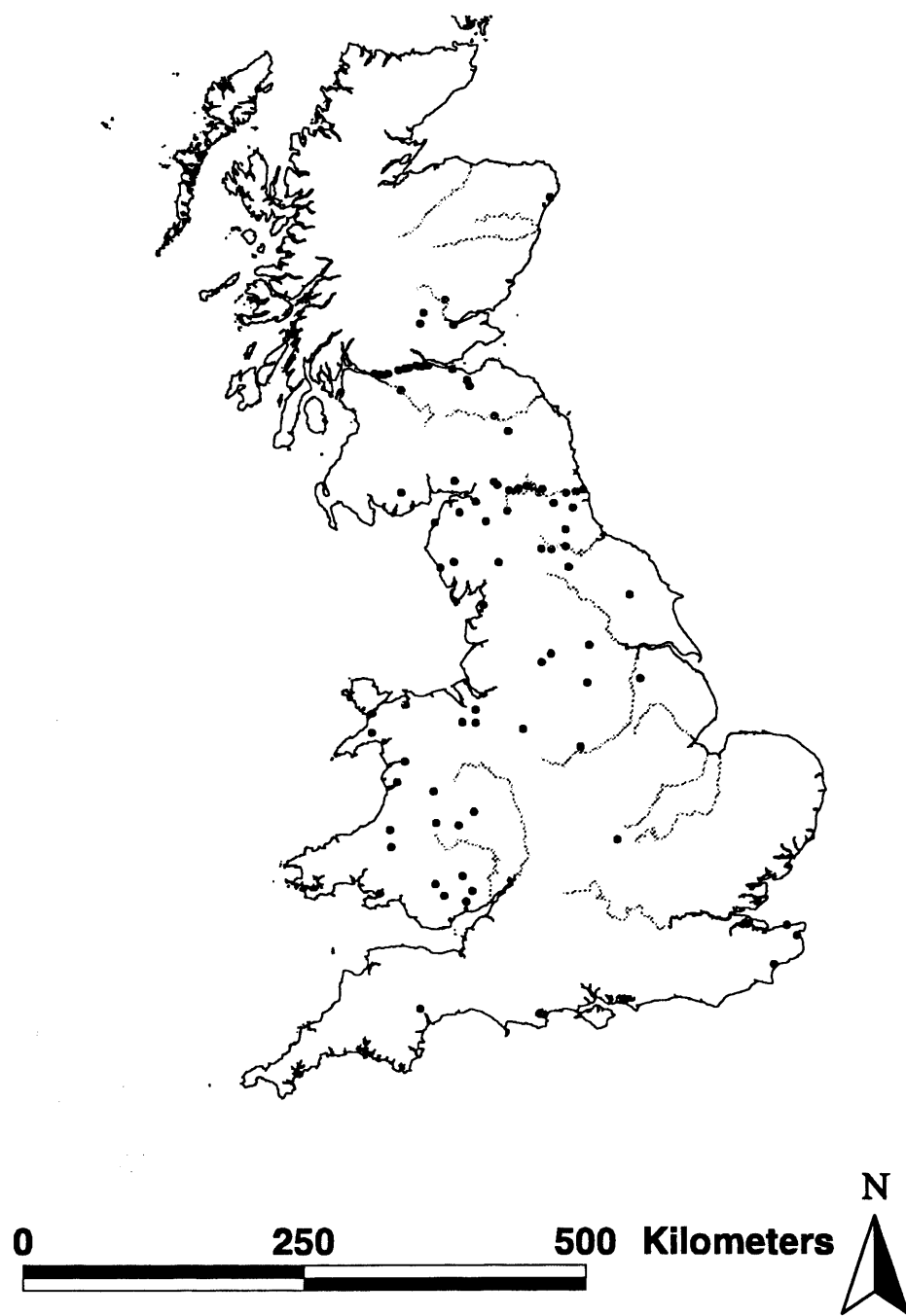


Fig. 6.6: Fortresses and forts with baths

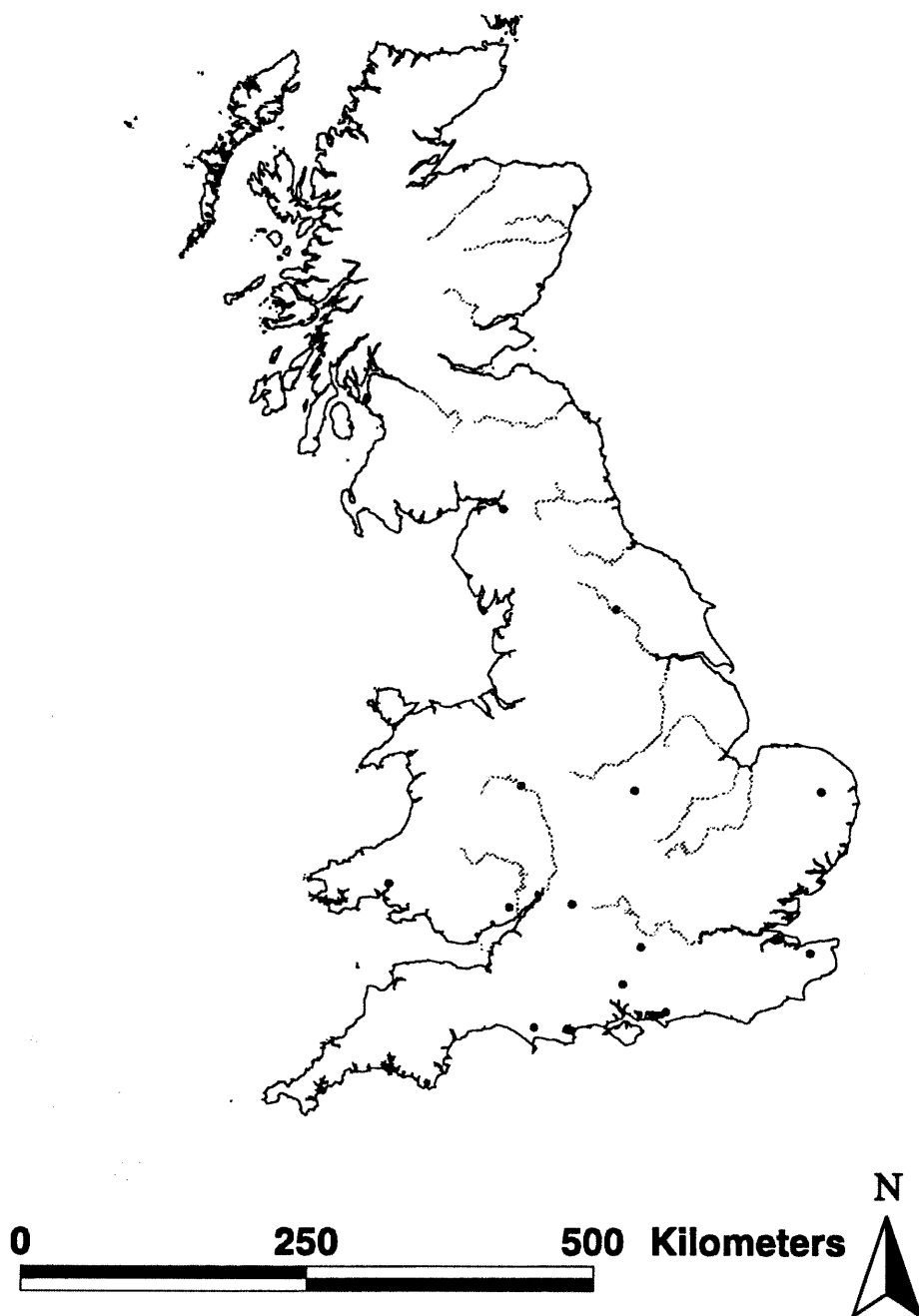


Fig. 6.7: *Civitas* capitals with baths

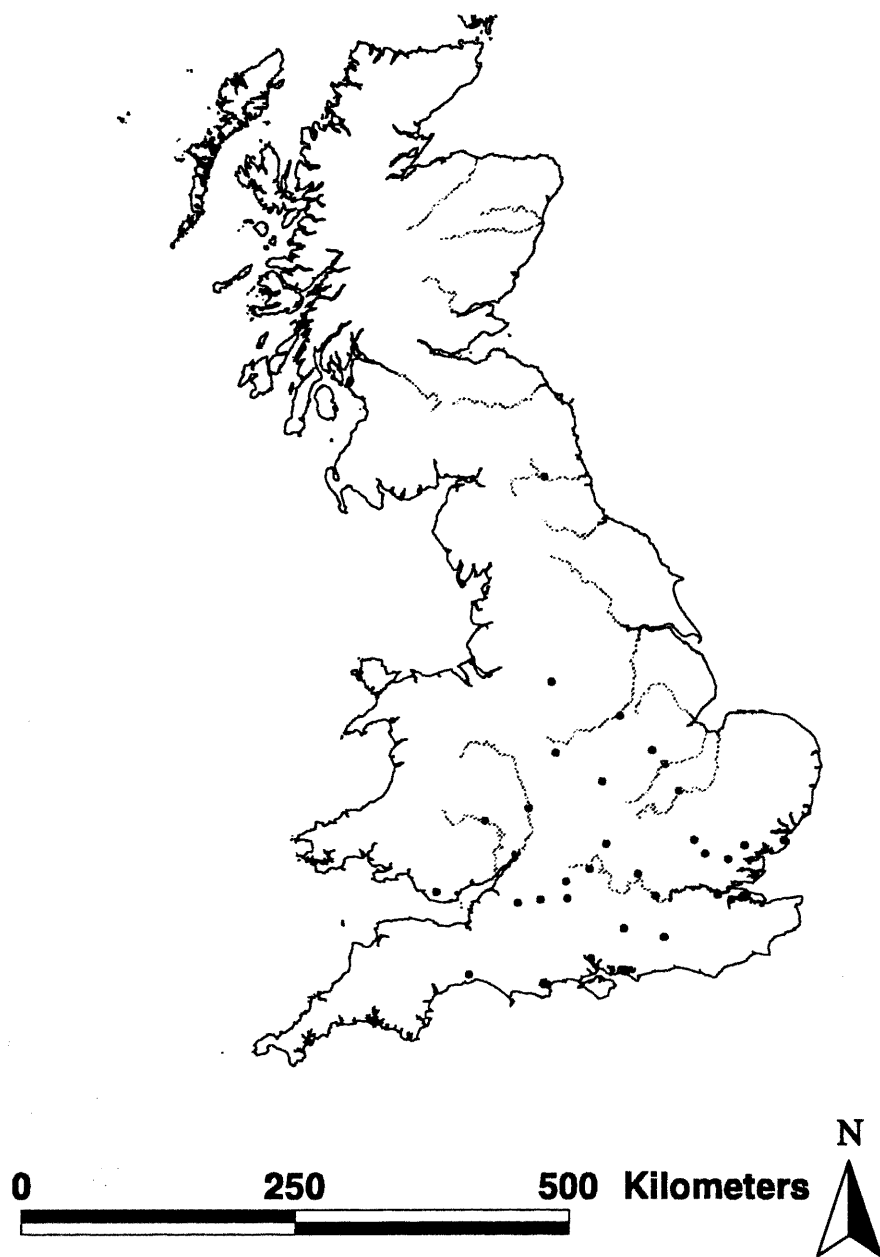


Fig. 6.8: Small towns with baths

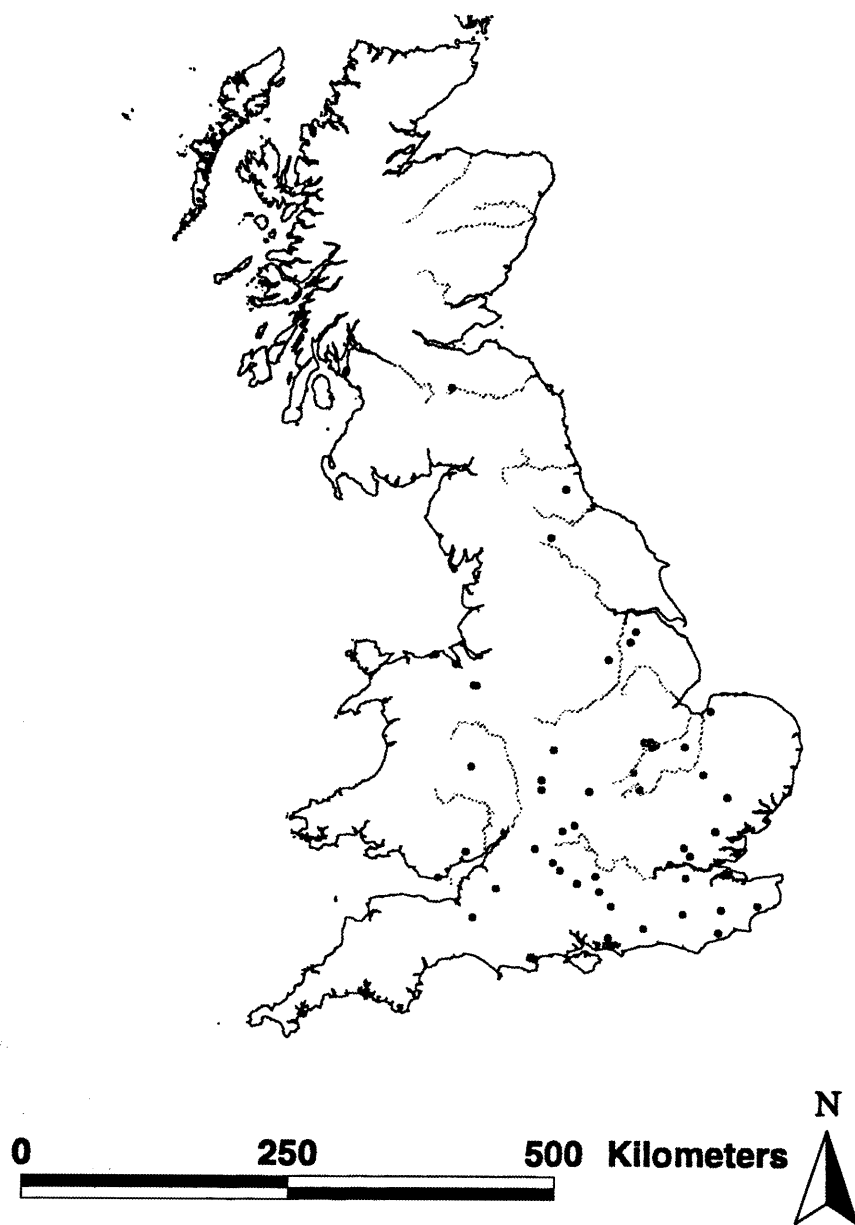


Fig. 6.9: Settlements with baths

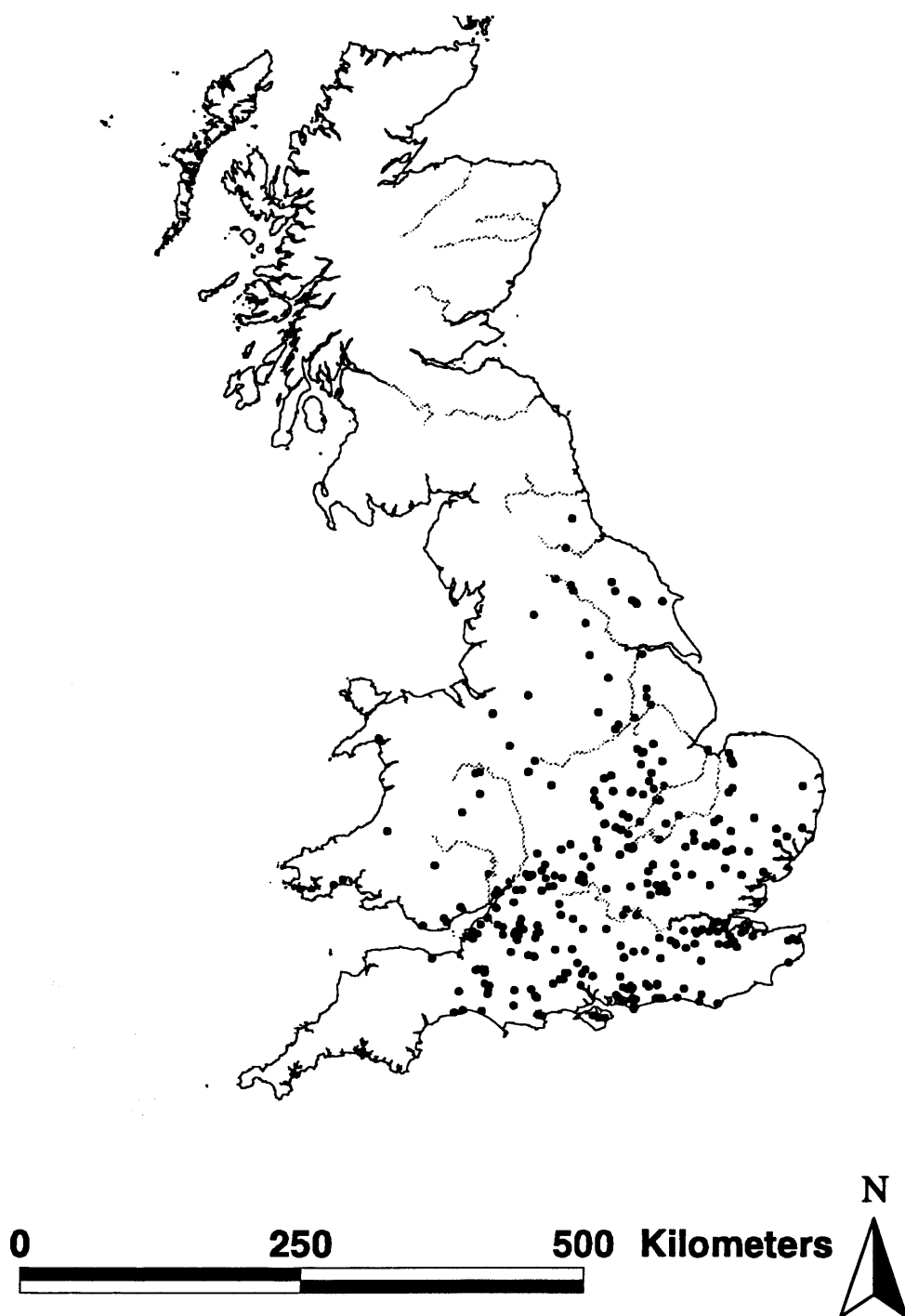


Fig. 6.10: Villas with baths.

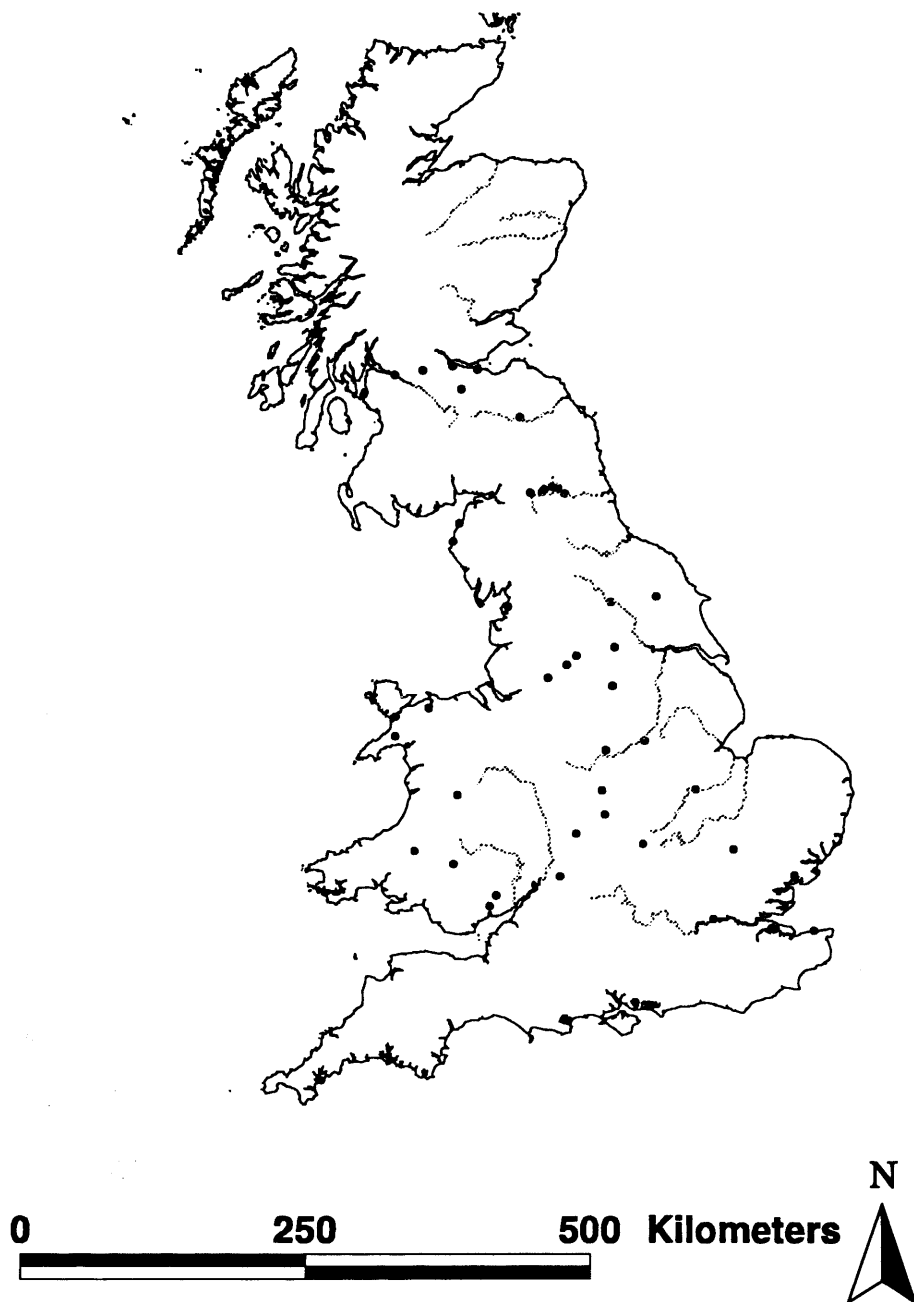


Fig. 6.11: Fortresses and forts with wells

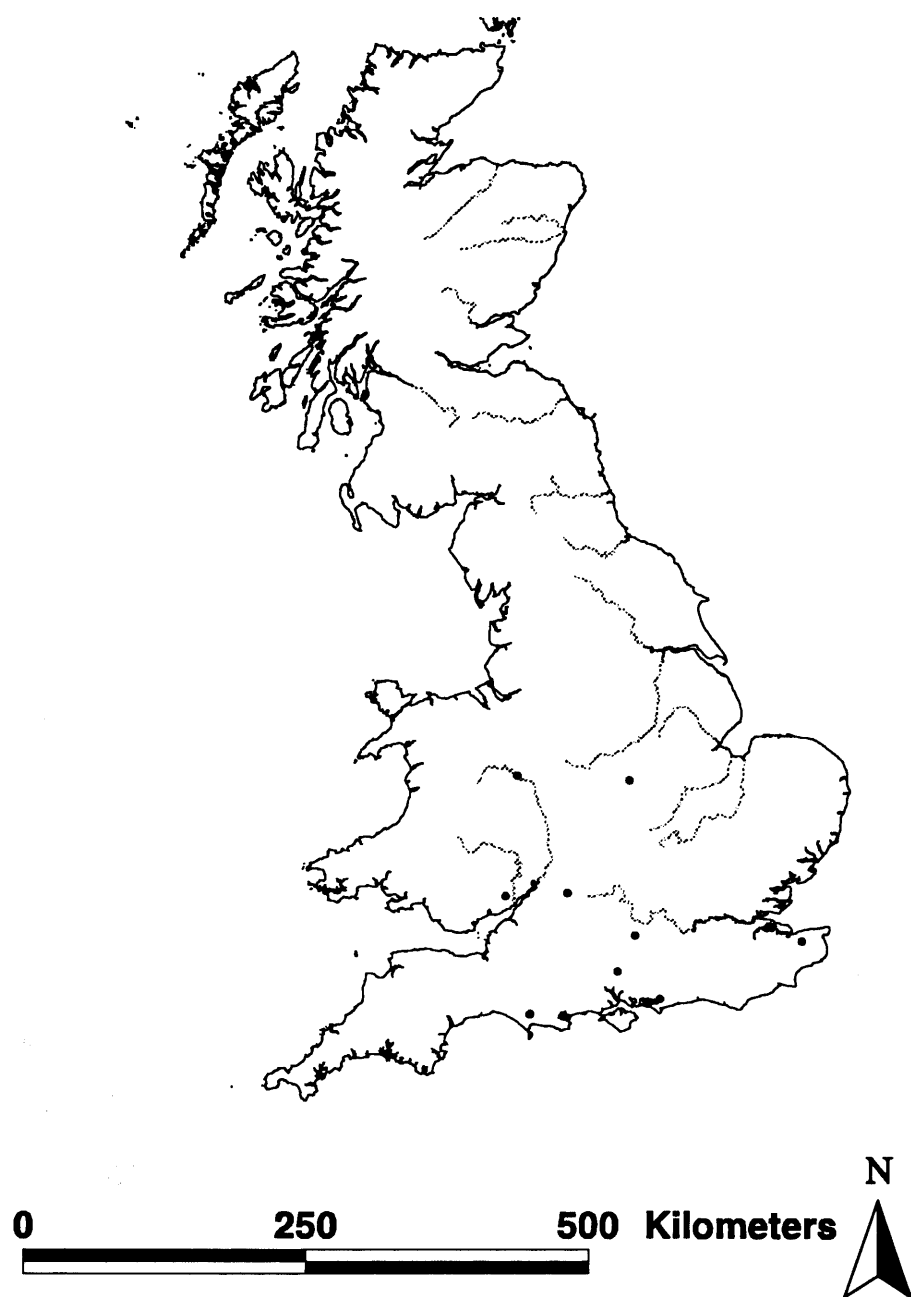


Fig. 6.12: *Civitas* capitals with wells

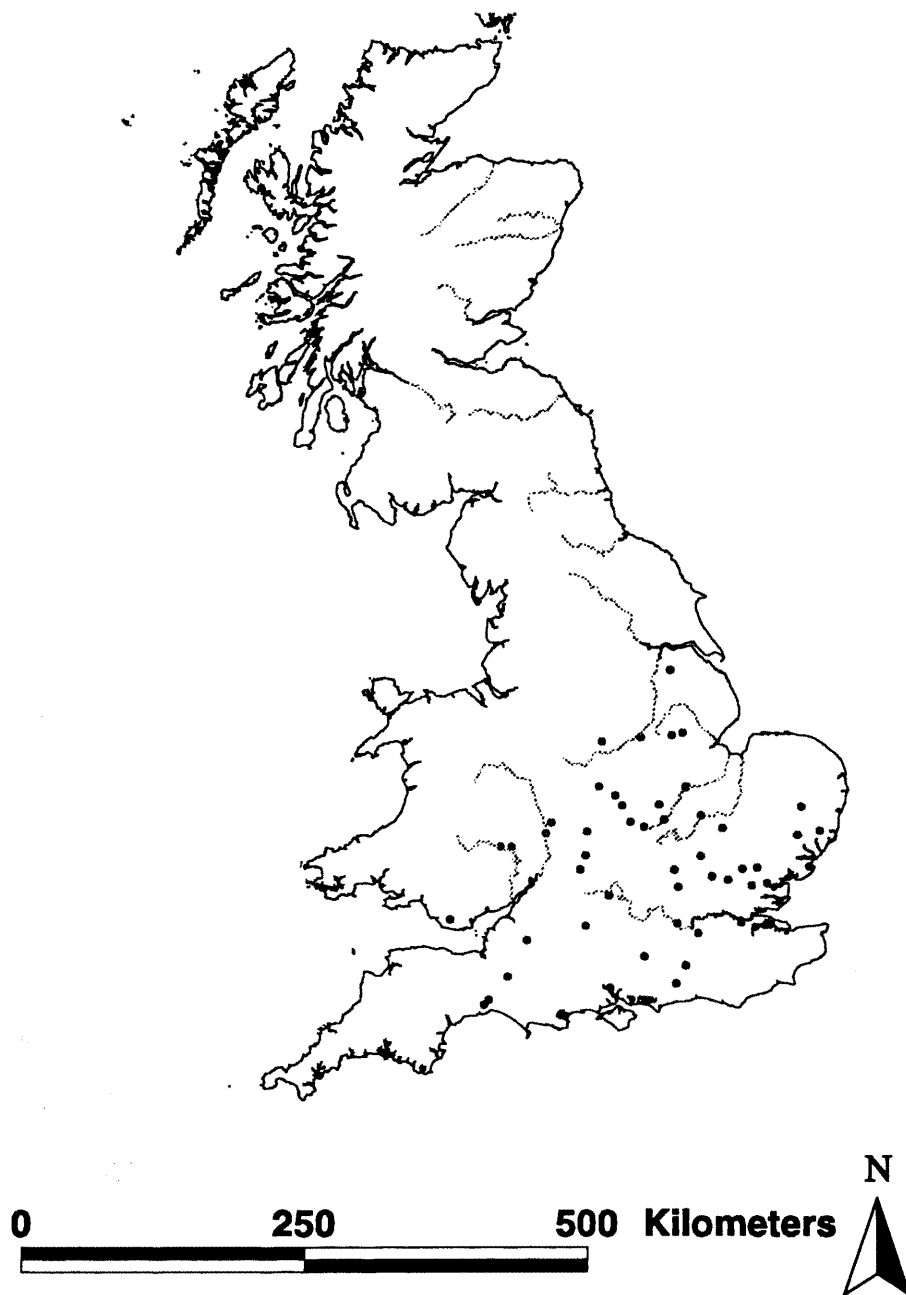


Fig. 6.13: Small towns with wells

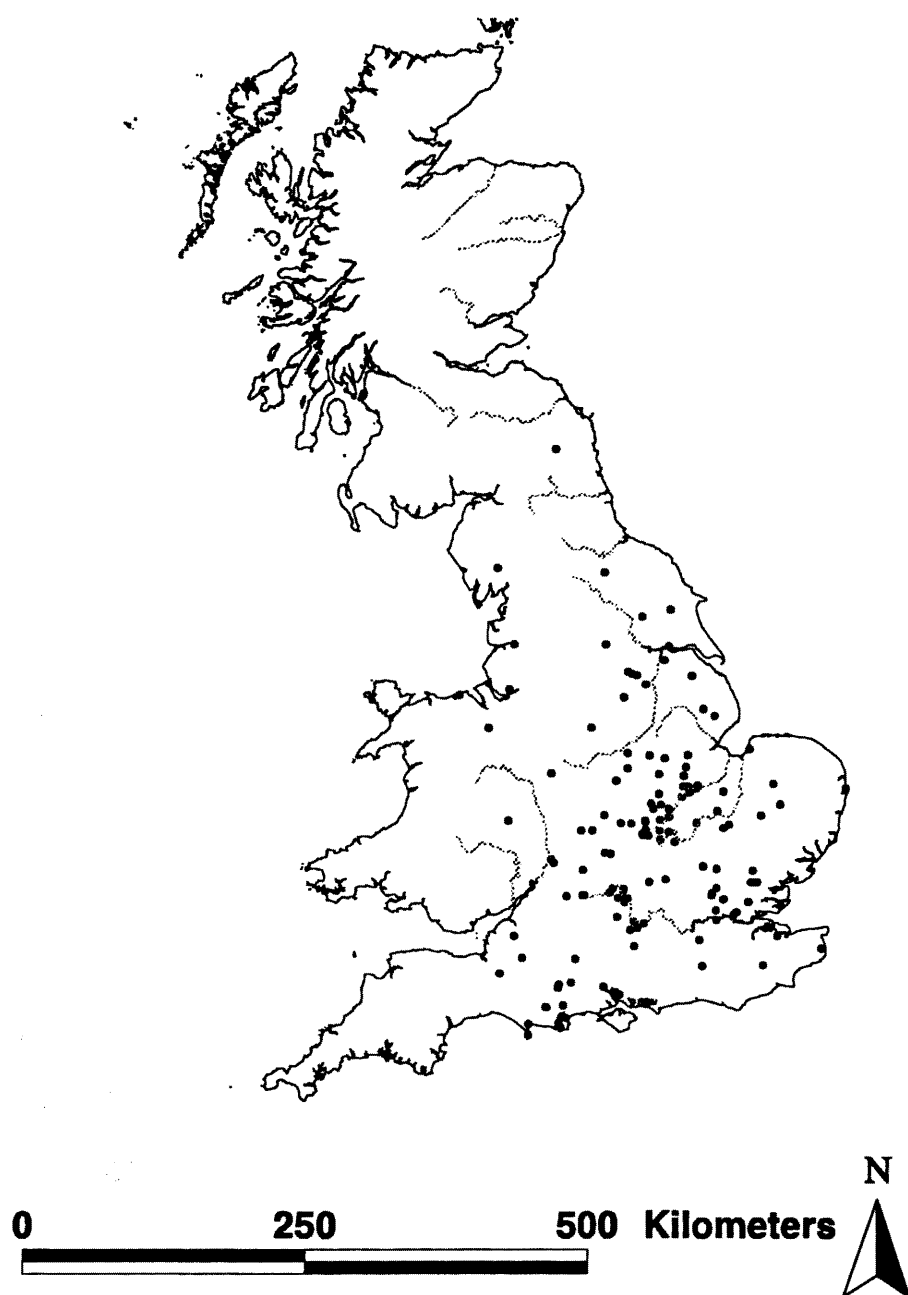


Fig. 6.14: Settlements with wells

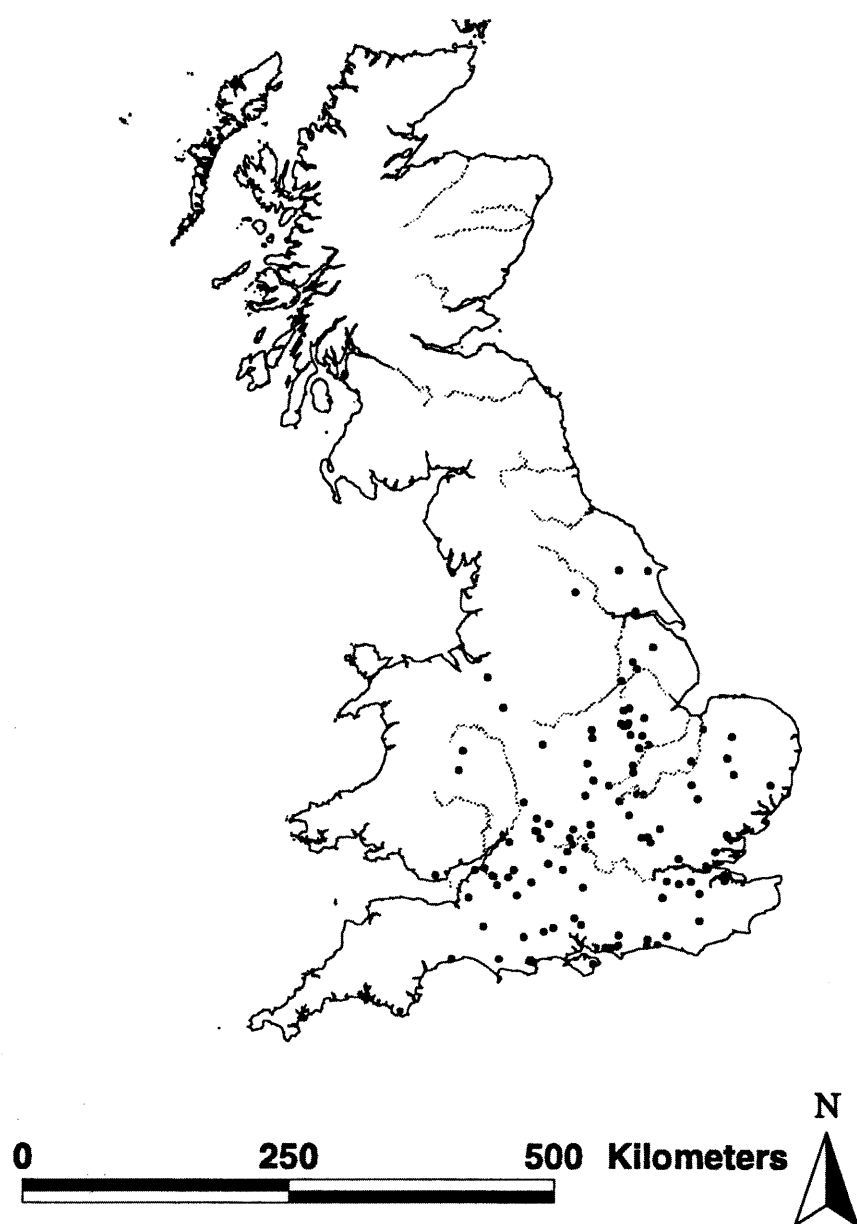


Fig. 6.15: Villas with wells

CHAPTER 7.

SOME SOCIAL, ECONOMIC, ORGANIZATIONAL AND CONSTRUCTION ASPECTS OF WATER-RELATED FEATURES

1. INTRODUCTION

This chapter will briefly deal with some aspects of romanization and the social impact that the provision of water and water-related structures had on the Britons. The coming of the Romans to Britain introduced a new social perspective for the local people, and new systems of organizing the towns that were created specifically to urbanize the local population. In particular the organization and administration of water supplies and the public baths became integrated with the management of towns, villas and even settlements. A case study of the planning and construction of an aqueduct is discussed. Provision of water supplies did not directly affect the economy of Roman Britain but it did have financial implications. The Roman public baths were costly structures both to build, to manage and maintain, which will be considered for the British situation.

2. ROMANIZATION DEBATE

It would appear that the romanization debate for Roman Britain has taken two directions: a socio-religious approach and a pragmatic one. The first can be explained as an interaction of cultural processes and change between that of the conquered societies of the Empire and the established social order of Rome.¹ The second deals with the material culture introduced to those societies in the form of urbanization and Roman buildings, housing, baths, water supplies and imported wares. The Romans had a long history of romanization of their widespread empire and Britain was one of the last areas to be exposed to their influence. Recent research² indicates that the British, particularly in the south, were exposed to Roman goods and imports even before the conquest and their response to the material culture introduced by Rome followed a natural development of their own culture as they encountered the newly imported romanized cultural influences. After the conquest romanization became a subtle form of acculturation brought about by the exposure of communities that had come under the commercial or political influence of Rome, and the importation of many material culture products that directly or indirectly were of Roman origin (Haselgrove 1984, 20). Baths and running water supplies were introduced to Britain as new forms of

1 Brendel 1979.

2 Cunliffe 1982; Hingley, 1982, 17-52; Hodder 1982; Millett 1990, 1-39.

material culture, unfamiliar to Britons. As Britons became exposed to these aspects of Roman material culture, they gradually adopted it to improve their standards of living and adapted their own traditions and cultural values in order to benefit from the material changes brought to Britain by the Romans, as illustrated by the many small towns and villas found south of the northern military zone.

Burnham poses three key questions relating to this process of romanization: "(i) how did the process of interaction and romanization work? (ii) how did things actually change under Roman rule? and (iii) how deep did the veneer of romanization percolate?" (Burnham 1995, 121). The Romans actively "promoted town growth as the focus of self-government" and they expressed this through the provision of public buildings and amenities, including baths, water supplies and sewerage systems (Burnham 1995, 122). Rome exploited the political divisions within the indigenous British tribal communities, but was careful not to break up the existing social structures unless security demanded it (Haselgrove 1984, 6). It in fact started in the early 1st century BC, and received impetus under Julius Caesar's invasions of Britain and by Augustus' policy³ of diplomacy during the period of indirect contact, which was "'romanization' at a remove" (Haselgrove 1989, 22). When direct contact was eventually established by Claudius' conquest, more substantial acculturation in the form of Roman building programmes manifested themselves on the British landscape. The public buildings of *civitas* capitals, for instance, were a manifestation of what Rome saw as the romanized cultural expression of how they intended the Britons to perceive their newly established *civitas* centres. I do not intend to enter into a profound discussion of the romanization process, but Burnham's second question is relevant to the provision of water-related structures and is recognized as part of the material changes the Romans offered to the Britons in order that they would accept more readily the occupation of the country. The Britons, especially the élite, did absorb some of the material aspects that the Romans introduced, such as stone buildings for their homes, baths, aqueducts and wells.

Keith Branigan (1994, 9-16) comes out strongly in support of the theory that the amenities which the Romans introduced during their

3 Haselgrove, 1989, 17-30, and nos.16-22, provides an analysis of the so-called 'romanization' process before and immediately after the conquest period. The whole process of romanization is very complex, but it is evident that the acculturation of the British (and the Gauls) was a deliberate process, without it being enforced by coercion, as an expression of Roman values for their hopeful adoption. In large measure the romanization was achieved at certain levels and may have changed the lifestyles of Britons in many respects, but did not change them into Roman Britons.

establishment of forts, towns and civitas capitals created a new outlook for the British people, which they seem to have adopted readily. This was particularly evident from the many elaborate homesteads and villas that spread over southern Britain amongst the élite, a kind of self-romanization. The poorer Britons may not have responded to the romanization process with equal enthusiasm, since they could not escape entirely from having contact with the Romans, mainly because of their obligations for the taxes demanded by the occupation power. Even so the construction of Roman forts, stone housing, temples, baths, aqueducts and fountains must have had a profound effect on all the local people in spite of them adhering to much of their own cultural traditions.

Clarke, commenting on the analysis of the data from the fort at Newstead, comes to the conclusion that "On Britain's northern frontier the gulf between material cultures of these (Roman and native) is so great as to make the distinction between military and civilian, seem petty. In reality it can now be seen that there is no such thing as Roman society, or Roman culture, but rather many sub-cultures each with its own aspirations and values" (1995, 81). There was no policy of separation between Romans and Britons, but there may have been selective differences between their cultural practices. Gildas writing at the end of the 5th century made it clear that Britons and Romans remained separate groups throughout the period of Roman occupation (Jones 1996, 9), which is confirmed by Zosimus' writing in the 6th century. Nevertheless, however separate the two groups may have remained culturally in some respects, the material culture aspect at a pragmatic level contributed to the romanization process as the British adapted to stone housing, Roman baths and running water supplies. Villas were probably the clearest expression of this romanization process during the 3rd and 4th centuries, when villas were transformed into large houses. The new owners built elaborate baths richly decorated with paintings and mosaics at great cost, indicating a considerable increase in wealth and social status.

When the Romans departed early in the 5th century the Britons discarded the Roman influences as the Anglo-Saxon invaders imposed new cultural values on a decentralized nation without a unifying leadership.

3. ORGANIZATION AND ADMINISTRATION OF WATER SUPPLY PROJECTS

In the absence of literary or epigraphic information on the organization and administration of towns in Roman Britain, evidence from other parts of the Empire must be used⁴. Epigraphic evidence of a law, the *Lex Coloniae Genetiviae Juliae*, setting out the charter for the *colonia* of Urso in Spain and the details of how the town had to be administered, is given in a set of tables in which various procedures were explained, such as how the *decuriones* were to make decrees regarding carrying out of public work and for the building of an aqueduct (Hardy 1912, 44, XCVIII & XCIX). *Coloniae*, *municipia* and *civitas* capitals developed from the 2nd century BC into the Empire period, their administrative structures being based on that of Republican Rome and of the Empire period, but their municipal status was ranked at a lower level than that of Rome (Abbott & Johnson 1926, 3-20).⁵ The models for those towns seem also to have applied to the towns in Britain.

Chartered towns were able to raise revenue through the *incolae* (residents) who would be liable to the *munera* (a liturgical obligation) for the town (Duncan-Jones 1960, 160, 164, 174-8), but this did not apply to *civitas* capitals. The four *coloniae* were preceded by a military presence on their sites, so it is likely that the army would have had a considerable influence on their initial construction and layout. Once a *colonia* was established it would create its own *ordo* and elect its own municipal officers to administer the town, though initially the army must have been involved in their planning and layout. Whether the army was ever involved in the construction of the aqueduct for the *colonia* at Lincoln is uncertain, but the quality of the workmanship of the concrete encased pipe seems to indicate considerable skill, which was readily available from the army. The indications are that Verulamium was a *municipium* and the army surveyors may have been involved with setting out its street grid, and possibly also were involved in the construction of its sewers and original street drainage (Frere 1964, 104-5). London was an unusual

4 Hardy 1912, gives translations of several laws relating to municipalities of which the *Lex Julia Municipalis* and the *Lex Coloniae Genetivae Julia* give information on municipal administration. A set of tables was found at Osuna in Spain giving remains of the *Lex Coloniae* for the people of Urso containing the charter granted to the *colonia Genetiva Julia*, and Clause XCIX deals specifically with aqueducts.

5 Abbott and Johnson gives the original surviving texts of 206 inscriptions and documents relating to the provinces on various edicts and laws issued during both the Republican and Empire periods. Many of these relate to municipalities and their administration, defining the powers of officials and how the affairs of towns had to be conducted. These were generally called *leges datae*, such as the *tabula Heracleensis* of 45 BC (no. 24) and the *lex coloniae Genetivae Julia* of 44 BC (no.26)

town having had a walled fort of uncertain date, but founded about AD 100 (Frere 1974 125) and incorporated into the city walls probably constructed during the 3rd century (Morris 1982, 171). There is no suggestion that the army was involved in the planning of the town, though the construction of some structures such as the basilica and the Huggin Hill baths may indicate that there was imperial involvement and hence probably the army (Selkirk 1995, 329). The fact that London had a fort within its walls complicated the question of its administration, but Selkirk suggests that it might have been a *municipium* and would therefore have had an *ordo* like the *coloniae*.

Ways of raising revenue by *civitas* capitals could have been from minor local taxes of different kinds (Duncan-Jones 1960, 160 n.8), or by benefactions from the wealthy (178-81), for the construction of public buildings and baths, including funding for a costly aqueduct. Competition between families and individuals to gain personal status in a community seems to have been important, so that elected magistrates would spend large amounts of money as benefactors to towns (Duncan-Jones 1960, 170(5.2)).⁶ A town council (*ordo decurionum*) consisted of *decuriones*, who elected *duoviri* responsible for the organization and administration of a town (Abbott and Johnson 1968, 65). According to the *Lex Coloniae Genetivae Juliae* the *duoviri* would put a proposal for an aqueduct to at least two-thirds of the *decuriones* who would decide on "the lands through which an aqueduct may lawfully be brought" (Hardy 1912, 44-5, (sect. XCIX)). The *duoviri* appointed magistrates, the equivalent of *aediles*, who were responsible for running the affairs of the town, including public buildings, public baths, streets, the water supply and drainage. It would seem reasonable to assume that this model for town councils also applied to the public towns of Roman Britain and that decisions to build an aqueduct would have followed a similar procedure as that at Urso. All the *civitas* capitals would have been administered based on the same model as that of the chartered towns without the benefit of raising taxes for its development projects, and this would have applied to Durnovaria (Dorchester).

⁶ Duncan-Jones 1990, 174-8 and 1982, 84. 'Pliny mentions that the *summae honorariae* of new councilors at one town, Claudiopolis, were immediately put to use in building new town baths' 176). *Summae honorariae* applied to chartered towns like *coloniae* and *municipia*. There are inscriptions from Lepcis Magna and Subratta implying very large individual contributions towards the cost of aqueducts and fountains. The town of Durnovaria must have relied heavily on private donations from inhabitants and local taxes.

3.1. Social aspects and dating of the Dorchester aqueduct water supply.

The settlement at *Durnovaria* became the tribal *civitas perigrina* of the *Durotriges*, c. AD 70 (RCHM(E) 1970, 534), but later, because of prosperity in the region of Ilchester, it may be likely that during the 3rd or 4th centuries there was also a *civitas* centre created at this town (Wacher 1995, 324). Why and when the *decuriones* of *Durnovaria* decided to build an aqueduct is uncertain. There was certainly prosperity amongst the native British during the 2nd to 4th centuries (Salway 1981, 235-8). Based on the remains of the public buildings - such as a *forum*, *basilica*, public baths and amphitheatre - the economic situation at *Durnovaria* was prosperous during the later 2nd and 3rd centuries (Putnam 1984, 36-8)⁷. However, the construction of a costly aqueduct (Fig.7.1), is suggested to have taken place earlier than the 2nd century period of prosperity, even though the town already had wells to supply drinking water.



Fig. 7.1 Photo of Dorchester aqueduct near Poundbury (AB, 1994).

Dating evidence from pottery and coin finds seems to suggest that the first period leat aqueduct was constructed about two decades after *Durnovaria* became the *civitas* capital. Green (1987, 49-51) suggests 3 periods of construction of the aqueduct, based on excavations during 1968 and 1980, at least in the vicinity of Poundbury (A, Fig. 7.2a).

⁷ According to Bill Putnam (1984, 32-3), the *Durotriges* were originally not all that interested in the building of a new *civitas* town at Dorchester during the Flavian period, but by the 3rd century their wealth had considerably improved, as for instance, can be seen by the extensive villa of Colliton Park.

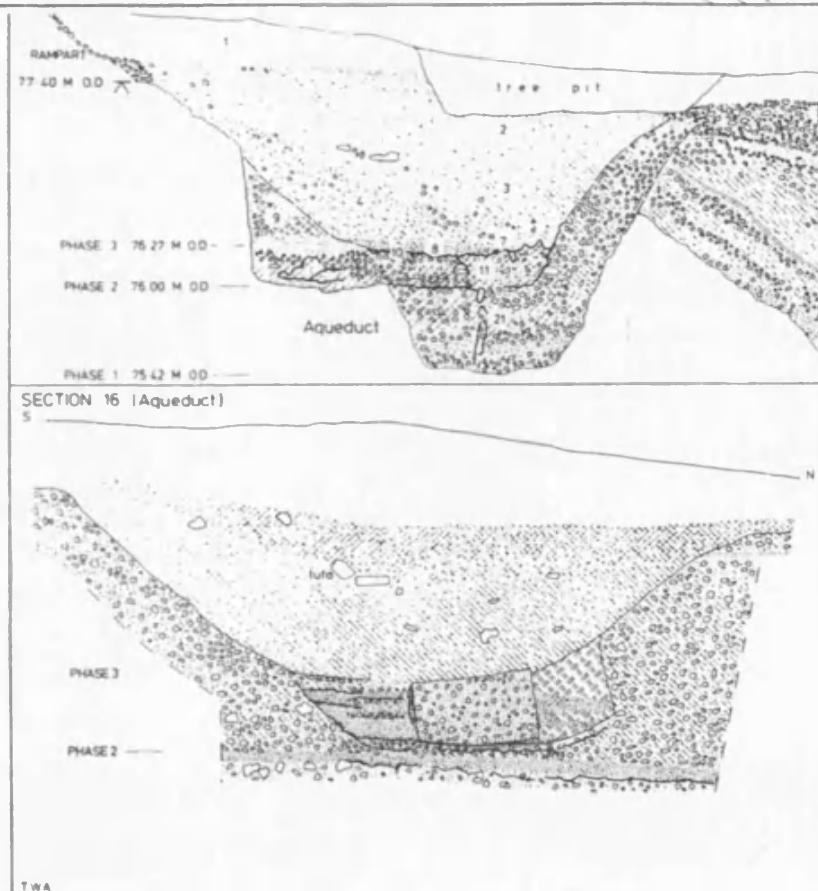
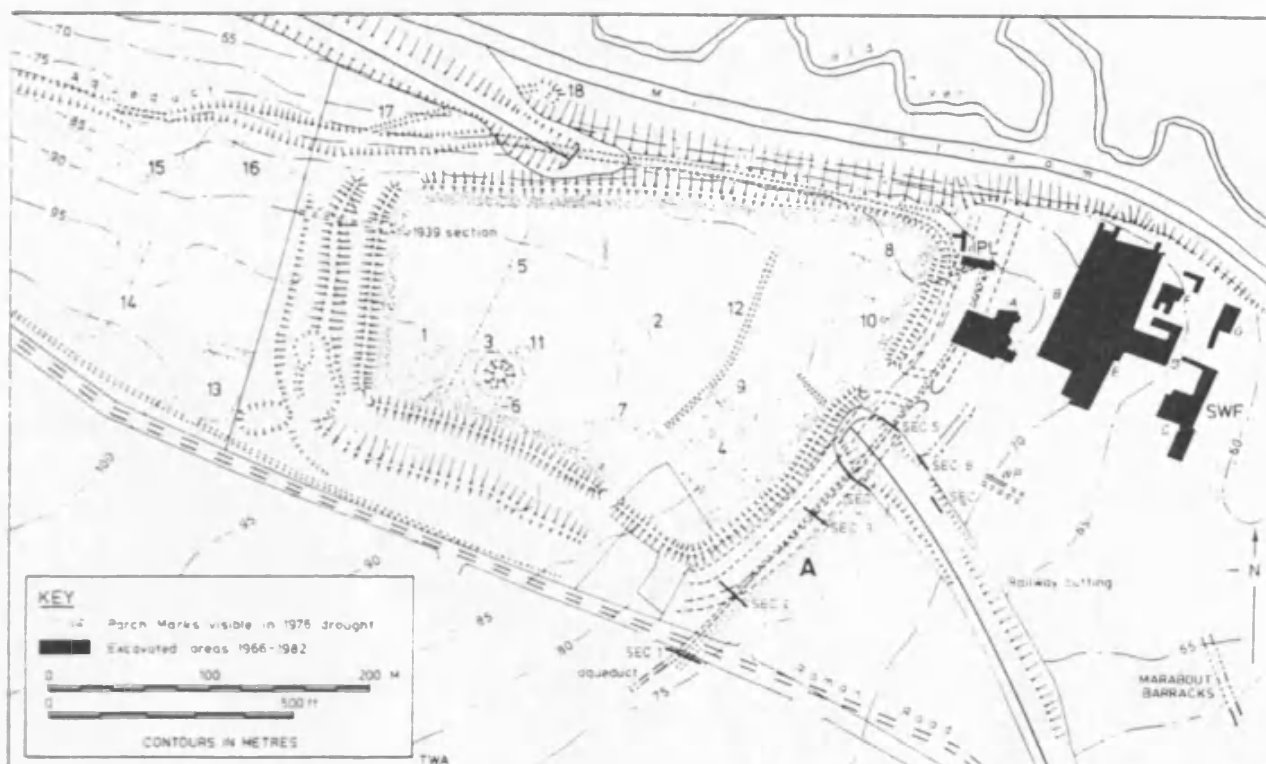


Fig.7.2a: Poundbury Camp and aqueduct (after Green 1987, 16, Fig.1);
 Fig.7.2b: The aqueduct channel showing the three levels of construction:
 1st, 2nd and 3rd phases, (after Green 1987, 50, Fig. 23).

Dating is difficult, but is based on samian ware of the late 1st or early 2nd century found in the channel silt, and a slightly worn silver coin of Vespasian (AD 69-79) found in the diversion conduit on Colliton Park (RCHM(E) 1970, 588-9; Green 1969, 172). Samian ware was also found at one of the places sectioned along the east side of Fordington Bottom (B, Fig. 7.4). Based on this evidence, the narrow channel of the aqueduct (Fig.7.2b) of the first phase was cut during the late 1st century. Green suggests that due to flow problems encountered soon afterwards, the aqueduct was reconstructed 0.5m higher along this section, to a different cross-section with a wider channel and steep sides, perhaps also in the late first century or early 2nd century. At a much later date the channel was again reshaped at a higher level about 0.3m above the phase 2 level. A grooved bowl dating to the 3rd century was found in layer 6 of the in-fill of the Colliton Park conduit, below the final 7th layer which was 'certainly not complete before the 4th century' (RCHM(E) 1970, Vol.2, 589). There seems to be evidence also for such changes at Bradford Peverell (see C, Fig.7.4) (Green 1987, 51). This last phase may have coincided with the building of the Roman baths.

The tenuous nature of the dating evidence for the first two phases of construction of the aqueduct, raises the issue of whether a newly created *civitas* capital would at such an early date have embarked on a costly aqueduct. There seems to be a need to investigate this aspect because aqueducts at civilian towns seem to have generally dated from the Hadrianic period, unless perhaps there were veteran army personnel who could have provided the expertise to plan and construct a leat. Green indicates that the earthwork structures were started 'within decades of the dereliction of the Camp' (1987, 49), which seems to exclude military involvement. The final phase 3 aqueduct seems to date from the mid 2nd century or later.

The Romans initially created the large *Durotriges civitas* capital (by mid 2nd century 28 to 32ha)⁸ with little regard for the political division between the northern and southern groups⁹ and this must have created intense rivalry between families from the north and south. The northern group centred round *Lindinis* (Ilchester, 8.9ha) may well have been the wealthier as indicated by the number of villas surrounding it

8 RCHM(E) 970, n.3, 533.

9 Ilchester seems to have become a separate *civitas* centre at a later date (Wacher 1995, 21), but see Rivet and Smith, giving the alternative views of Stevens and Bogaers (1979, 392-3). Stevens suggested, based on inscriptions, that the *Civitas Durotrigum* was subdivided with Ilchester as the capitol in the north and *Durnovaria* that of the south. Bogaers disagreed, suggesting that *civitas Durotrigum* simply meant "town in the territory of the *Durotriges*".

(Wacher 1995, 324). Since the initial *civitas* capital was at *Durnovaria* (32ha) it is possible that there was competition between the two groups to hold office within the *ordo*, as rival factions vied with each other to provide benefactions for expensive building projects to gain civic status. The material remains indicate clearly that the inhabitants of the *civitas* did indulge in considerable expenditure at *Durnovaria* to improve their social standing, material culture, and civic status, but this aspect has received minimal attention.

This would have applied to other public structures constructed during the same period. If the calculation of water delivery suggested for the aqueduct is valid (RCHM(E) 1970, 587), then much of the water gained at great expense was allowed to be wasted back into the river.

A number of questions arises when a *civitas* capital embarks on major building programmes such as the construction of an aqueduct. Firstly, the town did not have the power to raise funds by imposing taxes, so funding for public buildings and facilities had to be raised from amongst the community themselves. *Durnovaria* was one of the smaller *civitas* centres, so why did they indulge in excessive spending on public facilities? Secondly, did this contribute to overstretching of resources? The answer to the first question was complex, because the *Durotriges* community as a *civitas stipendiarius* also had tax commitments to the province, but as suggested above, rivalry between the northern and southern groups could have been a motivation. The *Durotriges* tribal area had several important LPRIA hillforts with rival élite families who had accepted the romanized building styles, but retained their former wealth and power. An important element could well have been the competition between the two groups for civic status. However, having overspent large sums of money on public buildings, baths and an aqueduct, it is possible that further sources of revenue for maintenance of these structures had become unavailable, and they slowly deteriorated until they no longer functioned effectively.

Although we have no direct evidence for *Durnovaria*, evidence for other towns such as London, Silchester and Wroxeter, shows neglect of many public buildings by the fourth century (Millet 1990, 130, Table 6.1). Inflation and increased tax also became significant factors during the 4th century and the *decuriones* became less inclined to contribute to development of cities during the 3rd century (Millet, 1990, 128, 204). Either the wealth of even the rich declined during the later 3rd century, or the northern people transferred their funding to Ilchester,

thus depriving *Durnovaria* of further munificence from that quarter. It may in part also have been connected with the internal political and military situation of the late third century resulting from the insurrections of Carausius and Alectus (Frere 1974, 337-40), and the troubles on the northern and eastern frontiers in the 4th century (346-8), which could have adversely influenced the markets that provided the wealth of the previous century. New demands were made on the wealth of inhabitants to provide defences, as at *Durnovaria* and other towns in the *civitas*, so that many public facilities must have suffered because of lack of maintenance. The expenditure of the earlier period in many areas of Roman Britain could not be sustained later as available resources became overstretched by channeling it into defences. The rich also spent more on providing themselves with more luxurious homes, further removing financial resources from towns and inevitably the towns declined as their buildings, water supplies and drainage deteriorated, in spite of having become walled towns. *Durnovaria* seems to have declined in this way during the 4th century when its public baths went out of use, probably because the aqueduct was also no longer in use.

4. DORCHESTER AQUEDUCT CASE-STUDY

4.1. Discovery of Dorchester aqueduct.

J.N. Coates first recognized the remains of the linear features of an aqueduct at Dorchester in 1902 (Fig. 7.3).

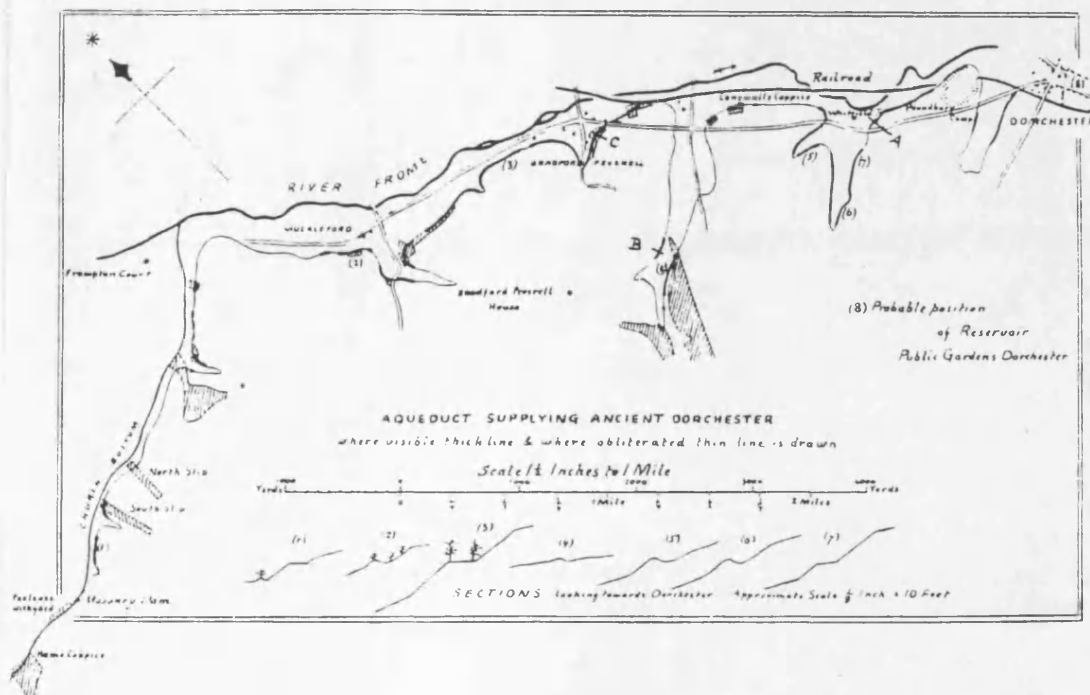


Fig.7.3: Coates' route of Dorchester aqueduct, (PDNHAFC 22, 1901, 80).

His plan shows the source for the aqueduct to be in the Church Bottom stream in the vicinity of the masonry dam at Foxlease Witkybid(?). He shows a profile for a section of what he interpreted as part of the aqueduct (marked (1) on his plan).

The leat aqueduct to *Durnovaria* has been investigated on three occasions, but the actual source has never been reliably located notwithstanding Foster's survey of 1922 and the re-survey of 1925 (RCHM 1970, 585). P. Foster (like Coates a major in the Royal Artillery) subsequently suggested in 1922 that the source of the aqueduct was at Notton Mill (G, Fig. 7.4), its length being about 18km (11 miles) from the West Gate of the Roman town.

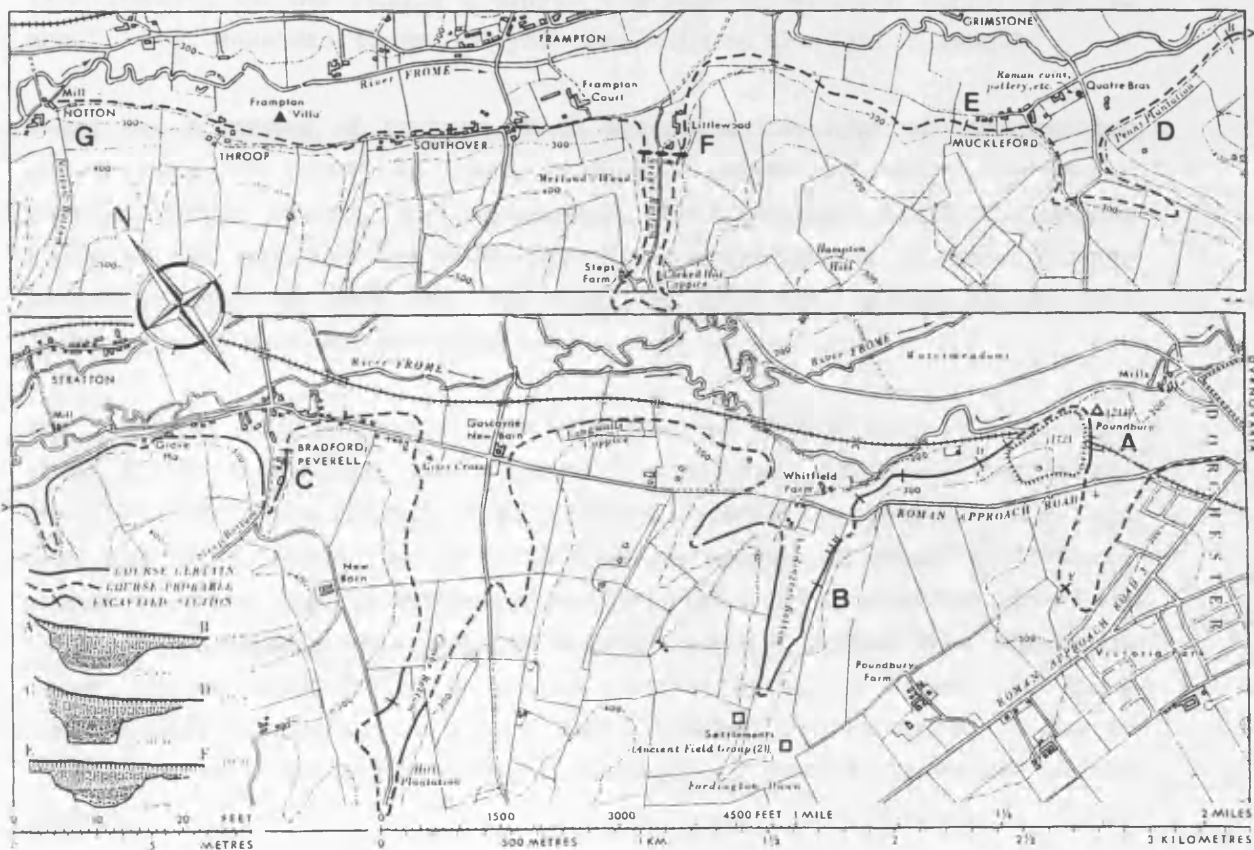


Fig.7.4: Plan of Dorchester aqueduct route (from RCHM(E) 1970, 586). Places along aqueduct are marked A: Poundbury; B: Fordington Bottom; C: Bradford Peverell; D: Penns Plantation; E: Muckleford; F: Putnam's suggested dam wall; G: Notton Mill.

For linear features such as aqueducts and roads, it is not practical to carry out excavations in detail for their whole lengths. This has been the situation with the Dorchester aqueduct, and is one of the reasons

why the source of its supply has not been located. Bill Putnam has been doubtful that the source was at Notton Mill and has been excavating along the aqueduct since 1992, looking at some of the problems associated with the structure and trying to locate its source. Four reports have been published so far in the *Dorset Proceedings*¹⁰ and there is an interim 5th report relating to the 1996 excavations. Previous to Putnam's work the aqueduct's route had been firmly established as far as Penns Plantation (D, Fig. 7.4). Putnam has now extended and confirmed the route as far as Littlewood (F), that is about 2.5km further than was previously known (Putnam 1995, 128-31). In the interim report he suggests that a dam was constructed across the Steps Bottom stream just south of the Littlewood farm buildings (F), which he suspects was the source of the aqueduct, and will be investigated during 1997. This would reduce the length of the aqueduct by about 4km, to a length of about 14km instead of the length given in the RCHM(E) article (1970, 585) of about 18km. However, in my analysis below I use the latter length.

There are a number of factors which determine the type of construction of an aqueduct, such as cost, available revenue, labour resources, suitable water source, and topography. The topography along the chosen route of the aqueduct was such that for the Dorchester aqueduct it was decided to have an open leat aqueduct, cut into soil and in places into flint rock to maintain the flow rate.

The straight line distance from the town to Notton Mill (G) is only about 9.1km (5.7 miles) (as compared to the length of 18km), indicating the tortuous route needed to provide an acceptable gradient. The fall over the total length is 7.6m (25ft) giving a slope of about 1:2400, approximately the same as suggested by Vitruvius. Level readings have been taken at selected points and the RCHM(E) article states that where the depth of the channel below present ground level is known, it shows considerable variation. It is not known whether the variation is due to "imprecise cutting rather than to cleaning or natural scouring of the channel".¹¹

It is not known who was responsible for the construction of the Dorchester aqueduct. Usually the necessary expertise was supplied by the architects and engineers in the Roman army. If the army was involved, what would have been the relationship between it and the *civitas*? A pos-

10 *Dorset Proceedings*, 114, 1992, 239-40; 115, 1993, 152-3; 116, 1994, 123-4, and 117, 1995, 128-31; Putnam W G & Hewitt I, Interim Report December 1996 'Excavations and fieldwork on the Dorchester Roman Aqueduct 1996', Bournemouth University.

11 RCHM(E), County of Dorset, England, 2(3), 1970, 585.

sibility is that some retired army veterans with the required knowledge might have settled in the town and helped with the technical aspects related to the aqueduct. Alternatively, the town *ordo* might have hired qualified engineers and contractors retired from the army, or could have called in the army to assist. It is also quite possible that private individuals had also acquired the technical skills necessary for construction, and especially in surveying (Campbell 1996, 77-80). It would seem that the provincial authorities allowed the army to assist with technical help for towns if they were not occupied on military campaigns, as for instance Tacitus¹² suggests that "Agricola gave private encouragement and official assistance to the building of temples, public squares and private mansions" and presumably other types of construction such as aqueducts.

4.2. Sequence of construction procedures.

We have limited knowledge of how the Romans actually set about the building of such construction projects. We can observe the remains of their finished structures and how the labourers manipulated the materials for building the structures can conjectured. Adam (1994) discusses the problem and from visible features on extant structures makes some suggestions about construction methods¹³ such as the erection of formwork and scaffolding. For instance, bridge structures like the Pont du Gard give indications of support points for them.

The sequence of operations during the construction phase of an aqueduct after a route has been decided is not known. For the construction of Hadrian's Wall some possible sequences of construction have been suggested, but the details are still partly obscure. We can conjecture about them by applying modern technological knowledge (itself very varied) but the reconstruction of actual Roman practice will always be highly conjectural.

There might have been other aspects of detail which would come to light only as the work progressed. For instance, if a bridge spanned a river, the operations for constructing the caissons, or for the installation of wooden piles, would have necessitated special sequences. Cutting into

12 'Tacitus on Roman Britain and Germany', trans. by M Mattingly, 1948, *The Penguin Classics*, No 15, sect. 21, p.72.

13 Adam J-P, 1994 (English Ed.), 20-215. Adam gives many illustrations of how it is considered the Romans might have built certain structures. Many of these are based on methods drawn from the renaissance period and from modern practice with a Roman flavouring to them. In spite of this the book gives an excellent approach to how it could have been done with the simple aids at the disposal of the Romans.

rock, as had to be done on the Dorchester aqueduct, would have involved additional sequences.

Nevertheless it can be assumed that a typical sequence could have been as follows:

Table 7.1 : Sequence of construction procedures.

1. decision by the *decuriones* to construct a structure, e.g. an aqueduct;
2. *agrimensores* instructed to survey a route;
3. planning of the feasibility of the project depending on the results of the survey;
4. raising funds for work;
5. preparation of drawings, if any;
6. organization of a workforce and equipment for use on construction;
7. provision and mustering of materials and tools for the project;
8. provision of food and accommodation where necessary for workforce;
9. facilities for payment of the workforce;
10. arrangements for the control of the workforce and allocation of work to various sections of the project;
11. arrangements for the inspection of the work;
12. execution of the work;
13. approval by senior authorities of the progress of the work;
14. final acceptance of the completed work.

4.3. Hypothetical construction of the Dorchester aqueduct

As an engineer who was involved in the design and construction of similar projects some 1800 years later I am aware of some of the complexities of planning such enterprises. I am going to consider the likely implications of the planning, construction and cost of an aqueduct such as the one at Dorchester. I shall base these on a set of hypothetical assumptions in order to establish some order of costing and also to assess the workloads that would have been necessary to provide Dorchester with a running water supply. The town already had wells as the main water supply, but the town *decuriones* must have decreed to build a gravity-fed aqueduct. The appropriate *duovir* would then have been instructed to make all the necessary arrangements to plan and have the aqueduct constructed. The next step would have been to identify an appropriate water source, either based on the knowledge of an army engineer or on that of the local inhabitants. A geometrical, or as we now call it, a tacheometer survey, would then have been necessary for identification of a route along contours to ensure a sufficiently low

fall of elevation, yet allowing for a reasonable rate of gravity flow to bring water to a position in the town where it could be distributed to public amenities and private individuals. It is at this stage that the highly trained army *agrimensores*¹⁴ would have most likely been used, primarily to look at the terrain and to assess the practical feasibility of the scheme, and hence to establish an adequate route¹⁵.

Today, if we want to determine the feasibility of such a scheme it would be a simple matter to look at airphotos or contour maps for the planning of a possible route. Geological and hydrological maps could assist in location of spring or river sources which would be at a high enough elevation above the delivery point. It is customary for modern engineers to do a feasibility study from contour and geological maps before they go into the field to survey a projected site or route. A preliminary survey would then be carried out, most probably from the source end (but not necessarily so), with a crudely calculated rate of drop in elevation over a fixed distance. If this preliminary survey showed that the rate of fall could be maintained over the projected length of the route, a more detailed survey would be done providing levels of the invert of the channel. This latter measure indicated the depth of cut to form the channel.

Many aspects of Roman surveying remain uncertain. However, we know the type of very simple instruments they used such as the *groma*, *chorobate* and *dioptra* (Dilke 1980). Various possible methods of surveying technique have been suggested that could have been applied. Whatever methods they actually used, their skill at high quality surveying of difficult routes is attested all over the Roman Empire¹⁶. The surveying of the routes of the Nîmes aqueduct in France and the Köln aqueduct must be among the more outstanding surveys done by the Romans. The fall in elevation for the Nîmes aqueduct, in quite broken and hilly countryside,

14 *Agrimensores*, 'measurers of land', 'were the land surveyors of ancient Rome', from AOW Dilke's *The Roman Land Surveyors*, 15-8.

15 Surveyors in the Roman empire were generally trained in the army, but there were skilled surveyors in the private sector. Hyginus, writing in the late first/early second century indicated he was a surveyor and he offers advice to other surveyors (JRS 86, 1996, 77). There may have been survey personnel available after retirement from the army who would have contracted to do surveying for *civitates*, but there is no certainty that such freelance surveyors had been employed on the aqueduct at Dorchester. There is likely to have been some working system by which towns other than the chartered towns had survey facilities as indicated by the plans of their regular street grids. Civilian sites with aqueducts must have had surveying facilities.

16 The *Corpus Agrimensorum* is a collection of surveyor's manuals that has come down, often in corrupt and fragmentary texts. Frontinus is one of the earliest contributors to this corpus, and many of the authors give details of how to solve certain specific problems. However, none of the manuals actually describe the procedure used for using the surveying instruments. AOW Dilke, 1971, *passim*.

of one third of a metre in a kilometer over a distance of 51km is an outstanding achievement. The surveying on some of the leat routes in Britain was also of high quality, as for instance those of the Dorchester, Great Chesters and Winchester aqueducts.

A series of 14 cross-sections was taken along the Dorchester aqueduct by several surveyors between 1855 and 1956, including the profiles produced from the survey work done by the Royal Engineers in 1925 (RCHM(E) 1970, 586)¹⁷. Some of the data from these surveys are used in the following analysis. Figure 7.5 shows two assumed cross-section profiles, one for sloping ground and the other for level ground. Calculated areas are shown for these cross-sections, and volumes calculated for an aqueduct length of 18.23km. From these, estimated volumes of materials removed can be made for the likely original construction of the channel, and then some estimated costs can be calculated. These figures will all be highly speculative, but the intention is to give some idea of how planning and budget costs are arrived at in practice today (very much simplified). It is not intended to imply that this was the procedure followed by the Romans.

It is to be noted that for the fairly low degree of sloping ground of ratio 1:3, about 20 degrees to the horizontal, the area is nearly double that for level ground. However, since it was necessary to follow the contours to maintain a steady fall for a reasonable rate of gravity flow, in this case about 1:2400, it is not possible always to avoid sidecuts such as shown in the profile. Sometimes the situation arises where on level ground a fairly deep cut has to be made, which brings its own special construction problems. In practice, from a tachy survey and levels, a detailed cut-and-fill projection can be made to provide a reasonably accurate estimate of the quantities of material to be removed to form the invert base-line and profile of the aqueduct channel. It is not known whether the Romans went to such sophistication in their planning or during the construction phase.

I calculated the *in situ* volumes of earth that would have had to be moved for the two profiles (Fig. 7.4), assuming the entire length of the aqueduct consisted of a single type of cut. These were respectively 51,790m³ and 30,900m³. The actual quantities would likely have been somewhere in between these two values depending on the slopes of the countryside traversed.

¹⁷ The details of the field work of these cross-sectional surveys and the surveys by the Royal Engineers are in the archives of the Dorset County Museum, Dorchester.

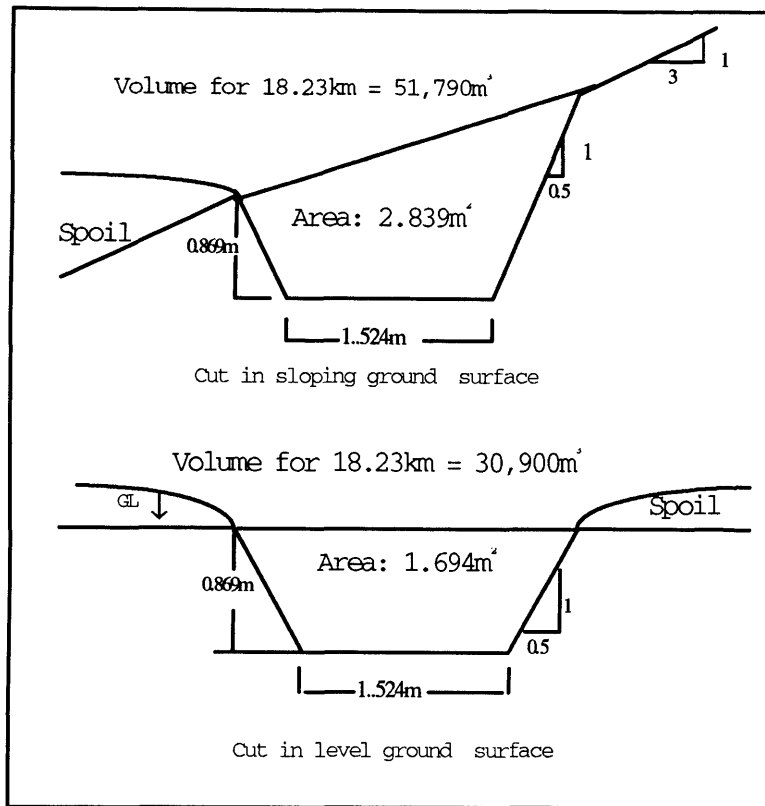


Fig.7.5: Assumed cross-sections of profiles for Dorchester aqueduct, (AB).

These are large volumes of earth and rock to move, considering that the tools used were principally pickaxes and spades, hammers and chisels to loosen the rock and soil. I have chosen for convenience of calculation a value near the mean of those volumes, that is $41,400\text{m}^3$.

In the RCHM(E) article (1970, 587)¹⁸ it was suggested that the slopes of the walls of the actual cut were at the ratio 1:0.5. This is very steep, giving a vertical to horizontal slope of about 63 degrees. For soils in general, at steep slopes like this, as swelling and shrinking takes place over a period of time during wetting and drying cycles, one can expect slumping of the sides to the natural angle that would be stable for such soils. Each soil type has its own characteristic behaviour depending on its plasticity properties, grain size and state of *in situ* consolidation. I have used the suggested slope, but would have thought

¹⁸ The RCHM article actually refers to a "flat-bottomed ditch with steep sides in ratio 2:1". The conventional approach would be to express the ratio as 1:2, in terms of the trigonometric function used to calculate the angle of the slope. But a ratio of 1:2 gives a flat slope to the sides of 26° , whereas a ratio of 1:0.5 would give the angle of the "steep sides" sides of 63° .

that a maximum slope would have been at most 45 degrees (ratio of 1:1). This would have increased the chosen volume by about 9,000m³ (22.2%).

When we try to estimate the labour force required to excavate such quantities of soil one can apply the modern experience of labour-intensive construction in, for instance, some of the African or Indian communities. For certain publicly-financed projects in these countries the decision was taken not to use modern excavation equipment in order to give maximum employment to people. However, it should be noted that the spades and picks in use today are made of steel and are much more durable, and somewhat larger, than those used by the Romans. Similarly, the size and shape of these tools are better adapted for work-efficiency than the typical examples of spades and pickaxes which have been recovered from antiquity.

4.4. Previous estimation of quantities and cost for the Dorchester aqueduct.

There has been only one previous estimate of the work and cost of the Dorchester aqueduct. Stephens (1985a, 204) gives estimates of the earth that had to be removed for the construction of the Dorchester aqueduct, giving a volume of 30,750m³ 'of spoil removed'. He used the cross-sectional dimensions given in the RCHM(E) article for level ground. Stephens then used "modern tables of building estimates" and arrived at a figure of 92,300 man-hours for the Dorchester aqueduct, which he adjusted upwards by 50% to allow for the difference in time-scale and the inefficiency of Roman "shovels and spades", which were smaller than those that his tables would have been based on. This gives him an estimated "total number of labouring-hours" of 138,400. It is not clear what he means here by the term "man-hours", but I interpret it as the total number of hours worked on the project based on the efforts of a single person. He then divided this figure by 8 to get to an 8-hour 'working-day', giving 17,300 working-days. He assumes the wage of a labourer to be HS2.5 per day, and calculated the cost of the aqueduct multiplying the single labourer wage with his 17,300 working-days to obtain a total cost figure of HS43,000.¹⁹ For a number of reasons, this seems absurdly low (see below). He does not give details of his calculations. It would appear that he took into consideration only the operation of digging loose the soil, which in practice is only part of the operation. If removing the soil is taken into account Stephens'

¹⁹ Based on the 138,400 labouring hours and the volume of material of 30,750m³ it would have taken 4.5 hours to dig a cubic metre of compacted material or 1.78m³ per day. If a present wage of £4/hour is taken, it would cost £18 to dig one cubic metre of material, which seems low.

estimate could at least be doubled. He did not take into consideration cutting into the flint rock. I suspect the original number of "man-hours" to be too low for the reason mentioned, and that he did not allow for side-cut into sloping ground, of which there was a fair amount.

4.5. Calculation of aqueduct quantities.

Initially it will be assumed that all the excavation is only in soil. Allowance can be made for rock chipping and removal afterwards.

At the Leiden Museum in the Netherlands, I measured the size of a Roman spade recovered from the Roman fort at Valkenburg. The blade dimensions were approximately 0.273m wide by 0.219m high. Assuming that a typical spadeful of earth would form a roughly triangular prism, I estimate that it would have required about 10 spadefuls of loose soil to fill a cubic foot²⁰ (0.0283m³) container, or about 353 spadefuls to fill a cubic metre container. Compacted soil *in situ* will, when loosened, occupy between 1.65 to 1.75 times its compacted volume; I have used a factor of 1.71. Hence the uncompacted volume calculated from the cross-sections shown in Fig. 7.5 should be 41,400m³ multiplied by 1.71 giving 70,700m³ to be dumped as uncompacted spoil. For calculation purposes I used the slightly higher volume of 70,800m³ (c. 2.5 million ft³) to make the calculations clearer. At 353 spadefuls per m³ (10 spadefuls per ft³), this would have required about 25 million spade movements²¹.

Based on personal experience of unskilled labour-intensive road- and dam-building projects, I shall consider two time lengths that it would have most likely taken to complete a spade movement: a half-minute and a one-minute time span. These time spans vary considerably in practice, but it provides an order of work activity for estimation purposes. These also take account of waiting time between different activities, breaks and changeover time.

To start with, let us consider the basic spade movement of half a minute to set out the calculation procedure for the time spent on shoveling the loosened earth into containers. The figures thus produced can then be adjusted as multiples of the half-minute base value. On this basis it would have taken of the order of 12.5 million minutes or roughly about 8,680 man-days for a 24 hour day (23.8 man-years), to fill the

20 Initially I calculated everything in the feet/pound system and then converted the values to metric values. The original figures were all rounded figures but on conversion to metric equivalents tens and units enter into the values which is not really justified as one cannot usually estimate large bulk volumes so closely.

21 See previous note.

containers with the total of 70,800m³ (2.5 million ft³) of loosened soil. For an 8 hour working day the above will come to 26,040 man-days (71.3 man-years). If the period was one minute for completion of a spade movement the time taken would be doubled. The above applies only to the filling of the containers. The diggers loosening the soil would have taken a comparable time and so would the carriers of the spoil. So effectively the three operations would have involved three concurrent periods of 26,040 man-days.

Next, I consider the number of labourers required to do the digging, the filling of containers and the removal of soil. I have used the calculation of time taken by the labourers who fill the containers as the basic unit for calculating the overall time of construction, as their work regulates also the carriers' work load and the rate at which the project progresses²². I have considered four units of labour forces used to fill the containers with soil: 200, 100, 50 and 25. I present the estimate of the time taken for 200 men to complete all the excavation, and for the other labour force units the calculation is summarized in Table 7.3 (p.276). If we assume that the large force unit of 200 'labourers' was available to fill the containers each day, that would give a figure of 43.4 labour-force-days for a 24 hour work-day. If a day's work was based on 8 hours and the efficiency 75% ($43.4 \times 3 \div 0.75$), then the time taken would have been 174 days (about half a year) to complete the excavation if all the work was only in soil. With a labour force of 100, the work would require 348 days, or about 1 year. If the labour force was only 50, the work would take 696 days or nearly two years, and with only 25, the work would have taken 1,392 days or nearly 4 years. If the time period is one minute per spade movement on average, then the above figures would all be doubled. Therefore, for the labour force of 50 the project could easily have taken about 4 years, and with half that number the project could have taken about 8 years.

The logistics of the movement of the containers, based on practical experience, would have required a proportion of carriers directly related to the distance they had to walk to dump the spoil. This ratio multiplied by the 200 labourers who filled the containers would give the number of carriers for each distance. Table 7.2 (no.23) gives the

22 For modern construction projects, apart from the preliminary planning period, the actual construction period on earthworks projects is usually governed by the time excavation and moving of earth takes to complete. The same would apply to a building project where the controlling operation is usually chosen to estimate the length to complete a project.

relevant information from which to determine the number of carriers required²³.

Table 7.2: Ratios of filling times relative to times taken to dump spoil.

Distance walked from pickup position (m)	Time taken (mins)	Pickup and dumping (min)	Total time to dump soil (mins)	Filling container at 0.5min per spadefull (mins)	Ratio 1:	Filling container at 1.0min per spadefull (mins)	Ratio 1:
d			x		y_{2.5}		y₅
200	6.4	0.4	6.8	2.5	2.72**	5.0	1.36**
143.75	4.6	0.4	5.0	2.5	2.0	5.0	1.0
100	3.2	0.4	3.6	2.5	1.44	5.0	0.72
65.625	2.1	0.4	2.5	2.5	1.0	5.0	0.5
50	1.6	0.4	2.0	2.5	0.80	5.0	0.44
25	0.8	0.4	1.2	2.5	0.48	5.0	0.34
10	0.16	0.4	0.56	2.5	0.29	5.0	0.14
0*							

* This situation will pertain when the soil is dumped onto the embankment directly by spade. For only this situation will no carriers be needed.

** The ratios show that the time taken to walk the distances can be either more than, equal, or less than the time taken to fill a container. When the ratio is equal to 1, then the number of carriers required match the number labourers filling containers. If the ratio is greater, more carriers are required by the proportion indicated by the ratio. If the ratio is less than 1, then the number of carriers needed will be less by the proportions shown by the ratios. If the ratio is zero then no carriers are involved and the spoil is dumped in its final place by spade. The critical distances shown for the ratios to be 1 is shown in bold numerals. On a labour intensive project tables of this kind (usually more elaborate) are used to regulate labour distribution for this type of work. Equations of the linear relationships are given by 1) $y_{2.5} = 0.4x$, and 2) $y_5 = 0.2x$. Equations relating the distances walked to the relative ratios are given by 3) $y_{2.5} = 0.0144d$, and 4) $y_5 = 0.0072d$. From these any other values of the ratios can be calculated based on the time taken and distances to walk to dump the spoil, from which estimates can be made to balance number of labourers filling containers against number of carriers.

23 The mass per unit volume of *in situ* soil is about 1800kg/m³, i.e about 112 lb/ft³. Therefore, in its loosened state it will be about 112/1.65 pounds or nearly 70 lb/ft³. It is estimated that a carrier will on average carry about 35 pounds of earth at a time. For a rate of 0.5min per spade movement and 10 spades per cubic foot of soil, it will take 2.5 minutes to fill a carrier's container of about one-half a cubic foot. If the spade movement is 1 min/spade it will take 5 minutes. The distance the soil will have to be carried will vary. Table 7.2 shows distances from 200m to zero and assuming that the carrier walks at a pace of 16 min/km. The times taken to walk to the dumping position and back are shown in second column, to which must be added the times shown for items 1 and 2 below, which remains constant. The sequence of his movements will be as follows:

- 1 - pick up container and adjust to carry 0.2 min.
- 2 - dump soil and get ready to return 0.2 min.
- 3 - filling of container by shoveller: 1/2min/spadefull; 2.5 mins (constant).
- 1 min/spadefull 5.0 mins (constant).

Therefore, proportion of filling time : collecting, walking and dumping time, expressed as a ratio of y:x, where x are the times given in the 4th column, and $y_{2.5}$ and y_5 the ratio values given in column 6 as 1: $y_{2.5}$, and in column 8 as 1: y_5 .

There would have been a labour contingent who loosened the soil with pickaxes. It would probably have consisted of at least as many labourers as those who filled the containers, that is another 200 labourers. As there would have been any number of miscellaneous duties to perform I also add another 100 men of more professional status. There were likely to have been other functionaries such as accountants, paymasters, blacksmiths, carpenters, and others such as ordnance staff. This gives a labour force of roughly 700 men based on the initial 200 unit. This means for the 50 men basic unit, the total labour force would probably have been of the order of 175-200 men. Pure speculation, but if one has to produce a budget for a project these are the kind of estimates and assumptions that are made in practice, always with some past experience to help in projecting an acceptable initial budget for planning purposes. It generally always seems to be too low when compared with actual construction costs.

The question of economics would have been an important consideration in determining the size of a team, particularly with regards to the raising of revenue for the project. Local town administrations were responsible for their own cults, public buildings and social services, and for their own finances and provincial tax. So it may have been reasonable for the city's administration to have wanted to spread the work out over a longer period in order to extend the period for raising funding from whatever sources. Hence, they may well have preferred to use a smaller work force and spread the cost of constructing the leat over a number of years, rather than a large force capable of completing the project in less than 1 year (see Table 7.3). The work force might therefore have been at the lower end of the scale shown in the table. And, of course, the number could have varied from time to time during the work period.

Who the labourers were that worked on the aqueduct at *Durnovaria* is not known. Pliny the Younger refers to criminals condemned to work as forced labourers on public works (*damnatio ad opus publicum*)²⁴. Citizens in some Spanish and Egyptian cities could be conscripted to give a small number of days service on public works (Duncan-Jones 1990, 176-7). The same could also have applied to the province of *Britannia*. However, this can only be surmised, as we have no way at present of determining what actually happened.

²⁴ Pliny, *EP.* 10.31-2.

Duncan-Jones' quotes the wage scale for farm labourers as determined by the Diocletian Price Edict of AD 301 (1982, 11, n.6).²⁷ as being 25 *denarii* per day and food, which seems to reflect an inflation rate of 17-19 times of the wheat-price compared with the 2nd century prices (Duncan-Jones 1982, 366). If these rates of inflation are applied to the 25 *denarii*/day, the uninflated rate in the 2nd century wage would have been about 1.4 *denarii*/day or HS5.6. This is 3.5 times the Mons Claudianus rate of HS1.6/day and 2.25 times the rate of HS2.5/day. The construction of the Dorchester aqueduct is suggested as having been built in the late 1st or early 2nd century, or about 200 years before the DPE had effect. Therefore the rates of pay provided for in the DPE cannot be used as a common labourer's wage for the 1st and 2nd centuries. The rates of pay of ordinary soldiers were HS2.75 and HS3.3/day in AD 84 and had doubled by AD 197 (see n.26), which may suggest that the labour pay rate of HS2.5/day is not excessive and that the rate for the Egyptian quarry workers may not necessarily have applied in Britain.

Based on the two rates of HS2.5 and HS1.6 for the assumed 600 common labourers and a higher rate of HS5/day for the 100 specialized workers, (assuming that skilled workers and professionals would have earned at least double that of the unskilled labourer), the cost estimates for the project for all workers, are:

- a): $\{(HS2.5 \text{ /day} \times 600) + (HS5 \times 100)\} \text{ men} \times 174 \text{ days/men} = HS348,000$
and
b): $\{(HS1.6 \text{ /day} \times 600) + (HS5 \times 100)\} \text{ men} \times 174 \text{ days/men} = HS254,040.$

If the aqueduct was actually 4km shorter, as suggested by recent excavations, the costs would have reduced by a factor of about 22%, that is, to HS278,400 and HS203,200.

It is difficult to compare these figures with costs for aqueducts in other parts of the Empire where costly stone channels and bridge structures carrying the aqueduct conduits were involved.

By AD 212 the rates of pay had increased by 4 times and by AD 235 the rates had increased by 8 times to **HS7,200** and **HS6,000**/per year, or HS19.7 and HS16.4/day. (M A Speidel in *JRS* 82, 1992, 106). The author states that the bold figures are based on direct documentary or literary evidence.

27 Duncan-Jones 1990, 176-7: Wachter 1978, *Roman Britain*, 215, says that the basic agricultural wage for a day labourer was 25 *denarii*, but he also received fringe benefits of food'. I have not included food costs, assuming that the labourer provided his own food.

Pliny writing to Trajan mentions the cost of HS3,318,000 for an incomplete aqueduct.²⁸ Coulton (1987, 84, n.43) gives costs of several aqueducts varying in cost from about HS8 million (Aspendos) to HS30 million (Alexandria Troas) for aqueducts in the Eastern Empire (Coulton 1987, 84). Duncan-Jones (1982) gives extensive tables of estimated costs of buildings and other structures, but not costs of aqueducts, except at p.318 n.4, where he states that the cost of 'the Aqua Marcia (built in the second century BC) was HS180 million, and the Aqua Claudia and Annio Novus HS350 million'. (Macmullen does not seem to give costs for aqueducts). These structures involve stone bridge work, which generally would be more expensive.

What has not so far been considered is the excavation in the flint chalk rock, of which there has been evidence in the recent excavations. The photograph shows the rock cut at the lower part of the channel on both sides. Because the flint rock would have been pervious, it was lined with a clay layer shown in the picture (Fig. 7.6).

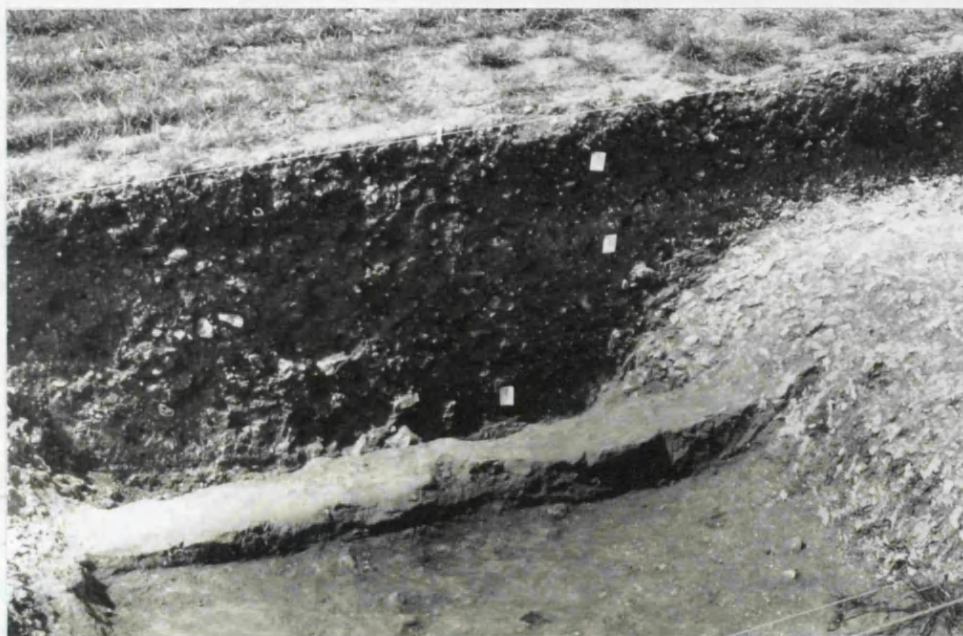


Fig. 7.6 Photograph of rock cut of the Dorchester leat, near Bradford Peverell (AB).

This activity would have included another sequence in the construction operation, not allowed for in the cost estimate of the aqueduct. I have no figures for the length of channel that was in rock-cut, but if one takes a stab at 5% (I suspect it was higher), and at a rate of four

²⁸ Pliny, *EP.* 10.37.

times the cost of excavating the soil, then we need to add another fifth to the above cost amount giving an excavation labour cost of a) about HS365,400, and b) about HS266,700. To this should be added the equipment and material costs, such as pickaxes, shovels, hammers, chisels, sack and bucket containers, rope, pegs, levelling staffs, surveying equipment, and other peripheral costs. This is usually taken for estimation purposes at 40%. So an overall rough estimate for the Dorchester leat aqueduct for the two rates of pay is a) about HS511,500, and b) about HS373,400.

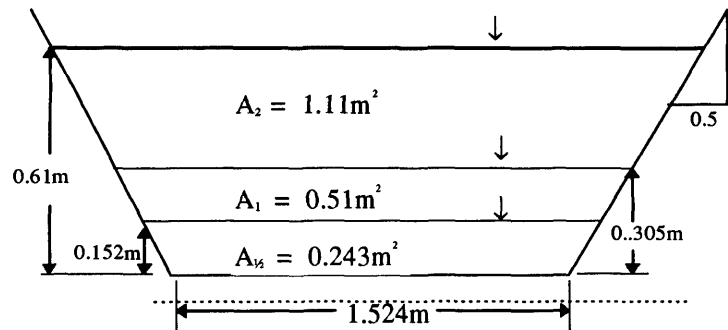
However, if one considers the inflation that has taken place indicated by Duncan-Jones' figure of 25 *denarii*/day for farm-workers during the later 3rd to early 4th century, the rate of pay for labourers could have increased by a factor of 2, which would have doubled the cost of the aqueduct. This aqueduct was a simple earthworks type structure only, but the cost of digging and moving of one cubic metre of soil/rock would have been about HS15, which is low considering that a fair amount of rock was present in the excavations. The cost calculated applies only to direct labour costs for digging and dumping the material. There usually are hidden costs such as surveying and problems with the peculiarity of the site, which would have added to the total cost. The assumption is that the town hired the labour for the project. If the town had a private contractor who tendered for the work, the costs would probably have been considerably higher, because a contractor has to allow in his tender for some profit and for hidden costs, and the constraints placed on him.

The above cost estimate is based on a number of assumptions which might not have applied at all during antiquity, but it gives an order of cost for such a major project in the 2nd century AD. This would have represented a large sum of money for a town like *Durnovaria*, notwithstanding the much higher costs suggested in the sources for aqueducts elsewhere. My calculation could easily be out by 30 to 50%, or even more either way, but the implication is that constructing an aqueduct like the Dorchester one was a major undertaking. The appointed *aedile* would initiate, plan, budget, organize the labour force, provide technical expertise, food, equipment, and finally supervise the construction of the aqueduct. The maintenance of the aqueduct once constructed, would have been his responsibility, but even so must have been a constant concern for the town administrators. There however seems to be no evidence of maintenance activities on the Dorchester aqueduct,

which, of course, for an earthwork type structure could have been obliterated during the later periods.

4.7. Flow in the Dorchester aqueduct.

The RCHM(E) article (1970, 587) quotes the discharge volume calculated according to Lewis and Jones (1960, 78-9), arriving at a maximum discharge rate of 58,908,000 litres/day (12,958,000 galls/day), for a depth of 0.61m (2ft) of flow in the leat. This is an enormous quantity of water. Figure 7.7 illustrates the ratios of water flow for different depths in the leat. For a depth of flow of only 0.305m (1ft) the water quantity would be less than half the previously suggested discharge rate, that is only 27,040,000 litres/day. If the flow depth was 0.24m (1/2ft) the quantity of water delivered would be only about 1/5th the suggested figure at 11,781,000 litres/day. The storage capacity at the source end would have had to be considerable to provide even this low quantity of flow. This low flow rate is still a large amount of water for a town, of say, about 10,000 inhabitants, providing about 1,200 litres/head/day. Conceivably during heavy rains and a flood period the high figure for the Dorchester aqueduct could have been possible and even greater, but it is likely that the town authorities intended the flow to have been at the lower end of the scale.



$$A_2 : A_1 : A_{1/2} = 1 : 0.46 : 0.22$$

Approximately 1 : 1/2 :

Fig.7.7: Relative flow in channel (AB).

Hodge (1993, 347) gives a table of estimated deliveries of water for a number of the aqueducts of the Empire. In contrast to the Dorchester aqueduct, the Anio Novus, Marcia and Claudia aqueducts each delivered to Rome in excess of 184 million litres of water per day. Many other aqueducts are reported to have delivered water in excess of 100 million

litres/day. One of the reasons why aqueducts provided such large quantities of water, is that the engineers had to ensure that a source would be able to deliver a sufficient quantity of water to justify the expenditure on an aqueduct. A second factor in antiquity was that they had no real practical means of controlling the flow from the source to the delivery end. In modern times very sophisticated gate-valves are provided, which are controlled electronically, to supply an urban community on a demand basis. It also means that it is a simple operation today to stop flow in an aqueduct for maintenance purposes. This was not such an easy matter in ancient times, though there is evidence of sluice gates (cut-off wooden planks which could be slipped into grooved slots) (Hodge 1983, 319).

There is also archaeological evidence of accumulated sinter or calcium carbonate deposits which had to be removed from the channels of aqueducts. The phenomenon is caused by a chemical reaction between calcium in the water and carbon dioxide in the atmosphere to form calcium carbonate. Once the initial surface reaction has started the calcium carbonate continues to deposit on the layers of sinter already deposited. There does not appear to be any evidence for this along the aqueducts in Roman Britain, mainly because in leat systems the calcium carbonate that does deposit is probably eroded. However, there are pipes in Roman Britain which have evidence of sinter deposit.

The Romans always allowed for overflow facilities and apart from the public function of fountains as water supply points, excess water was used to clean the drains along streets and public latrines, and thereafter discharged into the sewer system or directly into a river. At Dorchester near the west gate, Bill Putnam (1984, 40) comments that the aqueduct must have delivered its water to the *fons aquarum*, or public fountain, and the "surplus water overflowed from the fountain, and was used to flush the lavatories before returning to the river below the town" (40). It has been suggested that the deep conduit which was found in Colliton Park served both as a spillway for excess water from the aqueduct and as a distribution channel to private homes. This wastage of water is an indication that water was not generally considered as a material from which income could be derived.

The construction of aqueducts, however simple, entailed major works for any community. We know very little about how the Romans set about construction of their major projects, although a few sculptures and paintings do give some indication of men at work and what tools they

used. Frontinus and Vitruvius mention some aspects of construction, but generally they only give rules about of how to find things like water and how it was distributed in Rome.

5. DIGGING OF WELLS

A number of sites referred to in Chapter 4 had wells which drew special attention, either because of their considerable depths or because they required steining. Wells that required steining is usually an indication that they were made in soils which showed stability problems. Only a few wells from the Roman period have been described in detail, such as the well at Wilford in Wiltshire (p.137) and the well at the forum in Lincoln (pp.123-4). Pitt-Rivers refers to the two deep wells he excavated near Rushmore (p.132), and a 30.5m well is reported at Brading on the Isle of Wight. However, not much has been said about how the wells were likely to have been dug, and about the remains of the steining timbers or masonry used in them. Detailed drawings have been made for the well-head at Lincoln and the stratigraphy of the materials through which the well was dug. Digging of wells was a well developed procedure and they are found at every type of site, and often in large numbers as at Silchester, London and Newstead. I shall briefly look at some problems associated with digging of wells.

Construction of wells was a special type of project because usually few people are involved. It is not known who were used for digging wells, but there is the possibility that there were professional well diggers, who were used at civilian sites. At military sites soldiers may have been used, but because of the nature of the work it is likely that cheap local labour or slaves may have been employed working under supervision of a military officer. Hand dug wells had to be of such a diameter that at least one person could dig and place the loosened material in containers for hauling to the surface. For that reason wells are seldom recorded as having a diameter less than one metre. A number of wells have been found with diameters of 2m, and larger. In large diameter wells more than one person could work down a shaft at the same time²⁹. Wells with a square cross-section may not necessarily have been dug square, but their steining timbers give the impression that they were square. There were advantages to digging a round well to insert square steining timbers, because if the diameter was slightly larger than the diagonal of a square steining structure it would assist in supporting

²⁹ In areas where shafts were sunk for recovery of lime in the chalk formations of southern England the shafts were usually larger than 2m in diameter so that more than one person could work below at the same time.

the corner posts and would have provided the space to place the lateral planks in position. Working in the confined space of wells creates special problems, particularly from the health point of view (see p.101). To what extent that would have been a consideration if slaves were used, is not known. Another problem would have been the supply of sharpened tools for working in rock.

It is difficult to estimate the cost of deep wells for the Roman period because extrapolation of costs based on modern practice would be invalid. Modern costs for drilling shafts with the large diameters mentioned in the literature (i.e. from 1m to 2.75m) would be of the order of £3000 to £6000 per metre drilling in soft rock, with at least another 25% additional costs to establish the equipment and personnel on a site to do the work. A shaft of 30m depth could cost from £100,000 to £250,000. Drilling in hard rock formations could increase those costs by several orders. In antiquity digging a shaft in soil or gravel conditions would almost always have required support of the walls by steining, which would have taken a long time considering that everything was done with hand tools and using rope, ladders or steps cut into the walls of the shafts. If the soil or gravel layers were unstable from the start steining would have had to be carried out at regular depth intervals before it would have been safe to proceed further down. Major problems in digging a shaft by hand are dust and lack of fresh air from about 6m down. It is customary for amateurs who dig wells by hand to have air cylinders blow fresh air into the hole with a pipe lowered to the bottom. The ancients did not have this advantage.

The rate of digging a well is difficult to assess because it depended on the material to be penetrated and the quality of the chissels used to loosen the rock. Soils and gravels would be relatively easy to dig, but as the depth increases removing the loosened material would change the rate of effective penetration of the shaft. Table 7.4 gives the volumes of materials that have to be removed for wells of different diameters and depths.

When a layer has been loosened it would have to be placed in a container to be hauled to the surface, which would take a longer time as the depth increased. If a container of 0.5ft^3 (0.015m^3) is used to haul the material to the surface it would require well over 2000 movements of the container for a 1m diameter well 10m deep.

Table 7.4: Volume of material in round well shafts (m³).

Diameter(m)	Depth(m)				
	1	5	10	20	30
1	0.78	3.9	7.8	15.7	23.5
2	3.14	15.7	31.4	62.8	94
3	7.07	35.3	70.7	141.4	212.1

Effectively the rate of digging the shaft could decrease from 1m for the first metre of digging per day to 1/5th and less per day for deep wells. At an average rate of 0.2m/day for a 1m diameter shaft it would take a minimum of at least 50 working days to dig 10m and for a 2m diameter shaft it would take a minimum of at least 200 working days. To this would have to be added the time taken to install the steinning, which could easily double the length of time taken, since this operation would become increasingly more difficult with depth. Digging in soft rock would be several times slower and here the rate of progress would depend more on the rate to penetrate the rock and usually steining was not necessary. The above estimates are based on working an 8 hour day without stopping, which would hardly happen in practice, so that the rate of progress of sinking a well would have taken even longer than shown above.

This brief discussion is intended to show only some aspects of well digging, as there are other problems that would have faced the ancient well digger. An important issue always was where to dig and be certain of getting to water-bearing layers. Although Vitruvius (Vit. 8.1) gave his views on finding water, in practice it seems that digging was carried out on a site where water was required, hoping that water will be found. In areas like London and Silchester the materials were water-bearing gravels so that water was easily found. The two deep wells at the settlement at Rushmore and the one at Lincoln were in rock.

6. WATER IN THE ECONOMY OF ROMAN BRITAIN

There seems to be no evidence that water from public water supplies had to be paid for in Roman Britain, as for instance, it was paid for in Rome by private owners of baths. This would imply that water was not used as a source of revenue by towns which provided running water to communities, but this cannot be proved. However, indirectly water was necessary for many industrial enterprises such as agriculture, mining, quarrying, building, lime production, tile manufacturing, metal working, tanning, pottery and the mosaic industries. Agriculture would have depended on rainwater, so that special

provision of water supplies to irrigate crops and market gardens would not have been necessary.

Many industries would have been located near rivers for easy access to water, while for some others, well supplies would have been adequate. Roman pottery manufacturing was a major industry in Britain, illustrated by the wide distribution of kilns south of the military zone (Jones and Mattingly 1990, 206, Map 6:24). Several excavation reports³⁰ describe the kilns and type of pottery produced. Swan mentions a number of pottery sites where wells and springs were the main water supply sources (Swan 1984, 6). Usually wells, tanks or other provisions for water storage were situated within about 400m of the workshops or kilns, (1984, 6). She refers to the pottery industry at Sheepen, Colchester, where there was a well near the kiln sites (1984, 44). At Colchester there is indication of an aqueduct at Sheepen, which possibly could have served the extensive pottery works at Warren Fields (Swan 1984, 92-5, Fig. XXIII), where more than 30 kilns have been found. The pottery production centre at Alice Holt Forest, also with more than 30 kilns as indicated by waster dumps, was another sizable operation. Two short leats have been found taking water from small streams to two clay pits near the kilns (Lyne & Jeffries 1979, 3-4, Figs. 1 & 2). In the Cantley/Rossington area, Doncaster, one of the "largest excavated regional kiln concentrations in Britain" with more than 40 kilns (Swan 1984, 105), seems to have produced the remains of only a single well near kiln 14 (Gilmour 1955, 536-45; YAJ 39, 1956, 33, Fig. 1). If this was the only well it must have been a public well, which introduces the question of ownership. The plan shows concentrations of kilns about 3/4km and 1 km from the well, which is a long way to carry water daily. It is likely that alternative water supplies must have been available. If, for the production of pottery at each kiln, a minimum of 100 litres of water per day was required, then a minimum of 4,000 litres/day would have had to be drawn from the well each day. A 2m diameter well with a constant water depth of about 2m would have been adequate to provide that quantity of water each day. The constant preparation of the potting clay would have required water storage closer to the workshops where the pottery were made than the distances from the well seem to indicate. Swan has indicated that water storage facilities were usually nearby kiln groups. The extensive pottery

30 AJ 38, 1955, 403-6, 407-12, 536-45, Pls.I-IV; 39, 1958, 32-47, 364-88. Continued excavation of the sites seem to have been terminated because of lack of further funding at that time.

industry along the Nene valley most likely obtained its water directly from the river.

The Dolaucothi gold mine in Wales is an important example of a site where aqueducts were specifically constructed for industrial use. Since the mines would have become imperial property once the people of west Wales were subdued, it is likely that the aqueducts were constructed by the army with the help of slaves. The main aqueduct was 11km long and tapped the Cothi river near the Pwll Uffern waterfalls north of the site. Several sections were rock cut, and Haverfield commented that some sections may have had a flat ledge on which wooden troughs or pipes were laid, which have long since disappeared (Jones, et al, 1962, 72). It filled a large masonry tank of about 11 million litres capacity, from which water could be quickly released in great volumes to remove soil in the hushing technique to expose gold-bearing quartz veins. Excess water was directed into a reservoir above the main workings, which was used for ore-washing (Jones, et al, 1962, 72-5). Two shorter aqueducts along the Anell and Gwenlais valleys provided water for other parts of the mine workings (Burnham 1994, 42-3). At one point the Cothi aqueduct crossed a low point and it has been suggested by the excavators that a conduit of some kind may have been carried on wooden trestles to maintain a flow gradient, but there is no visible evidence of remains to confirm the suggestion. It has also been claimed that an aqueduct near Linley (Shropshire) also supplied water for sluicing purposes to expose lead and silver ore bodies. There may have been other sites where this hydraulic technique was used (Jones and Mattingly, 1990, Table 6.1).

Tanning and metal working industries would also have needed water, for which wells and other simple water storage facilities would have been adequate. Evidence for tanning operations have been found at Wroxeter (*Brit.* 9, 1978, 437), at Brithdir (*Brit.* 7, 1976, 296) and at Alcester (Hingley 1989, 93). At the latter site wells were most probably the water supply, but no water supply has been recorded for the fortlet at Brithdir, for which the water supply was probably the River Wnion. Metal-working industries during the Roman period were widely spread over Britain, and at many of the sites water supplies have been recorded, but the water requirements for the industries have not received much attention.

The need for water in the building industry would primarily have been used for mixing of mortars to lay bricks and bond masonry in structures, plastering of walls, and for mortar sealant for tanks and channel type aqueducts. The water could have been obtained from any source such as local springs, streams, wells or from running water supplies if they were available. Mining, quarries, tileries and lime production required substantial quantities of water and would have needed dedicated water supplies, which could easily have been channeled from springs or streams. Industrial enterprises would generally have been close to water sources such as rivers, streams or springs, unless water was brought in by aqueduct or wells were dug nearby. I have not studied the problem of water requirements for these special industries other than the aqueducts supplying water to the gold mine at Dolaucothi.

7. COSTS AND ADMINISTRATION OF BATHS

How public baths were administered in Roman Britain is not known. From the literature and inscriptions of baths elsewhere in the Empire there is evidence for quite a complex bath management staff. Nielsen says "The Roman system of bathing was so complex that a whole team of persons of different rank was necessary for the baths to function satisfactorily" (1993, 125).

The large *thermae* complexes could have been publicly owned, either by the state in the name of an emperor, as for instance the large *thermae* of Caracalla, or the bath of Agrippa. In many places like Rome and Ostia, baths used by the public could be privately owned (Nielsen 1990, 119). Towns were the owners of public baths through the elected body administering the town. Depending on the size of these baths there would have been employees who would have been specialized to run such an enterprise. Nielsen suggests they were often freedmen or slaves (1993, 125). If there were traders, tavern-keepers and prostitutes at baths, they no doubt paid some form of rent to the owner. In Rome many baths were constructed by private persons and run as commercial enterprises (Nielsen 1990, 120). In Britain it is not certain whether there were any privately owned baths that could be used by the public. Privately owned baths in Britain usually were associated with villas or houses in towns. However there were large public baths in towns such as the baths at Wroxeter, Leicester and Bath. It is not known how these British baths were administered and whether they were run on the same basis as their counterparts elsewhere.

It would seem that the supervision of public baths came in the early days under the *aediles*, one of the town magistrates, and during imperial times were supervised by an appointed curator, and still later became the responsibility of the city prefect.³¹ There was an official called the *balneator* who seemed to be the person who was in daily charge of the baths (Nielsen 1993, 127), with many responsibilities, and it was he who had to oversee that the bath temperatures were correct, and that there was enough fuel of the right kind. He was the person against whom complaints were made to the owner if there were some aspect bathers objected to in the running of the baths. However, we do not know whether the same sort of control existed at public baths in Britain. Conceivably one of the *aediles* or an assistant would have exercised that duty at baths in British towns. Who would have been the employees at baths in Britain is difficult to ascertain, because the type of person in Britain who would have worked at a bath would not likely have been freedman or slaves as suggested for Italy or other parts of the Empire. Whether baths were run by the town itself or whether they were leased out as a commercial enterprise we will probably never know. Small private baths probably had one attendant, mainly to ensure that the furnace was regularly stoked and that there was always water in the three different kinds of baths. Baths at forts or fortresses would no doubt have been under the direct control of the army, but even for those baths it is not sure who would have carried out the more menial type jobs.

Wood fuel would have been a most costly item to provide, especially as costs would have involved the original purchase of the wood, cutting and transporting to a destination. In a *papyrus* from Egypt (*Plondon* 1166, lines 72f {AD 42}) it is required 'that a gymnasiarch 13 months before taking office should furnish, for the baths belonging to the gymnasium, fuel amounting to 12,000dr. = HS12,000 per annum' (Nielsen 1993, 123). This is about 13 times the amount paid annually for water, also for Egypt (see below). The cost of water to baths is a difficult issue, because public baths run by a town may have owned the aqueduct and therefore the supply of water would normally have been supplied free to the bath. But there are several references indicating that water supplied to some public baths was paid for, for which the evidence is cited by Nielsen (1993, 124, ns.26-29). For instance water for the Severan baths in Egypt cost 18 *obols* per day, the equivalent of HS924 per year (Nielsen 1993, 124, n.30)³². It was not uncommon for a benefactor to invest an amount

31 Nielsen S, 1993, 125, n.7, refers to O Robinson who published an article 'Baths, an aspect of Roman local government law', in: *Sodalitas. Studi in onore A. Guarino*, 3 pp. 1065-82. I have not been able to refer to this reference.

32 *Plondon* 1177, lines 30ff, {AD 113}.

of money that would cover the cost of water supply and fuel for public baths. If baths were leased out, the lessee would have had to bear the cost of supplying water to the bath and have had to obtain a license to draw water from an aqueduct (Nielsen 1993, 123-4). Baths would have required regular maintenance because of the high temperatures to which many parts were exposed. It is clear then that a public bath, even of modest sizes would have represented considerable expenditure for a town. Towards the later 3rd and 4th centuries the operation of baths became so expensive that additional demands were imposed on many different groups of the community and in some instances the state may have taken them over to ensure their continued operation (Nielsen 1993, 125).

Nielsen (1993, 131-5) gives a detailed discussion of admission charges for bathing. The source material reveals that it was common to charge for bathing from early antiquity, and later the term used for this admission charge was referred to as the *balneaticum*, in Greek βαλανικόν. Public baths were paid for by a tax, documented in many accounts and receipts from the Ptolemaic period (Nielsen 1993, 131, n.3), but there seems to be little evidence for this tax in the Roman context. However the costs of running town public baths seem to have been paid as a liturgy or *munus* by elected officers of the town council (Nielsen 1993, 123 n.4), or by donations. Evidence from Egypt, recorded on Greek *papyri* and *ostraca*, show the two methods of payment by tax and admission (Nielsen 1993, 132). An entry fee was charged to Greek *gymnasia* and the king of Egypt received a large income from public baths. If the baths were leased out, the king received a third part (*trith*) of their income (Rostovtseff 1941, I, 312). As commercial enterprises no doubt the rents charged for the various facilities offered within the baths would have been based on some profit making basis, because the admission charge would be insufficient to cover all the costs of running the baths.

There are many references to the payment of admission charges, first referred to by Cicero (Cic. Cael. 62), who stated that the cost to use baths in Italy was a *quadrans*, (= 1/4 *as*). From Diocletian's time bathing was affected by inflation, who in his Edict of Prices dictated that the charge to public baths would be 2 *denarii* (Nielsen 1993, 129, 133). It seems there was, during the later Empire period, an additional charge of 2 *denarii* for cloakroom facilities both at public and private baths, collected by a *capsarius* (Nielsen 129, 133). From the admission charge the leaseholder of a privately owned public bath was expected to pay his annual tax. Admission charges would therefore have covered only

a small portion of the running costs of a bath. The leaseholder met his financial obligations by sub-licensing certain functions, such as cloakroom facilities, shops and other facilities, and the supply of oil. However, little information is available on how these privately leased baths functioned (Nielsen 1993, 124). For Roman Britain we also have no information on the financial implications of running bath institutions.

Yegül refers to the text of the management of a small bath belonging to the state mines and the mining community of Vipasca (modern Aljustrel?) in Portugal. The bath was leased out under contract to a lessee, giving the details of his obligations (1995, 47, and *CIL* II, no. 5181, lines 22f). The contract stipulated that the lessee were '... required to heat the baths and keep them open for use entirely at his own expense every day from day break to the seventh hour for women [until c. 12.00-1.00pm] and from the eighth hour of the evening to sunset for men [from c. 1.00-2.30pm to c. 6.30-8.30pm; the first set of figures being winter hours], at the discretion of the procurator in charge of the mines'. The lessee was responsible for 'a proper supply of running water for the heated rooms, to the bath-tub at the highest level and the basin, for women as well as men. He shall charge men 1/2 as and women 1 as each [1/4 of a *sestertius*]. Imperial freedmen and slaves in the service of the procurator of the mines are admitted free; likewise minors and soldiers...'. It seems to have been the common practice for men and woman to have different bathing hours, and in some of the larger establishments even separate bathing facilities. However gradually mixed bathing became common, at least in Rome, as referred to by Martial and Juvenal³³, and probably as a result of increasing scandals, Hadrian placed a prohibition against mixed bathing ("*lavacra pro sexibus separavit*")³⁴. The hours of bathing reserved for men during the afternoon session coincides with the social practice of having dinner in the late afternoon, so women had to use the baths during the morning. There may have been other reasons why the sexes were separated, particularly moral reasons, as commented on by both Pliny the Elder and Seneca³⁵. Another possible reason may have been that women used the baths differently. The enforced separation time when they could bathe would have increased the cost of the bathing facilities, a probable reason for the increased entrance charge to them in this instance. The

33 Martial, 3, 51; 3, 72; 7, 67; 11, 47; Juvenal, *Satires*, 6, 412ff.

34 SHA, *Hadrian* 18,10. The ban was revoked under Marcus Aurelius, but raised under Elagabalus. See Yegül, 1995, 429, n.24.

35 Pliny, *N.H.* 24, 26, (transl. H Rackman); Seneca, *Letters*, 86, 10, (transl. RM Gummere).

lessee was also required to keep the bronze equipment of the baths and its fixtures clean by washing, drying and coating them with fresh grease every 30 days. He had at all times to keep a supply of wood sufficient for 30 days, and was not allowed to sell wood. If the baths were not kept open and properly furnished he could be fined by the procurator up to HS200 (Yegül 1993, 47). There clearly were very strict regulations to control the running of baths and to ensure the safety and health of the public.

It is not known whether there were any baths used by the public in Britain and leased out to private lessees, and whether similar type contracts were in force.

7.1. Construction costs of baths.

The economics of baths is a complex subject which I cannot deal with adequately here. There is very little information on the actual construction costs of baths in the Roman Empire; however, because of their complex structural features, they must have been very costly structures to build compared to other major public buildings. Duncan-Jones (1974) gives some useful statistics on the cost of baths or the donations made by benefactors. The Forum Baths at Ostia cost about 2 million *sestertii*, whereas the baths at Teanum Sidicinum in Campania cost as little as HS60,000 (30-31, 124-30). Fronto expected to pay HS300,000-350,000 for his baths, excluding the cost of the land (Nielsen 1990, 121). Pliny gave a donation of HS300,000 for the decoration of the baths at Comum, his home town and a further HS200,000 for the *tutela* or maintenance of the baths. He probably also paid for the construction of the baths.³⁶ We have no similar cost figures for baths in Roman Britain, but when baths of comparable sizes are compared from Britain to those in other parts of the Empire, the public baths at Leicester would be considered medium sized (0.42ha). It is suggested by Nielsen that medium sized baths could have cost from HS300,000 to HS600,000, (Nielsen 1990, 122). If a modest bath cost say HS250,000 (=1 million *asses*), at a charge rate of 1/2 an *as* per person, it would have required 2 million persons to be admitted to cover the initial cost of the baths. At 100 persons per day it would have taken about 60 years to have accumulated this cost.

36 *CIL* V 5262 Comum, c. 111-113 AD. It is not clear whether the *tutela* generally included cost of staff and running costs, such as provision of fuel and water (Nielsen 1993, 122-3).

8. CONCLUSION

Romanization was a two-way process: Rome who initiated a course of action to persuade her provincial subjects to adopt the Roman way of life and in the case of Britain, the Britons who adopted aspects of the process. There was, however, a large section of Britons, generally the wealthy and powerful families, who seemed to impose on themselves a kind of self-romanization as they voluntarily adapted to Roman housing, baths and water supplies, particularly reflected in the development of Romano-British style villas without imposition from above. To provide these romanized buildings with the mosaics and wall paintings, professionals from Rome and Italy must have been deliberately hired. On the other hand, culturally and religiously Britons seem to have remained British. This was a tenuous influence, which became evident when the Romans departed and Britons adapted to the new influences of the Anglo-Saxons and Normans.

The source of the Dorchester leat, like all the other known leat aqueducts in Britain, is still not known. The costs of aqueducts in Britain are unknown. A hypothetical analysis of the construction of the Dorchester leat indicates some practical aspects of its construction and provides an order of costs. Additional issues relating to dating, maintenance and length of time the aqueduct remained in service is unknown. The implications for a *civitas* capital when a utility like an aqueduct went out of service must have been serious, because of the dependence of other utilities on its supply of water. In any study relating to the towns of Roman Britain, the loss of their running water supplies must be an important consideration.

Nothing is known about the costs of baths, the single most popular building type that was introduced to Britain by the Romans. How the public baths were run and how they were used, compared to what is known about them elsewhere needs to be studied. There is no ancient literature on the subject, so that interpretation would have to be based on archaeological finds and remains of bath buildings.

There is a real need for a study to determine what level of importance water-related structures had in the economics of urban communities, and what part Roman public baths played in the social life of Britons.

CHAPTER 8.

CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSIONS

Roman water supplies and baths were dominant structural features at many sites in Roman Britain, but their relevance to the social and economic development of urban and rural centres has rarely been included in academic discussion. The economic implications of providing running water supplies and baths would have been important for the communities involved, yet discussions on them do not enter debate on the development of towns or rural settlement (Todd, 1970, 1978; Burnham 1986, 1987; Hingley 1989; Burnham and Wachter 1990). To understand fully the development of urban and rural centres it is important to evaluate the contribution of water supply structures and baths to the development of the economy of Roman Britain and what their social and material impacts were on towns, settlements and villas. The most recent research on water supplies was by Hanson (1970), confined to military sites and major towns, and a review of civil and military water supplies by Stephens (1985a, b)

Aqueduct water supplies brought a new dimension to urban and rural British communities who were quite unfamiliar with artificial methods of providing water where it was required. Their construction involved considerable expenditure for towns and villas, and was related to their economic wealth. Failure of a running water supply had serious consequences for the inhabitants, who became dependant on public facilities such as baths and fountains. The failure of the Dorchester leat aqueduct during the 4th century was possibly responsible for the baths going out of use (Green 1984, 51), which could have accounted for the progressive deterioration in the viability of the town. This may also have been the problem at Wroxeter (White 1990, 5) More research is necessary in order to determine the extent of the effect that failure of water supplies had on the communities they served.

The high rainfall in Britain has tended to reduce the importance attached by scholars for the need of water supplies, but even in the wet countries they were priorities for both the Roman rulers and the public. Even though water was such a basic need, it seldom enters analyses of the ancient economies and development of urban and rural settlements. It was necessary for drinking and cooking, and it was used for washing of the person, washing of clothing, and was needed for bathing facilities, for specialist production in textiles,

potting, tanneries, etc. Yet many scholars who comment on development of urban or rural communities in Roman Britain, hardly ever use the word 'water'. Any synthesis of urban and rural society should take note of the importance of the water needs within that society.

Several issues relating to water requirements are uncertain, such as the amount of water a household would have needed or what quantity was used by industry. It may be possible to arrive at some order of requirements of water usage based on contemporary pre-industrial societies, which will need special study. It is also not known whether towns supplied water only to public facilities and households, or also for specialist production, which needs to be investigated.

Aqueduct water supplies usually came from rural areas, but it is not known what effect the taking of water from a particular area to a town would have had on settlements based near the water source, which needs to be investigated.

Aqueducts found in Roman Britain were mainly of the leat, pipe and simple channel types (Chapter 3, p.57), but no systematic study has been made of their typology in Roman Britain. They were used at all site types, but mostly by military establishments and towns. Where they were used at rural sites like villas, they were usually of pipe construction and relatively short in length, tapping nearby springs. Some leat type aqueducts have been reported for villas (as at Gadebridge Park). Although there are many leats from the Roman period, little has been published about their physical and hydrological characteristics. Along the Dorchester aqueduct, probably the the most thoroughly investigated leat, a number of cross-sections have been made in places where the structure has been positively identified, and on Fig.7.4 (pp.264 & 269) 3 cross-sections are shown. Along sections where it was cut into flint rock the shape is likely to be that of the original cut. Over a period silt deposits would have accumulated at the bottom of the leat to find a flow level for a specific grade along a section, which may have given the impression that the leat was lined with clay. However, the quantity of water that flowed in leats, or for how long the leats supplied water, is not known. The hydrological aspects of aqueducts is poorly understood and needs to be researched to understand how effectively they functioned as water supplies.

Aqueducts have been described at individual sites where they have been found, but at many sites insufficient information is available to determine exactly what type of structures they were, such as the probable aqueducts for Colchester, Gloucester or York. It has been established that leats, wooden, lead and ceramic pipes have been used, but there is a need for correlating the information so that a distribution pattern can be obtained for the whole of Britain. In my database I have listed some of the types of aqueducts found at sites, but the record is not complete. A detailed study of all the sites where aqueducts have been recorded would be necessary to provide a complete distribution by type of conduit.

Provision of aqueducts to urban communities in Roman Britain must have influenced the development of towns and indirectly had some impact on their economy, but no comment has been made on this aspect of water supply in the literature. Determining the life spans of aqueducts may be useful in analysing the prosperity or decline of towns. The life span of wooden aqueducts must have been very limited, implying it was not a long-term means of providing water. Leats could silt up or their banks could have collapsed, so that unless effective maintenance was carried out regularly, an aqueduct could after a while be ineffective as a supply of water. Archaeological evidence seems to indicate that the disuse of the baths at Dorchester was related to the end of the effective supply of water from the aqueduct (Green 1984, 51). This may also have been the problem at Wroxeter (White 1990, 5). How widespread this problem was needs to be studied, because it is likely that failure of aqueducts would have impinged on the economy of a number of towns.

Wells were a standard form of water supply at most inhabited sites, notwithstanding the number of sites where they have not been found. At several sites (for example at Lincoln, London, Silchester and Wroxeter) provision of public wells must have had special significance for those people who did not have wells (Chapter 1, 7 and n.9). Wells were not only sources of water but often they were also used for ritual purposes and as depositories for religious artifacts (Clarke 1996, 79; Ross 1968, 255-85). Although wells have been found at Silchester where they were the main source of water supply, their internal distribution and use have not been specifically studied since they were first reported during the 1890s and early this century. It would be a particularly useful study to determine how many wells were in operation at the same time, and who

used them. At London a large number of wells have been found, but large areas have not yet been examined, with the likelihood that more wells will be found. At Newstead, recent further excavations have revealed more wells/pits than the original 107 found by Curle (Clarke and Jones 1994, 110, Fig.1). At Wroxeter wells were found grouped in two localised areas (Chapter 6, 196, Fig. 6.17), with large areas of the Roman town still unexplored. No Roman wells have been found at Colchester within the *colonia* walls. At the other major Roman towns there is also a lack of evidence for wells. Further archaeological work will be needed to provide a more balanced distribution of wells.

Wells are not easily categorized, basically being a hole in the surface soil and the substrata down to water-bearing materials. Their shapes were generally dictated by the materials in which they were sunk and the type of linings if steined, square for boxframed and round for barrel linings. Depths range from about 2m to well over 30m. When dug into gravel, sands and clays their walls may have been unstable and needed steining for support. Many wells with linings have been found but the distribution of sites with different types of linings and inter-site differences need to be correlated. Box-framed linings changed in construction over time and also need correlation. This is particularly well illustrated by the difference in workmanship between the wells at Scole (Fig.4.4a-d, pp.112-5) from the 1st century to that illustrated for London (Fig.4.2, 107). This could have been due to improvements in carpentry skills and tools, a topic well worth investigation.

Archaeological evidence indicates that at a number of sites the life spans of wells were often of short duration. The density of well distribution shown for Newstead (Clarke and Jones 1994, Fig.1), both in the fort and the *vicus* to the south, suggests that many wells were in use for short periods and only about 10 to 15 were in use at any one time (Clarke and Jones 1994, 117). This may also have been the case in London where there were concentrations of wells in the Queen Street area. Whether wells had a similar short life span at Silchester is uncertain because most of the wells were associated with separate buildings. A study of the life span of wells may provide information on changes that may have taken place within sites and could be significant for villas.

Who dug wells is not known, but with the difficulties of well digging it seems possible that itinerant professional well diggers may have

performed that task. There is no direct evidence to prove this assertion. Builders may have contracted to do the work when they were hired to build public buildings or homes for private owners. A study of well digging and their steining could bring to light other aspects of specialist skills in the building trade during the Roman period, especially the progress in carpentry. For instance, it may be possible that the skills in construction of steining of wells followed local building styles.

Baths were closely linked with water supplies because they were often the largest consumers of water. They were the most common single type of water related structure, the main reason having been their importance as social centres, both publicly and in private homes. More baths have been recorded at villas in Britain than at all the other site types grouped together, indicating their social importance to the private sector during the Roman period. Although public baths had the practical function of bathing, perhaps their major function was as centres where people could meet socially and obtain services which were not otherwise available. However, for Roman Britain nothing is known about these functions of public baths. Much of the literary and epigraphic information about behaviour at baths outside Britain is supplemented by finds found at baths or associated structures. Perhaps it may be possible to gain some knowledge about the people who used baths in Britain from a study of such finds in the context of their clothing, jewellery and other artefacts, and with some imaginative interpretation. This can be judiciously supplemented from what is known of behaviour at the continental baths. To understand fully how Britons lived in Roman Britain it is necessary to supplement that knowledge with a study of the influence the introduction of baths may have had on their life styles.

The social importance of baths in the Roman world is well documented, but their significance for Roman Britain has not been evaluated. Baths were often constructed at military sites where occupation was for short periods, indicating a specific social need. At many military sites aqueducts were the main water supply, especially at sites where baths were important structures, such as at Caerleon, Chester, Chesters, Halton Chesters, Great Chesters, Benwell, and Vindolanda. The issue of the social importance of baths in Britain requires detailed research, and will require imaginative interpretation based on archaeological evidence in the absence of any contemporary literary comment.

The remains of only two Roman baths in Britain have been described in detail, the two at the fortresses of Exeter and Caerleon, but the discussions do not refer to the management of the baths, who would have carried out the duties of attending to the baths, and the provision of the large amount of fuel that was needed for heating. Baths at military sites may not have had the typical image of public baths, but there was a social aspect to them as well, which needs to be explored. Public baths were costly institutions to maintain, but no information is available on entrance fees or whether any revenue was derived from various activities that were permitted within their precincts. At Wroxeter public baths, White (Barker 1990, 4) suggests that as many as 1,000 people may have used the baths daily, implying a large staff was available to run the institution and that considerable social activities were available. Archaeological evidence shows that the baths required regular maintenance and repairs, and were extensively altered over a period of at least 150 years. The reasons for this may be obvious, but it is not known how it affected the use of the baths. There is a similar lack of information at the other public baths of the towns of Roman Britain. Roman baths had a variety of shapes, layouts and sizes, but no systematic study has been published of their characteristics in Britain. They are spread throughout Britain and there is a need to classify them on a regional basis.

An overall impression from the data presented is that the distribution of all water-related structures for Roman Britain is under-represented.

Summary of conclusions relating to Roman Britain:

1. There is a lack of modern commentary on water-related structures.
2. Little detailed information is available about aqueduct types, and their physical and hydrological characteristics.
3. The distribution of aqueduct types is not adequately correlated.
4. Their construction and functions are poorly understood.
5. Wells were a standard form of water supply to all communities and their distribution needs to be correlated on a regional basis.
6. The lining types of well steining varies considerably.
7. Baths are the most common water-related structure recorded in Britain.

8. Their classification, particularly their layouts needs to be systematized for Roman Britain.
9. The management and running costs of public baths in Britain during the Roman period is completely unknown.

2. RECOMMENDATIONS

The following set of recommendations are made with a view to providing a basis for a better understanding of the relevance of water-related structures in Roman Britain.

a). Research on water supply and aqueducts in particular, has been extensive outside Britain over the last three decades, whereas in Britain the lack of scholarly attention to them has obscured their importance. The reason for this may be due to the absence of the topic of water supply in both undergraduate and masters courses. In order to have a more balanced view of the development of urban and rural communities it is important that the topics of water supply and baths be integrated into studies of urban and rural development. To create motivation for future research, it is therefore recommended that the topics be included in both archaeology and cultural courses so that students become aware of the part water supply and baths had on settlement development.

b). There is no existing detailed analysis of the type of aqueducts that served all the different types of sites. For a better understanding of water supplies in Roman Britain specific research is necessary on the typology of aqueducts and their distribution. As a first phase in the study of the typology of water supplies, it is recommended that studies be undertaken to make a detailed analysis of the existing archaeological record of the remains of aqueducts at all site types. This may have to be followed with further field studies. As a second phase, research is necessary on what part water supplies had on both the economy and social aspects in Roman Britain.

c). A number of leat aqueducts have been found in Roman Britain, but they have all been investigated individually. A comparative study of these leats can provide information on whether there was a common approach to leat construction. There is also no information on the costs of leats, except Stephens' (1985a, 204) estimation of costs of the so-called Leicester aqueduct and those at Dorchester and Wroxeter. I have made an attempt to arrive at a cost of the

Dorchester leat aqueduct based on how it would be approached in the modern context. Research, however, is necessary to determine how leats would have been planned, costed and constructed in Britain, based on knowledge of Roman construction techniques. A comparative study of the details of construction aspects of leat aqueducts needs to be undertaken, and in particular whether there were any stability problems and whether maintenance was carried out during the Roman period.

d). Wells have been reported at many sites in Roman Britain, though the number of sites are considerably under-represented. At a number of sites such as Colchester, Caerwent, Gloucester, London, Wroxeter and York, and others, large areas are unexplored, and further research is necessary to provide a more balanced distribution of wells. Their distribution on a regional basis, and by site type, needs to be correlated using existing archaeological information. Internal distribution of wells at specific sites, and especially what function they served at particular structures, also needs to be studied. Wells are found in various type of geological environments, but at present it is not known how different geological formations influenced their distribution during Roman times, or which formations provided the most successful wells. Of the techniques of digging of Roman wells little is known. How sites for wells were located and who dug them needs to be investigated. Steining of wells with a variety of lining types have been reported at many sites, but for a better understanding of linings it is necessary to correlate the available information. Further research on lining of wells at minor sites is also required. It is recommended that selected topics from the above can be used as dissertation presentations at either undergraduate or masters level.

e). Roman baths were such an important social amenity in the Roman world, but in Roman Britain they have not been studied systematically in detail. There is a need to correlate the existing archaeological evidence on baths found at all the site types in Roman Britain. Currently the *International Association for the Study of Ancient Baths* is making a register of baths, and in due course there will appear one for Britain. Although baths have been studied extensively for the Empire, detailed work on the typology of baths in Britain has not been done except for a few sites. Classification of bath types based on the simple three layouts used in this thesis, of row, block and complex types (Chapter 5, p.145), oversimplifies their

configurations. There is need for research into this topic to systematize the way baths are described in the literature. Other aspects of baths in Roman Britain that need to be studied are the distribution of bath types, how the public baths were managed, their costs, and their place in Romano-British society. This research would be a major study and it is recommended that it be allocated as a thesis study.

f). A number of major unresolved problems relating to specific sites needs to be investigated, such as the aqueduct water supplies of Colchester, Caerwent, Gloucester, Verulamium, Dorchester, Lincoln, York and others. Specific research is required to solve these issues. The uncertainty of the Lincoln aqueduct is especially significant, since it is the major earthenware pipe aqueduct in Roman Britain. A solution to the location of its water source and how it functioned, will only be resolved by further archaeological research. The solution to this important aqueduct will be a triumph for archaeology and it is considered vital that the funds be found for further investigation of this difficult site. The same applies to the other sites, where details of their water supplies are still unknown.

g). The lack of scholarly debate on water-related structures in Britain has resulted in an important element being left out of the debate on urban and rural development, and I consider that it perhaps distorts the true evaluation of the economies of those centres and their social importance. The most important recommendation I can make is that water supplies and other water-related structures are made topics for study both at undergraduate and research level, on an equal basis with many other archaeological studies.

THE WATER SUPPLIES AND RELATED STRUCTURES
OF ROMAN BRITAIN

Volume 2: Appendices

Thesis submitted for the degree of
Doctor of Philosophy
at the University of Leicester

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APPENDICES

Appendix 1: Data from Database (302-317)

Appendix 2: Database References (318-482)

Appendix 3: Site Locations (483-498)

Appendix 4: Abbreviations (499-505)

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APPENDIX 1: DATA FROM DATABASE

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Dewar
Abbots Langley	villa		BA1						
Abergavenny	fort		BA1						
Abingdon	settlement			W1					
Abinger Hammer	villa	AQ1 lt							
Abridge	settlement			W1					
Ackworth Low	villa		BA1						
Action Scott	villa		BA1						
Adel	settlement	AQ1							
Ailsworth(1)	villa		BA1	W1+	DR1				
Ailsworth(2)	small town			W3+					
Alcester	fort			W2					
Alchester	small town		BA1						
Aldbrough	civitas	AQ1 ?	BA1					TA3	
Aldbourn	+settlement?		BA1						
Aldenham	villa		BA1						
Aldermaston	+settlement		BA1	W1					
Alfoldean	small town		BA1	W1					
Alresford	villa	AQ1	BA1		DR1		SP1		
Alwinton	settlement			W1					
Ancaster	small town			W5					
Angmering(1)	villa		BA2						
Angmering(2)	villa		BA1						
Apethorpe	villa		BA1	W1+					
Appleshaw	villa		BA1						
Arbury Road	settlement			W1					
Ardoch	fort (falsus)								
Armoth	villa		BA1						
Arreton	villa		BA1						
Ash	villa		BA1						
Ash-Cum-Ridley	villa		BA1		DR1		SP1		
Ashdon	villa		BA1		DR1				
Ashill	villa			W3					
Ashtead	villa		BA1		DR3			TA1	
Ashton	small town			W1	DR1			TA2	
Asthall	+settlement		BA1						
Atworth	villa		BA1						
Auckley	settlement			W1					
Axminster	small town		BA1 ?	W1					
Badbury	+settlement		BA1						
Badgeworth	villa		BA1				SP1, brook		
Baldock	small town			W3					
Balmuldy	fort	AQ1-cl pi	BA2						
Bancroft	villa	AQ1 - lt	BA2		DR2+	WP1	SP1		
Banwell	villa		BA1						
Bar Hill	fort		BA1	W1	DR2	WP1	SP1	TA1	
Barkby Thorpe	villa		BA1						
Barming Heath	villa		BA1					TA1	
Barnack	villa			W1					
Barnsley Park	villa		BA1	W3					
Barnwell(1)	villa		BA1			LP1+			
Barnwell(2)	villa		BA1						

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Barochan	fort				DR1				
Barrington	villa		BA1						
Bartlow(1)	villa		BA1 ?			LP1		TA1	
Bartlow(2)	villa		BA1	W1		LP1			
Barton Court Farm	villa			W2					
Bath	small town	AQ1- 1d pi	BA1		DR2+	LP1+	SP1		SE1
Bathford	villa		BA1			WP1+	SP1		
Beadlam	villa		BA1						
Bearsden	fort		BA1		DR1				
Beaufront Redhouse	fortress	AQ1?-1d pi	BA1	W1 ?		LP1			
Beauport Park	settlement		BA1						
Beckfoot	fort	AQ1						TA1	
Beddingham	villa		BA1						
Beddington	villa		BA1	W1					
Beenham	villa		BA1						
Benwell	fort	AQ1 ?	BA1			WP1 ?		TA1	
Bere Regis	settlement			W2					
Berinsfield	settlement			W1					
Bewcastle	fort		BA1		DR1				
Bibury	villa		BA1		DR1				
Biddenham	villa			W1					
Biglis	settlement				DR 1+			TA2	
Bignor	villa		BA2		DR1+	WP+			
Billericay	settlement			W1 ?					
Binchester	fort		BA2						
Binstead	villa		BA1						
Birdoswald	fort	AQ1- st ch			DR1	WP1		TA1	
Birrens	fort	AQ1- st ch	BA1			WP2 wd		TA1	
Biterne	small town		BA1	W1+	DR1				
Bitteaby	villa		BA1						
Bitton	villa		BA1						
Bledlow-Cum-Saunderton	villa		BA1						
Bletchingley	villa		BA1						
Blisworth	settlement			W1+					
Blyborough	+settlement		BA2						
Boreham	+settlement		BA1	W2					
Borough Hill	villa		BA1						
Bothwellhaugh	fort		BA1		DR2	LP1			
Bottesford	villa					WP1+			
Boughton	settlement			W1					
Boughton Monchelsea	villa		BA1		DR1				
Bourne	villa	AQ1 - 1t	BA1 ?						
Bourne/Morton	villa	AQ1 - 1t							
Bourton-on-the-Water	small town			W1+	DR1+			TA1	
Bowes	fort	AQ1 - 1t	BA1						
Box	villa		BA1						
Boxted Farm	villa		BA1 ?	W1					
Bozeat	settlement				DR1+				
Bradford Down	villa		BA1						
Bradford-on-Avon	villa		BA1						
Brading	villa		BA1	W1					
Bradley Hill	settlement				DR2+			TA1	
Braintree	small town			W1					
Braishfield	villa		BA1						

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sever
Brampton	small town		BA1	W3	DR1+			TA4	
Brandon	fort				DR1				
Brantingham	villa(falsus)	?							
Braughing	small town		BA1		DR1				
Brecon Gaer	fortress(A)			W1					
Brewood	villa		BA1						
Brislington	villa		BA1	W1					
Bristol(1)	villa			W1					
Bristol(2)	villa		BA1						
Brithdir	fortlet		BA1					TA1	
Brixworth	villa		BA1						
Broadfields	settlement			W1			SP1		
Bromham(1)	villa		BA1	W1 ?					
Bromham(2)	+settlement?		BA1						
Brough-by-Bainbridge	fort	AQ1			DR1	PL1+,st- ch			
Brough-on-Humber(1)	fort	AQ1							
Brough-on-Humber(2)	settlement	AQ1?		W1+					
Brough-on-Noe	fort	AQ1			DR1				
Bryncross	settlement				DR2				
Buchley	fort				DR2 stln				
Bucknowle Farm	villa		BA1		DR1				
Buckton	fortress(A)	AQ1	BA1 ?			WP1			
Bunny	settlement			W1					
Burgh	villa		BA1						
Burham	villa		BA1						
Burrow-in-Lonsdale	fort	AQ1 - lt							
Burton	settlement	AQ1 ?				WP1 conc			
Buxton	small town		BA2				SP2		
Cadder	fort		BA2		DR3		SP1		
Caerhun	fortress(A)		BA1	W1	DR1+				
Caerleon	fortress(L)	AQ1- ld pi ?	BA5	W2	DR1+	WP1 ld	SP1	TA1	SE1
Caernarvon	fortress(A)	AQ2- pi ch	BA1	W1	DR3	PL2			
Caersws	fortress(A)		BA1	W1+					
Caerwent	civitas	AQ1	BA2	W16	DR1+	PL1+		TA1	
Caister-on-Sea	fort				DR1+			TA2	
Caistor-by-Norwich	civitas	AQ1-wd pi	BA1		DR1	WP1			
Calne	villa		BA1					TA1	
Cambridge	small town			W3				TA1-ld	
Camelon	fort		BA1		DR1+				
Camerton	small town			W1					
Camphill	villa		BA1						
Canterbury	civitas	AQ1 ?	BA2	W1+		WP2+		TA3	SE1
Cantley	settlement			W1					
Cappuck	fortlet	AQ1-pi ch	BA1			WP1			
Cardiff Castle	fortress(A)				DR1				
Carisbrooke	villa		BA1						
Carlisle	civitas	AQ1	BA1		DR1+			TA1	
Carlisle-Old	fort		BA1 ?						
Carmarthen	civitas	AQ1 - lt	BA1						
Carpow	fortress(A)	AQ1	BA1		DR1+	WP1+			
Carrawburgh	fort		BA1	W1					
Carsington	settlement			W2	DR2+				
Carvoran	fort			W1					
Castell Collen	fort		BA1						

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Castle Cary	fort		BA1						
Castle Greg	fortlet			W1					
Castle Hill(1)	small town		BA1	W3	DR1			TA1	
Castle Hill(2)	fortlet			W3+?					
Castle Nick	fort				DR1stln				
Castle-Dykes	villa		BA1		DR1				
Castleford	fort	AQ1-st cul	BA1	W1	DR1stln	WP1	SP1		
Castleshaw	fort		BA1 ?	W1	DR1+			TA1	
Castlesteads	fort				DR1+				
Castor(1)	villa		BA1	W2					
Castor(2)	+settlement		BA1	W2					
Catagore	villa		BA1						
Catterick	fort	AQ1 - ch.	BA1		DR1	WP2+			
Cattybrook	settlement				DR1				
Caversham	settlement			W1				TA1	
Chalk	villa		BA1						
Chapel Hill	fort		BA1						
Charmy Down	villa			W1	DR1 ?				
Chedworth(1)	villa		BA2	W1	DR4	WP1- 1d	SP1	TA2	
Chedworth(2)	villa		BA1 ?			WP1+			
Chells Manor	settlement			W1					
Chelmsford	small town	AQ1- wd pi	BA1	W1 ?					
Cheshunt	settlement			W1	DR1				
Chester	fortress(L)	AQ1	BA1		DR1- st	WP2+ 1d	SP2+		SE1
Chester-le-Street	fort	AQ1	BA1		DR2				SE1
Chesterholm	fort	AQ1- st ch	BA1	W3	DR1+	WP1	SP1	TA3	SE1
Chesters	fort	AQ2, 3rd ?	BA1	W1	DR1+		SP3 ?	TA1	
Chesterton(1)	small town			W1					
Chesterton(2)	small town		BA1?						
Chesterton(3)	fort		BA1						
Chichester	civitas		BA1	W4	DR1-st	WP - ea		TA1	SE1
Chigwell	+settlement		BA1	W2					
Chilgrove(1)	villa		BA1						
Chilgrove(2)	villa		BA1	W1					
Chipping Warden	villa		BA1	W1					
Chiseldon	villa		BA1						
Churchill	settlement						SP1		
Churchill Hospital	settlement			W1					
Cirencester(1)	civitas	AQ1	BA1 ?	W4+					
Cirencester(2)	villa		BA1 ?						
Claydon Pike	settlement			W3				TA2	
Clayton	villa		BA1	W2					
Cliffe House	settlement				DR1+				
Cnut's Dyke	settlement	AQ1 - 1t?							
Cobham	villa		BA2 ?						
Cobham Park	villa		BA1						
Coddenham	small town			W1					
Colchester	colonia	AQ1 ?	BA2	W9	DR10+	WP9+	SP5+	TA2+	SE1
Cold Brayfield	villa						SP1		
Cold Knap Point	+settlement		BA1						
Coldharbour	settlement	?							
Colerne	villa		BA1						
Coleshill	+settlement		BA1		DR1			TA3	
Collingham	villa		BA1	W1		WP2+		TA1	

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Colliton Park	villa			W4	DR1+				
Colsterworth	settlement			W1					
Combe Down	villa		BA1 ?						
Comberton	villa		BA1			LP1			
Combley	villa		BA1						
Compton(1)	villa		BA1						
Compton(2)	villa		BA1						
Compton(3)	settlement			W1+					
Congresbury	villa		BA1						
Corbridge	small town	AQ2	BA1		DR1+				
Corhamby	villa		BA1	W1					
Corton	settlement?			W1					
Cosgrove	villa		BA1		DR1++			TA1	
Cotterstock	villa						SP1	TA2	
Covehithe	villa?			W1					
Cow Roast	settlement			W8					
Cowbridge	small town		BA1	W1 ?	DR2				
Cox Green	villa		BA1						
Cramond	fort		BA1	W1	DR1+				
Croy Hill	fortlet				DR1+				
Dalginross	fort	AQ1 - lt ?				WP1 ?			
Dalswinton	fort	AQ1 - lt							
Darenth	villa	AQ1	BA1		DR1+	WP1		TA1	
Daventry	villa		BA1	W1					
Dean Hall	settlement				DR1				
Denton	villa		BA1	W1	DR1+				
Derby	fort		BA1	W6				TA2	
Dersingham	settlement			W2					
Desborough	settlement			W3					
Desford	settlement			W1					
Dewlish	villa		BA1		DR1 ?				
Dicket Mead	villa		BA1						
Diddington	settlement			W2				TA1	
Ditchley	villa			W1					
Dolaucothi	small town	AQ3							
Doncaster	settlement			W2+					
Dorchester(1)	civitas	AQ1	BA2	W1+					
Dorchester(2)	civitas			W1	DR1				
Dorn	small town			W2					
Dover	fort	AQ1				WP2+		TA1	SE1
Downshay Wood	settlement			W1+?					
Downton	villa		BA1						
Drayton(1)	villa ?		BA1?						
Drayton(2)	villa		BA2		DR1				
Droitwich	small town			W1	DR1+				
Dryhill	villa		BA1						
Ducklington	villa			W1					
Duncton	villa		BA1						
Dunsby	settlement	AQ1 - lt?		W1					
Dunstable	small town			W1					
Duntocher	fortlet	AQ1 ?	BA1		DR1				
Durham	+settlement?		BA1						
Duston	small town			W1+					
Earith	settlement			W1+					

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
East Coker	villa		BA1 ?				SP1		
East Ilsley	settlement			W1					
Eastbourne	villa		BA1						
Easter Haprew	settlement		BA1 ?						
Easton	villa?			W1					
Eaton	settlement			W2					
Eaton-by-Tarporley	villa		BA1		DR1+				
Ebchester	fort	AQ1	BA1						
Ebrington	villa		BA1		DR2+- st		SP1		
Eccles	villa		BA1						
Eckington	villa			W1+	DR1+				
Elginhaugh	fort		BA1						
Elsted	villa		BA1						
Ely	villa		BA1						
Emberton	settlement			W4					
Empingham	villa			W2					
Enfield	settlement			W1					
Engleton	villa		BA1						
Epperstone	villa		BA1						
Ewell	small town			W6					
Ewhurst	villa		BA1						
Exeter	fortress	AQ2 ?	BA2		DR1	WP1		TA1	SE1
Exning	villa		BA1						
Falkirk	fort		BA1						
Farley Hungerford	villa		BA1						
Farmington	villa		BA1		DR1				
Farmoor	settlement			W3					
Farnham Royal	villa					WP1+			
Farnham(1)	villa ?		BA1						
Farnham(2)	villa	AQ1	BA1			LP1			
Farnham(3)	settlement			W1					
Farningham	villa		BA1		DR1	LP1			
Farnworth	settlement			W1					
Fawler	villa		BA1						
Feltwell	villa		BA1						
Fendoch	fort	AQ1	BA1				SP1+	TA1	
Ffrith	fort		BA1						
Fifehead	villa		BA1			LP1			
Fillingham	villa		BA1						
Finchingfield	villa		BA1						
Findon	villa			W1					
Fingringhoe	fort			W2					
Fishbourne	villa	AQ1	BA1 ?	W1+ ?	DR2+	WP1			
Flamsteed	settlement			W1					
Fletton	settlement			W1					
Folkstone	villa	AQ1 ?	BA1		DR4	WP1+			
Fordcroft	villa		BA1						
Foscott	villa		BA1			LP1+		TA1	
Foxcote	villa		BA1			LP1+			
Frampton	villa (falsus)	?							
Frilford	small town		BA1	W1	DR1				
Friskney	settlement?	AQ1 ?							
Procester Court	villa		BA1	W2	DR4			TA1	
Funtington	villa					WP1			

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Gadebridge Park	villa	AQ1-lt	BA1	W1	DR2+	WP1		TA2	
Garden Hill	+settlement		BA1		DR1+	LP1			
Garton Slack	settlement			W2					
Gatcombe	villa	AQ1 ?						TA1	
Gayton	settlement			W1					
Gayton Thorpe	villa		BA1						
Gelligaer	fort		BA1						
Gestingthorpe	villa		BA1						
Glenlochar	fort	AQ1 - ch	BA1		DR1+	WP1		TA1	
Gloucester	colonia	AQ1 ?	BA1 ?	W2		WP1			
Goadby Marwood	settlement			W1+					
Godmanchester(1)	small town	AQ1 ?	BA1 ?	W1					
Godmanchester(2)	villa		BA1						
Gorhambury	villa		BA1	W1		WP1			
Goring	villa		BA1	W1	DR1				
Grafton Estate	settlement	AQ1	BA1						
Grandford	settlement				DR1				
Great & Little Kimble	villa		BA1						
Great Bulmore	+settlement		BA1		DR2		SP1		
Great Casterton(1)	small town		BA1						
Great Casterton(2)	villa		BA1						
Great Chesterford(1)	fortress(A)			W2					
Great Chesterford(2)	villa		BA1 ?						
Great Chesters	fort	AQ1 - lt	BA1					TA1	
Great Dunmow	small town			W1					
Great Linford	villa		BA1						
Great Staughton	villa		BA1						
Great Tew	villa		BA1						
Great Totham	villa			W1					
Great Witcombe	villa		BA1		DR13		SP1	TA1	SE1 ?
Greetwell Fields	villa		BA1	W4					
Greta Bridge	fort	AQ1?	BA1 ?						
Grimstead	villa		BA3						
Grimston	villa		BA1						
Grinley on the Hill	settlement			W1					
Hacconby	settlement	AQ2 - lts ?							
Haceby	villa		BA2						
Hacheston	small town			W1					
Haddon	+settlement		BA1	W1					
Hadstock	villa		BA1						
Hales	villa		BA1	W2	DR1+				
Halstock	villa	AQ1	BA2		DR3+		SP1	TA1	
Halton Chesters	fort	AQ1- wp	BA1			WP1 ?		TA2	
Hambleden	villa		BA1						
Hamilton	villa		BA1						
Hampstead Norrey's	settlement			W1					
Hanham Abbots	villa			W1					
Hardham	small town			W1					
Hardingstone	settlement			W1					
Hardknott	fort	AQ2	BA1						
Harlow	small town		BA1 ?	W1					
Harpole	villa		BA1					TA1	
Harpsden	villa		BA1						
Hartfield	villa		BA1						

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Hartlip	villa		BA1						
Havant(1)	villa		BA1						
Havant(2)	villa		BA1 ?						
Hayes	villa		BA1						
Hayton	fort				DR1			TA1	
Heath and Reach	villa			W1					
Hemsworth	villa		BA1						
Heybridge	small town			W5					
Hibaldstow	small town			W1	DR1				
High Cross	small town			W1+					
High Ham	+settlement		BA1	W1					
High Legh	settlement				DR1				
High Rochester	fort	AQ1- st ch							
Higham Ferrers	+settlement		BA1						
Hinton Charterhouse	villa		BA1						
Holcombe	villa		BA1						
Holditch	small town			W1					
Holme House	villa		BA1		DR1				
Holt	fortlet	AQ1	BA1			EP1			
Horncastle	settlement			W1					
Horningsea	settlement			W1					
Housesteads	fort		BA2	W2	DR2+	WP1+		TA5	SE1
Hovingham Park	villa		BA1						
Hucclecote	villa		BA1		DR1				
Hunsbury	villa		BA1	W1					
Huntingdon	villa	AQ1 ?						TA1	
Huntsham	villa							TA3	
Hurcot	villa		BA1 ?				SP1		
Ickham	settlement			W1+					
Ickleton	villa		BA1						
Icklingham	settlement			W1				TA1	
Iford	villa		BA1						
Ilchester	small town			W1	DR1+		SP1		
Inchtuthill	fortress	AQ1	BA1						
Inveresk	fort	AQ1 ?	BA1			WP1			
Irchester	small town			W3					
Islip	villa			W1					
Ivy Chimneys	settlement	AQ1 ?	BA1	W1			SP1+	TA1	
Ixworth	villa		BA1	W1				TA1	
Jordon Hill	settlement			W1					
Kelvedon	small town	AQ1 - lt	BA1?						
Kempsford	settlement			W2					
Kempston	settlement			W1					
Kenchester	small town		BA1+	W1					
Keston	villa		BA1	W1	DR1	WP1+		TA6	
Kettering	small town			W3					
Keynsham	villa		BA1	W1					
Kings Weston Park	villa	AQ1	BA1		DR1	WP1	SP1		
Kingscote	villa				DR2				
Kinneil	fortlet				DR1				
Kintbury	villa		BA1						
Kirk Sink	villa	AQ1	BA1&2		DR1+		SP1 ?		
Lake Farm	fortress(A)	AQ1						TA2	
Lambourn	villa(falsus)								

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Lancaster	fort		BA2	W1					
Lanchester	fort	AQ3 - st ch							
Landwade	+settlement		BA1						
Langton	villa		BA1	W1					
Latimer	villa		BA1						
Lea Cross	villa		BA2						
Leaden Well	villa			W1	DR1			TA3	
Lease Rigg	fort				DR3				
Lechlade	villa		BA1	W1					
Leckhampton Hill	fort			W1					
Leicester	civitas	AQ1 ?	BA1	W2	DR1+			TA1	SE1
Leicester(1)	villa		BA1	W1 ?	DR1			TA1	
Leicester(2)	civitas		BA1	W1					
Leintwardine	+settlement		BA1		DR1++				
Leyton	settlement			W2					
Lincoln	colonia	AQ2 ?	BA2	W2	DR1+		SP1	TA1	SE1+
Linley	settlement	AQ1							
Linton	villa		BA1						
Litlington	villa		BA1						
Little Dunmow	villa	AQ1 ?				WP1			
Little Ponton/Stroxton	villa			W1					
Little Waltham	settlement			W1					
Littlechester	small town			W2	DR1+				
Littlecote Park	villa		BA3	W3				TA3	
Littleton	villa		BA1						
Llanddewi Brefi	villa?		BA1						
Llanddowror	villa		BA1						
Llandough	villa		BA1		DR1	WP1		TA2	
Llanfrynach	villa		BA1						
Llanio	fort		BA1		DR1		SP1		
Llantwit	villa		BA1						
Locking	villa		BA1						
Loddington	settlement			W1					
Loddon	villa		BA1						
London	municipium (civium)		BA4	W55+	DR2++		SP2++		
Long Melford	+settlement		BA1						
Long Wittenham	settlement			W7					
Longstock	villa		BA1						
Longthorpe	fortress(A)			W1	DR1			TA1	
Loughor	fort	AQ1 ?	BA1						
Low Borrowbridge	fort		BA1						
Low Ham	villa		BA1						
Lower Slaughter	settlement			W11					
Lufton	villa		BA1						
Lullingstone	villa	AQ1 ?	BA1	W1 ?					
Lunt	fort			W6	DR1+			TA15	
Lydney	villa	AQ1	BA1		DR1+	WP1		TA1	
Lyminge	+settlement		BA1						
Lympne	fort	AQ1 ?	BA1						
Lynch Farm	settlement			W2					
Lyne	fort	AQ1			DR1+		SP1	TA3	SE1?
Maidenhead	villa		BA1						
Maidstone	villa		BA2 ?						
Malton	fortress(A?)	AQ1	BA1	W1		WP1 wd			SE1

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Mancetter(1)	fort	AQ1 ?		W1					
Mancetter(2)	small town			W3		WP1		TA1	
Manchester	fort	AQ1 ?		W1 ?					
Mansfield Wood House	villa		BA2			LP1	SP1		
Market Overton	villa			W1					
Marshfield	settlement				DR1	WP1		TA1	
Marsworth	settlement			W1					
Maryport	fort	AQ1	BA1	W1				TA1	
Melandra Castle	fort		BA1		DR1				
Methwold	villa		BA1						
Middleham	villa ?		BA1						
Mildenhall	small town		BA1	W1					
More	villa	AQ1		W1	DR1				
Moresby	fort			W1					
Morton Bourne	settlement?	AQ1							
Mountsorrel	settlement			W1					
Mucking	villa			W1+					
Mumrills	fort	AQ1 ?	BA1						
Munthem Court	settlement			W1					
Nantwich	settlement?							TA1	
Nazeingbury	settlement			W3					
Neath	fort (falsus)	?							
Neatham	small town		BA1	W11	DR1+			TA1+ ?	
Nether Wild Farm	villa		BA2						
Netheravon	villa ?		BA1						
Netherby	fort	AQ1 - e/w	BA1						
Nettleton	small town	AQ1 - lt							
Newcastle	fort	AQ1 ?							
Newhaven	villa		BA1?						
Newnham	villa		BA1 ?	W1					
Newport	villa		BA2						
Newstead	fort	AQ1	BA1	W107 ?	DR1				
Norden	settlement			W1					
Norfolk Street	villa		BA1		DR1			TA1	
North Leigh	villa		BA3	W3					
North Mundham	villa		BA1						
North Stainley	villa		BA1		DR1				
North Wraxall	villa		BA1	W1					
Northallerton	settlement?			W1					
Northampton	settlement			W1					
Northchurch	villa		BA1						
Northfleet	villa		BA1						
Northmoor	settlement			W1+					
Norton	settlement			W1					
Norton Disney	villa		BA1	W1	DR1+				
Norton St. Phillip	villa		BA1						
Nunney	villa		BA1						
Nursling	settlement			W1+					
Oakham	settlement			W2					
Oakley	villa			W7					
Oakridge	+settlement		BA1	W1					
Odell	settlement			W3				TA1+	
Odiham	villa		BA1						
Old Durham	villa		BA1						

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Old Kilpatrick	fort			W1					
Old Penrith	fort		BA1						
Old South Eau	settlement?	AQ1							
Orpington	villa		BA1						
Orton Longueville	+settlement		BA1						
Otford	villa			W1			SP1		
Oxford	settlement			W1	DR1			TA1	
Oxford(2)	settlement			W1					
Pagans Hill	settlement			W1					
Pamphill	villa		BA1						
Paulton	+settlement?		BA1						
Pen Llystyn	fortress(A)	AQ1	BA1 ?	W1		WP1		TA1	
Pen-Y-Darren	fort		BA1						
Pennal	fort		BA1					TA1	
Pentre Ffwrndan Farm	+settlement		BA1			WP1			
Peterborough(1)	settlement			W2					
Peterborough(2)	settlement			W1					
Piddington	villa		BA1		DR1+	WP1		TA1	
Piercebridge	fort	AQ1 ?	BA1						SE1
Pinchbeck	settlement					WP1			
Pitmeads	villa		BA1						
Pitney	villa		BA1						
Pitsford	settlement			W1					
Plas Coch	settlement			W1					
Plaxtol	villa		BA1	W1					
Poole	settlement			W1					
Portchester	fort			W3	DR1+				
Portishead	villa			W1					
Portland Island	settlement?			W1					
Prestatyn	settlement	AQ1	BA1	W1	DR1			TA1+ ?	
Puckeridge	settlement			W1+					
Pulborough	+settlement		BA1 ?		DR1				
Pumsaint	fort	AQ1 ?	BA1	W1				TA1	
Putley	settlement?				DR2				
Quernmore	settlement	AQ1 st-ld							
Quinton	settlement			W1+					
Radfield	settlement			W2					
Raeburnfoot	fortlet	AQ1 ?				WP1 ?			
Rainham	settlement			W2					
Ravenglass	fort		BA1						
Rayne	settlement			W1					
Reach	villa		BA1						
Reculver	fort		BA1	W1++	DR1				
Redlands Farm	settlement			W2					
Reigate	villa			W1++	DR1				
Richborough	fort	AQ1 ?	BA1					TA1	
Ridgewell	villa		BA1						
Rippingale	settlement?	AQ1- lt							
Rivenhall	villa		BA1						
Rochester	small town		BA1	W1	DR1+				
Rock	villa				DR1		SP1		
Rockbourne	villa		BA2	W3 ?	DR7				
Rockingham	settlement			W1					
Rodersham	villa		BA1						

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Roecliffe	fort			W3					
Romford	+settlement		BA1						
Rothley	villa			W1					
Rothwell Haigh	settlement			W1					
Rough Castle	fort		BA1	W1					
Rousham	villa		BA1						
Rowlands Castle	+settlement?		BA1						
Rudston	villa		BA1	W1					
Rushton	villa		BA1	W1+	DR1+				
Ruthin	settlement				DR1+			TA1	
Ryton on Dunsmore	settlement			W1					
Salford Priors	+settlement		BA1						
Sambourne	+settlement		BA1						
Sandringham	+settlement?		BA1						
Sandwich	villa		BA1						
Sandy Lane	small town		BA1						
Sapcote	villa		BA1						
Scampton	villa		BA1	W1	DR1		SP1		
Scawby	+settlement		BA1						
Scole	small town			W7					
Scunthorpe	settlement			W4					
Seabegs Wood	fortlet				DR2				
Seaton	villa		BA1	W1					
Selsey	villa ?		BA1 ?						
Sewingshields	fortlet MC34	AQ1 ?							
Shakenoak	villa		BA1						
Shawell/Churchover	villa		BA1	W2					
Shepreth	villa		BA1						
Shepton Mallet	settlement			W1					
Shipton Gorge	villa		BA1						
Shireoaks	settlement			W1					
Shoreham	villa			W1					
Shortlanesend	settlement				DR1				
Siberton	settlement?			W1 ?			SP1 ?		
Siddington	settlement			W1					
Sidlesham	villa		BA1		DR1				
Silchester	civitas		BA2	W76	DR1+	WP1+	SP4+	TA1+	
Sixpenny Handley	settlement			W1					
Slack	fort		BA1	W1					
Sleaford	small town			W1					
Snodland	villa		BA1					TA1	
Somerford Keynes	+settlement		BA1 ?						
South Shields	fort	AQ2	BA1		DR1+	WP1 st		TA1	
South Witham	villa			W1					
Southwark	fort			W38	DR3 +	WP1			
Southwark Street	settlement (mansio)	AQ1 ?	BA1		DR1+	WP1			
Southwell	villa		BA1						
Southwick	villa		BA2						
Sparsholt	villa		BA1	W1				TA1 ?	
Spilsby	settlement					WP1			
Spoonley Wood	villa		BA1	W1					
Springhead	small town		BA1	W1			SP1		
St. Mary Cray	settlement		BA1						
St. Stephen	villa		BA1	W1					

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Staden	+settlement		BA1						
Staines	small town		BA1	W1+					
Stainfield	villa			W1					
Stainley North	settlement		BA1						
Stamford Bridge	settlement			W1					
Stancil	villa		BA1						
Standon	villa		BA1						
Stanford in the Vale	villa			W1					
Stanton Fitzwarren	villa		BA1						
Stanton Low	villa ?		BA1	W1					
Stanton St. John	villa ?			W1					
Stantonbury	villa		BA1	W1					
Stanwick	villa	AQ1		W12	DR1+		SP1	TA1	
Stanwix	fort	AQ1- ch	BA1			WP1			
Stebbing	villa		BA1		DR1	WP1		TA1	
Stephen Mallet	villa ?			W1					
Stibbington	settlement			W1				TA4	
Stockport	villa		BA1 ?						
Stoke D'Abernon	settlement?				DR1+				
Stoke Gifford	settlement				DR1				
Stoke Orchard	settlement			W1					
Stoke Rochford(1)	villa		BA1						
Stoke Rochford(2)	villa		BA1						
Stoke Rochford(3)	villa		BA1						
Stone	settlement			W2					
Stonea Grange	+settlement?		BA1	W13	DR1+			TA1+	
Stoneham Aspal	villa		BA1						
Stonesfield	+settlement		BA1						
Storrington/Parham	villa		BA1						
Stowe	villa		BA1 ?	W1	DR1				
Strathgeath	fort		BA1		DR4			TA1	
Stretton Bridge	settlement			W1					
Stroud(1)	villa	AQ1 ?							
Stroud(2)	villa		BA1		DR2			TA2	
Sutton Courtenay	villa ?			W1					
Sutton Veny	villa		BA1						
Swaffham Bulbeck	settlement	AQ1- lt							
Swalcliffe Lea	settlement			W1					
Swanwick	settlement?			W1 ?					
Swindon	villa			W2					
Tallington	settlement			W2					
Tarrant Hinton	villa		BA1	W1					
Templeborough	fort	AQ1	BA2	W5	DR1+		SP1	TA2	
Teston	villa		BA1		DR1				
Tewkesbury	settlement			W1					
Thatcham	settlement			W1					
Theale	settlement			W3					
Thenford	villa		BA1						
Thetford	villa			W10				TA1+	
Thistleton	villa		BA1 ?	W2					
Thurgarton	villa		BA1						
Thurlby	settlement?	AQ1- lt		W1					
Thurnham	villa ?		BA1 ?						
Tiddington	small town			W14	DR1+				

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Tilston	+settlement		BA1						
Tingwick	villa		BA1		DR2			TA1	
Titsey	villa		BA1						
Tixover	villa		BA1						
Tockington Park	villa		BA1						
Tomen - Y- Mur	fort	AQ1- 1t						TA1	
Totternhoe	villa		BA1						
Towcester	fort	AQ1	BA1	W1	DR1			TA1	
Trows-Coed	fort	AQ1- 1t							
Tremadoc	villa		BA1						
Tripontium	small town	(burgi)	BA1 ?	W7	DR1+				
Turf Wall Mile Castle	fortlet MC50				DR1				
Twyford	villa		BA1	W1					
Twywell	settlement?			W1					
Upham	villa ?			W1					
Upmarden	villa		BA1						
Upminster	settlement?			W1					
Usk	fortress(L)	AQ1 ?	BA1	W1+ ?	DR1				
Verulamium	municipium	AQ1 ?	BA2 ?	W3+ ?	DR13+	WP2+	SP1		SE2
Wadfield	villa		BA1						
Wainfleet All Saints	settlement?	AQ1- 1t							
Walesby	villa			W1				TA1	
Wall	fortress(A?)	AQ1	BA1				SP1		
Walls	villa ?				DR1+				
Wallsend	fort		BA1						
Walton	fort		BA1						
Walton Heath	villa		BA1						
Walton-Le-Dale	settlement			W2 +	DR+				
Walton-on-Thames	settlement?				DR1				
Walton-on-the-Hill(1)	villa		BA1						
Walton-on-the-Hill(2)	villa		BA1						
Wanborough (Lower)	small town		BA1						
Wanstead Park	villa			W1					
Ware	small town			W1					
Washingborough	settlement?	AQ1 - 1t							
Wasperton	settlement			W2					
Watchfield	settlement			W1					
Water Newton	small town			W2					
Watergate Hanger	villa		BA1						
Weekley	settlement			W1					
Weldon	villa		BA1						
Well	villa	AQ1- st ch	BA1					TA1	
Wellingborough	settlement			W1					
Wellow	villa		BA1						
Welton Wold	villa			W1					
Welwyn	villa		BA2	W2					
Wendlebury	villa			W1					
Wentlooge Level	settlement				DR40+				
West Dean	villa		BA1						
West Deeping	villa		BA1						
West Keal	settlement			W1					
West Newton	villa		BA1						
West Winch	villa ?			W1					
Westbury	villa			W1					

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Westerwood	fort		BA1						
Weston Underwood	+settlement		BA1						
Wetwang	fort	AQ1- 1t							
Wharram Grange	villa		BA1		DR1 stln				
Wharram Percy	villa		BA1 ?						
Wharram-le-Street	settlement						SP1		
Wheatley	villa		BA1						
Whickham	fort (falsus)	?							
Whilton Lodge	small town			W1					
Whitchurch(1)	small town			W2					
Whitchurch(2)	villa		BA1 ?						
White Staunton	villa		BA1			LP1	SP1		
Whitebeech	villa		BA1					TA5	
Whitford	settlement?					LP1			
Whitley	villa ?		BA1 ?						
Whitley Castle	fort	AQ1 ?	BA1				SP1		
Whittington Court	villa		BA1						
Whittlebury	villa		BA1						
Whittlesford	settlement				DR1+				
Whitton(1)	villa		BA1			WP1			
Whitton(2)	villa			W1					
Wickford	villa			W1					
Wigginton	villa		BA1						
Wiggonholt	villa		BA1		DR1				
Wilderspool	small town	AQ1						TA1	
Wilmcote	settlement			W1					
Wilsford	settlement?			W2					
Winchester	civitas	AQ1	BA1	W1+		WP1			
Windermere	settlement?			W1					
Wingham	villa		BA1		DR1+				
Winterborne Kingston	settlement			W1					
Winterton	villa	AQ1 ?	BA2		DR1	WP1		TA1	
Witchampton	villa		BA1						
Withington	villa			W1			SP1		
Wittenham	settlement			W3					
Wolfhamcote	settlement			W1					
Wollaston	villa		BA1		DR1				
Woodchester	villa	AQ1	BA1		DR1		SP1		
Woodcock Hall	settlement			W1+ ?					
Woolaston	villa		BA1						
Woolstone	villa		BA1						
Wootton Hill	+settlement?		BA1						
Worcester	small town		BA1?	W2					
Worth	settlement			W1					
Wortley	villa		BA1		DR1	WP1 ld	SP2+		
Wraxall	villa		BA1						
Wroxeter	civitas	AQ1 - 1t	BA1	W17	DR2+	WP1+	SP1	TA1	SE1+
Wyck	+settlement		BA1						
Wycombe (High)	small town		BA1			WP1			
Wykham Park	settlement			W1					
Wymondham	villa			W1					
Wymondley (Great)	villa		BA1						
Yardley Hastings	settlement			W1					
Yarwell	+settlement		BA1?						

Site Name	Site Type	Aqueduct	Bath	Well	Drain	Pipe	Spring	Tank	Sewer
Yatton	villa		BA1						
Yeovil	villa		BA1						
York	colonia	AQ1 ?	BA2 +	W1+	DR2+	WP1+			SE1++

APPENDIX 2: DATABASE REFERENCES.

Abbots Langley, Hertfordshire

Archaeologia 53, 1893 253. Scott 1993, 91, SMR 0924, HT 2; SMR 510, HT 1. *VCH*, Hertfordshire 4, 1914, 147. *WSWHANS*, 1973, 14. Wardle 1982, 20-22.

Abergavenny Gwent, Wales.

Britannia 1, 1970, 55 Ant. Itin. 484.6 (*Gobannio*), 188, early fort; 2, 1971, 246, fort examined, 303; 4, 1973, 272; 11, 1980, 18; 18, 1987, 305; 20, 1989, 342. Nash-Williams 1969, 45. *PNRB*, 369. *TIRCGLL* 1983, 17, fort established c. AD 50, abandoned c. AD 150. Walls, granaries, bath-building. (*Silures*).

Abingdon, Barton Court and Ashville Trading Centre, Oxfordshire

Britannia 4, 1973, 320; 5, 1974, 456-7 villa and Iron Age settlement; 6, 1975, 279 Iron Age settlement and 4th c., well; 8, 1977, 419-20 Fig 28 showing well, SU 483 974, water-hole, well and well-house examined; 9, 1978, 466; 11, 1980, 396; 12, 1981, 343, Iron Age and Roman period; 19, 1988, 454; 20, 1989, 296; 21, 1990, 333-5, Fig.17, p.335, the excavated well is square, stone-lined, 2.8m deep, and with timber framework at the bottom. Originally an Iron Age site, Roman occupation pre-mid 2nd c., when major changes took place on site. Pottery finds suggestive of prosperity.

Abinger Hammer, Surrey

English and Field, 1991-2, 91-5, leat. Fulford 1977, 35-84. Scott 1993, 175, SMR 32 & 709, SY 1 & SY 2. *SyAC* 28, 1915, 41-50 bath; 29, 1916, 154; 81, 1991-2, 91-5. *The Builder*, 5th Jan., 1878.

Abridge, Essex.

Britannia 22, 1991, 261 timber-lined well.

Ackworth Low, West Yorkshire

Green 1910, 7. Scott 1993, 194, SMR 2307, WY 1.

Acton Scott, Shropshire

Archaeologia 31, 1846, 339-45. *PSAS* 1, 1861, 73. Scott 1993, 163, SMR 168, SH 1. *VCH* Shropshire 1, 1908, 259-61. Webster 1975, 84-6, plan (98-100, Fig 39). Small bath-suite.

Adel, Leeds, West Yorkshire.

Simpson 1879. *West Yorkshire Archaeological Survey* 1, 1981, 143-5. YAJ 32, 1934-6, 229, 459; 34, 1938-9, 231. TIRBS 1987, 1, major settlement, possible Roman fort on York-Ikley road; coins dating from 1st to 4th c.; altars dedicated to the goddess Brigantia; possible aqueduct. RIB 629-633. (*Brigantes*).

Ailsworth(1), Sutton Field, Lower Nene Valley, Cambridgeshire.

Arch. J. 30, 1873, 127 -40 bath, well, drain. Artis, 1828, 14-5, pl.1, Artis' survey map. PNHAS 1921, 29. RCHM Peterborough New Town, 1969, 17. Scott 1993, 31, SMR 01583, CA 2 (TL 10 97), SMR 00266, CA 3 (TL 10 97), SMR Cambs, CA 4 (TL 11 98 Sutton Fields), SMR 09099, CA 5 (TL 11 97). VCH Northants., 1, 1902, 174.

Ailsworth(2), Cambridgeshire.

Artis 1828 415, located a square stone-lined well at Normangate. Condron 1996, 415-6, Peterborough Museum record nos. 799, 816, 820, 823, 824, 829, 934, 1844, 1848. Swan 1984, fiche 368, '...several wells were also found...', dated to AD 140-160, fiche 366-7, a well, c. AD 140.

Alcester, Warwickshire

Britannia 1, 1970, 121, 129, 183, ns.24, 34, military equipment and fort; 7, 1976, 331, two wells; 9, 1978, 439-40 wells; 13, 1982, 361, fort and road; 19, 1988, 449-50, town buildings; 20, 1989, 287-8; 25, 1994, 272 defences. Booth 1980, 'Roman Alcester'. JRS 51, 1961, 172-3; 53, 1963, 134; 55, 1965, 208-9; 56, 1966, 206; 57, 1967, 185; 58, 1968, 187-8. TBWAS 66, 1945-6, 35-48; 1958, 10-8; 1959, 27-32; 1963-4, 139-43. VCH Warwickshire 1, 1904, 236-7. WMANS 18, 1975 (1976), CBA Gr. 8 summary report.. 2 wells - 1st 'abortive - overlaid with a stone wall'. '2nd well, 2m deep, was originally lined with staves and later with a box-framework. In the late 4th c. or later the well silted up' (Brit. 7, 331). TIRBS 1987, 1, civil settlement developed in Flavian period. Defensive rampart built in late 2nd c., reinforced with stone wall in 4th c. Decline in late 4th c., perhaps caused by flooding. (*Dobunni*).

Alchester, Oxfordshire.

Britannia 1, 1970, 118-9, 123; 5, 1974, 468; 6, 1975, 256; 18, 1987, 45, extramural settlement; 23, 1992, 312; 20, 1989, 141-7.

Foster 1989. Rodwell & Rowley 1975, 31, 118-23. VCH Oxfordshire 1, 1939, 281-8. TIRCGLL 1983, 17; town founded under Claudius (?); timber buildings reconstructed in stone c. AD 100. Declined early 5th c. Walls, bath-building. (*Catuvellauni*).

Aldborough, Boroughbridge, North Yorkshire

Britannia 1, 1970, 40, 42, 47 Ant. Itin. 465.3 (*Isurium*), 468.3 (*Isuriam*), 476.1 (*Isubrigantum*); 5, 1974, 416 cobble foundation; 6, 1975, 237, 'the Helican pavement mosaic'; 17, 1986, 76, 'Roman administration centre of the tribal area' of the Brigantes, pre-Roman occupation; 18, 1987, 373, lead sealing; 21, 1990, 322 ribbon development; 25, 1994, 265 street. CSIR: Great Britain I.3, 1983, Nos. 15-17. JRS 52, 1962, 169. PNRB 1979, 379-80. There is a large and deep Roman quarry below the *civitas* capital, also worked during the Medieval period. This quarry must have been a major source of stone since Roman times and supplied other centres with stone during the Romano-British period. It must have been a major undertaking to win the stone, as it was low down in the valley, and to transport the stone to other sites. Smith 1852, pls.xviii & xxviii. Wacher 1995 (2nd ed.), 401-7 (1974, 398-404), refers to baths near west gate, probably for a *mansio* (403). A possible aqueduct that fed water into the stone-lined water tank, 2.7m by 1.8m, but not sure about the aqueduct (405). There is slight evidence that there may have been similar tanks at the east and west gates. YAS Bulletin No.7, 1990, 15-20. YAJ 40, 1959, 1-77. TIRBS 1987, 2, RIB 708-10. Defensive earth bank built late 2nd c. (22ha); stone wall added in 3rd c., bastions in 4th c. Decline late 4th c. There was a civilian settlement towards end of 1st c., and the *civitas* capital was probably founded under Hadrian. (*Brigantes*).

Aldbourn, Upper Upham, Wiltshire

Britannia 24, 1993, 305 coin hoard. Scott 1993, 196, SMR SW302, WZ 1 Upper Upham; SMR NW303, WZ 2 Warnborough; SMR NW309, WZ 3 SU 22 55 Woodsend; SMR SE301, WZ 4, SU 26 73 Aldbourn Corse, 'substantial villa'; SE304, WZ 5, SU 25 73; SMR SE306, WZ 6; SW308, WZ 7, SU 23 74. WAM 41, 1920-1, 389; 1968, 119; 1972, 173; 1973, 135; 1975-6, 134, bath-house item 65; 1979-80, 205.

Aldenham, Netherwylde Farm, Colney Street, Hertfordshire

JRS 32, 1942, 112; 53, 1963, 136; 56, 1966, 209. Scott 1993, 91, SMR 91, HT 5. WSWHASB 16, 1960, 1. WSWHASN 2, 1965, 3; 3, 1966, 6; 5,

1967, 2; 1970, 3. *TIRCGLL* 1983, 17, detached bath building dated to early 4th c. (*Catuvellauni*).

Aldermaston, Berkshire.

Arch. Ex., 1976, HMSO. *Britannia* 8, 1977, 419, bath, well 4m diameter. *Current Arch.* 54, vol 5, Jan. 1976, 220f. 'In the late 3rd c. or early 4th c. an extensive field system was laid out. One of its ditches underlay a small bath-house: c. 12m x 4m....Beyond was a latrine pit and a well 4m in diameter, which yielded a sherd of c. AD 350.

Alfoldean, Slinfold, West Sussex.

Arch. J. 118, 1961, 163. *Britannia* 15, 1984, 328. Black 1987, 120-23, Appendix Nine, 'The Mansio of Alfoldean', Fig50, 247, bath-house, dating from c. AD 90-110, to 4th c. *SxAC.* 64, 1923, 81-104; 65, 1924, idem. 2nd Report, 112-57; 76, 1935, 183-92. *SxAS Newsletter* No.47, 1985, 456-57, English & Gower 'Alfoldean Roman Posting Station'. *TIRCGLL* 1983, 18, minor settlement, near bridge over river Arun. (*Regni*).

Alresford, Essex.

Antiquary 11, 1880, 36. *Athenaeum* 6 Dec., 1884, ?. Dunnett 1975, 96-8. *Essex Notebook* 88, 124. Laver 1887, 136-9. *PSA*(2) 10, 1883-5, 178. *TEAS* 3, 1884, 136, reporting a bath, channel water drain from a spring, which could imply a running water supply; 3(2), 1887, 136-9, pls.v, vi, site plans. *VCH Essex* 3, 1963, 37-8, Fig.9. *TIRCGLL* 1983, 18, corridor villa. (*Trinovantes*).

Alwinton, Northumberland.

Arch. Ael.(2) 8 1877-80, 75-6, 'ritual well at St Ninian's at Alwinton'. Hope 1893, 111-2.

Ancaster, Lincolnshire.

Arch. J. 103, 1947, 17-21. *Arch. Notes* 1954, 1955, 1956, 1965. *Britannia* 1, 1970, 47-8, 116 small town, 125-7, 184 early fort, 284; 2, 1971, 257; 5, 1974, 421; 7, 1976, 323. *JRS* 47, 1957, 210-11; 51, 1961, 171; 52, 1962, 167, 192; 53, 1963, 131, 167; 54, 1964, 159; 55, 1965, 205, 228; 56, 1966, 203; 57, 1967, 182; 58, 1968, 184; 59, 1969, 214; 67, 1977, 128 camp. Todd 1981. Todd in Rodwell & Rowley (eds.), 1975, 215-23. Whitwell 1982, 183 & 185, reports 5 wells. *TIRBS* 1987, 2, 1st c. fort and later civil settlement on Ermine Street at junction with King Street, at SK 983 436. (*Corieltavi*).

Angmering(1), West Sussex.

Black 1987, 87-9, 152, No.108, Fig 39 p.233. *Britannia* 1, 1970, 257; 2, 1971, 114, mosaic, 170, 175, 180, 184, building materials; 13, 1982, 211, tile c. AD 75. Cartwright 1832, Vol.2, 172-3. Cunliffe 1973, 76-9. *Gentleman's Mag.* 1, 1832, 577-9. Keef 1944-5, *SxAC* 84, 82-107. Scott 1993, 181, SMR 2243, WS 1, NAR TQ 00 SE 8, mentions an earlier bath building, c. AD 75-80 and a main bath building of Flavian period which lasted to mid 2nd century. Scott 1938, *SxAC* 79, 3-44. *SxAC* 84, 82-107. *Sux. Collector's Mag.*, 12, 1938, 405-10; 16, 1942, 336. *RAF APs*, CPE/UK 1843 4050 & 4051. Wilson 1947, *SxAC* 86, 1-21. *TIRCGLL* 1983, 19, large bath suite built c. AD 70.

Angmering(2), Highdown Hill, West Sussex.

Black 1987, 152. Scott 1993, 181, SMR 2237, WS 3, NAR TQ 00 SE 3; see also WS 4 at TQ 06 04, NAR TQ 00 SE28, uncertain Roman bath. *SxAC* 80, 1939, 63-87.

Apethorpe, Northamptonshire.

AASRP 5, 1859, 97-107. Northamptonshire Archaeological Atlas, Supplementary Series 2, 1980: Commentary on 18 transparent map overlays. *RCHM(E) Northants* 1, 1975, 8-10, bath, wells. Smith 1868, Vol.6, 280. Scott 1993, 139, SMR 1733, NH 3. *VCH Northants* 1, 1902, 191-2, bath, wells. Whitwell 1982, 102-3. *TIRBS* 1987, 3, occupation, coins indicate 1st half of 4th c. (*Catuvellauni* or *Corieltavi*).

Appleshaw, Redenham, Hampshire.

Britannia 17, 1986, 420. *PHFC* 9, 1920-5, 215-7, item 5, pl. opp. p.218. 4th c., bath. Scott 1993, 82, NAR SU 34 NW 7, HA 10.

Arbury Road, Cambridge, Cambridgeshire.

JBAA(3) 22, 1958, 20. *JRS* 43, 1953, 120; 44, 1954, 93; 56, 1966, 209; 57, 1967, 11; 59, 1969, 223. Frend 1955. *PCAS* 48, 1955, 10-43, Fig.2, pl.II of the well; description of well, pp.16-18, with Fig.3, showing sections through the well, which is 3.19m (10.5 ft) deep and 1.12m (3.66ft) in diameter; 49, 1956, 13-23; 52, 1959, 69-72, ?pit/well. *RCHM Cambridgeshire* 1, 1959, 6. *VCH Cambridgeshire* 7, 1978, 43-4, 67-8. Scott 1993, 33-4, SMR 05424, CA 30, well. *TIRBS* 1987, 16, TL 445 595; occupation 4th c. (*Catuvellauni*).

Ardoch, Porthshire, Scotland.

Note: No water-related structures. St. Joseph 1970, *Britannia* 1, 163-78, 201; 2, 1971, 248; 3, 1972, 5, 7, 14, 16, 30, 43: Samian from; 9, 1978, 410, military camp; 19, 1985, 326, inscription; 25, 1994, 255, fort.

Armoth, Trelissey, Dyfed, Wales.

Arch. Camb. 121, 1972, 107. *BBCS* 18, 1958-60, 295-303; 20, Part 2, 1963, 192. *Carm. Ant.* 7, 1971, 6. Nash-Williams 1954, 87. Savory 1964, 15. Scott 1993, 56, SMR 3644, DY 2, bath-house. Wainwright 1967, 66.

Arreton, Robin Hill Villa, Isle of Wight.

Britannia 5, 1974, 456 'excavations unearthed 2 mosaics, one of them with a dolphin motif, in or near a bath-suite, together with evidence of flooding of the hypocausts'. Isle of Wight County Press, 4 Aug., 1973.

Ash, near Sandwich, Kent.

Scott 1993, 102, KE 4, baths, TR 32 59. *VCH Kent* 3, 1932, 34. (*Cantiaci*).

Ash-Cum-Ridley, near Aynsford, Kent.

Britannia 1, 1970, 303, villa re-explored. Haverfield 1915, 25, 103, Fig 21, 'sunken bath, 7ft square,...A deep pond close by is said to be fed by springs'. *KAR* 20, 1970, 13-20, Fig 1 shows a small bath building within the complex. A pond (pit 2) next to the bath; a drain discharges from the bath into the pond. Scott 1993, 102-3, KE 5. *VCH, Kent* 3, 1932, 103-4. *TIRCGLL* 1983, 21; corridor villa; bath-house. (*Cantiaci*).

Ashdon, Essex.

Arch. J. 10, 1853, 14-7, Investigations during 1852: The first part describes the house and bath at Great Copt Hill, a part of Great Bowers' Farm, Essex. *Britannia* 24, 1993, 302. Scott 1993, 60, SMR 4760, ES 4. *RCHM, Essex* 1, 1916, 5. *VCH, Essex* 3, 1963, 44-5.

Ashill, Robin Hood's Garden, Norfolk.

Arch. J. 37, 1875, 108-9. *Britannia* 4, 1973, 268-9. *EAA* No.5, 1977, 9-30, 3 wells, 'The Romano-British site at Ashill is a bank-and-ditch enclosure about 700 ft square...., which revealed ditch sections and

two deep timber-lined wells' - contained lots of pottery; EAA Fig 5, p.12 illustrates a shaft or well No.3 to a depth of 12.14m (40ft), oak-lined, 1.52m (5ft) square from 1.82m (6ft) below surface. Norwich Mercury 24 Oct. 1874. Scott 1993, 129, SMR 8712, NF 4, two 1st c. wells. VCH Norfolk 1, 1901, 295-6. TIRBS 1987, 3, at TF 908 057. (*Iceni*).

Ashtead, Ashtead Common, Surrey.

Black 1987, appendix 7, 105-16, Figs 22 & 33, p.150, occupation c. AD 120-150 to c. 240-250. *Britannia* 2, 1971, 181ff; 3, 1972, 147; 6, 1975, 196; 17, 1986, 231ff; 21, 1990, 356; 25, 1994, 104. *SyAC* 37, pts. I & II, 1927, 144-63; 38, 1930, 1-17, 132-48, Fig 1, p.146, bath-house detached from dwelling house, storage tank and 3 drains constructed from large roof U-shaped tiles. Scott 1993, 175, SMR 270, SY 3. *TIRCGLL* 1983, 21, bath-building. (*Regni* or *Atrebates*).

Ashton, Northamptonshire.

Britannia 6, 1975, 253, stone-lined tank, probably for quenching; 8, 1977, 399, pl.29B, cylindrical lead tank, weighing over 3 cwt (152 kg) with Chi-Rho monogram, p.443, No.97; 9, 1978, 442, drainage & stone-lined well; 10, 1979, 302. *Current Arch.* 56, 5, May 1976, (1977), 274. *Durobrivae*, 3, 1975, 12-5; 5, 1977, 6-11. *Northants Arch.* 10, 1975, 153; 12, 1977, 210-11; 13, 1978, 181; 14, 1979, 105. *RCHM*, Northants, S-W, 4, 1982, 185, stone-lined well, item bc(2-4), at TL 046 892. Whitwell 1982, 186.

Asthall, Oxfordshire.

Oxoniensia 20, 1955, 29-39. Scott 1993, 157, OX 4, bath. VCH Oxon 1, 1939, 319-21, 330. (*Dobunni*).

Atworth, Wiltshire.

Antiq. J. 23, 1943, 148-52. *Britannia* 3, 1972, 346; 4, 1973, 317, stair- well; 5, 1974, 455; 6, 1975, 278; 7, 1976, 362. *WANHM* 49, 1940-2, 46-95. *TIRCGLL* 21, bath-suite, c. AD 200, abandoned c. AD 400. (*Belgae*).

Auckley, West Riding, Yorkshire.

Britannia 11, 1980, 145-64. Buckland, Magilton & Dolby 1980, 145-64. Buckland & Magilton 1986, Vol.1, 56. Swan 1984, fiche 700, well.

Axminster, Woodbury, Devon.

Note: There seems to be some confusion about this site in the literature. Scott suggests that this site is that of the *Moridunum* in Devon, but Rivet and Smith, in *PNRB* identify two Roman *Moridunum* forts, one at Carmarthen (SN 41 20) (p.422) and the other at Sidford in Devon at SY 13 89 (p.180, Fig.24, & p.421). Other literature cited also gives contradictory positions for this fort. *Archaeologia* 93, 1993, 41, (1-50 + pls.I-X), 'The British Section of the Ravenna Cosmography'. *Britannia* 19, 1988, 471-3; 22, 1991, 281-2, Fig 26, plan showing Woodbury Fort and how Fosse Way Roman road was diverted towards it. *Ephemeris Epigraphica* (Eph. Ep.) 9, 1913, 645: 'Statio Moridunum (Ant. Itin. 482, 483, 486; Ravenna Cosmography 425.8; Tab. Peut.), 'modo vias huius tractus flexibus vallium implicatas recte indagavimus, probe Seaton quaerenda est'. Exeter Museum Arch. Field Unit Rept. 87.06; 91.14; 91.18: at p.281 it is suggested that Axminster is the lost site of *Moridunum*. *JRS* 11, 1921, 211; 51, 1961, 188: 'Moridunum, site near Axe estuary identified as'. For a discussion on the location of *Moridunum*, see Rivet and Smith, *PNRB* 1979, 180, 421-2. *PDAS* 42, 1984, 33-57; 51, 1993, 33-133, comments, 'The status of the settlement, a *mansio* at Woodbury, i.e. within the fort, rather than a villa. Therefore a bath quite likely (p.79), and the site at *Moridunum*....' (p.78). Scott 1993, 49, DE 1, cites this site as possibly the Roman fort *Moridunum*. *TDAS* 17, 1885, 280; 54, 1922, 66-8.

Badbury, Wiltshire.

Arch. Review 1971, summary report. *Britannia* 2, 1971, 282; 3, 1972, 346 (uses SU 195 810), bath-house found during excavations for M4 motorway on east side of Ermin Street, 1.5 km N-E of Chiseldon, and it is 'attached to the front corridor'. *WANHM* 57, 1958, 24-29. *TIRCGLL* 1983, 22, baths; occupation 1st to 4th c. (*Belgae*).

Badgeworth, Dryhill, Gloucestershire.

RCHM 1976, 5-6, small brook, c. 139m (450 ft) north of villa, and a spring c. 139m (450 ft) S-W of villa, probably near the 182m (600 ft) contour. Scott 1993, 68, SMR 450, GS 7, ?bath.

Baldock, Hertfordshire.

Applebaum, 1932, 244-58. *Britannia* 2, 1971, 269, 289; 3, 1972, 329; 4, 1973, 298; 7, 1986, 338; 11, 1980, 412; 12, 1981, 345, 385-6; 15, 1984, 304; 17, 1986, 400; 18, 1987, 327; 19, 1988, 457; 20, 1989, 188, 298-300, Fig 22, 'traces of timber buildings with pits, ditches and

wells,...'. Burnham & Wachter 1990, 286, implies three wells. Current Arch. 86, 1983, Selkirk 'Baldock', 70-4 Goding 1863, 20-3. Gomonde 1849, 7-13. JRS 45, 1955, 72, no.20, tile; 49, 1969, 221-2.. JBAA (2nd ser.), 38, 1932, 235-69. Witts 1883, 60, no.10. Smith 1987, 212. Stead 1975, 125-9. TIRCGLL 1983, 23, occupied 1st c. to end of Romano-British period. (Catuvellauni).

Balmuildy, Strathclyde Region, Lanarkshire, Scotland.

Britannia 2, 1971, 122, diet; 3, 1972, 7, 19, 43-5, 75, principia, 303, Antonine Wall; 5, 1974, 177-8, 201, 303, 405; 6, 1975, 227-8; 11, 1980, 48, fort. DAES 1974, 44, summary by L J F Keppie, aqueduct of clay pipes. Frere & St Joseph 1983, 74-6. GAJ 4, 1976, 99-102. Hanson 1970, 215-6, 358. Macdonald 1934 (2nd ed.), 312-24. Robertson 1990, 84-7, Fig 54, (6) internal bath, (7) external bath. Miller 1922, 24, Fig.7. RCAHMS Lanarkshire 1978, 114-7, plan. Roy 1793, pl. 35, (Bemulie). TIRBS 1987, 4, RIB 2189-92; annexe, external baths, NS 581 717.

Bancroft, (formerly Bradwell), Wolverton, Buckinghamshire.

Britannia 3, 1972, 328-9; 5, 1974, 381-3, 436; 6, 1975, 257; 7, 1976, 337; 8, 1977, 400; 10, 1979, 303-4, baths; 12, 1981, 344; 15, 1984, 304, 306 Fig 19; 16, 1985, 290-3; 17, 1986, 399-401; 18, 1987, 326-7, Fig.14; 24, 1993, 315. CBA Gr.9, Newsletter 9, 1979, 67ff; 5, 1975, 14; 7, 1977, 79-85. Milton Keynes Development Corp., Occasional Papers in Arch., 1, 1975. Records of Buckinghamshire, 25, 1983, 171. South Midland Arch., Vols.15-17, 1985-87, 60-79, 2 bath-suites, a small one at west side of house, and a large one at south end of the house; drains for both baths; 'A possible water leat ran from the south along the west side of the double-apsidal caldarium, perhaps originating at a spring 100m to the south'. Williams & Zeepvat 1994, Excavation report in 2 vols, Vol.1, 'Excavations and Building Materials', Buckinghamshire Arch. Soc., Monograph Series No. 7. See section on water supply, 209-10, wooden water-pipe. TIRBS 1987, 5, occupation 1st or early 2nd c., when burnt down and rebuilt. Occupied into 5th c. Shrine at SP 825 405, of 4th c. (Catuvellauni).

Banwell, Chapel Leases, Winthill, Banwell Hill, Avon.

Arch. Review 1, 1966, 22; 2, 1967, 16. Banwell Arch. Soc. Newsletter 1973 & 1975. Britannia 17, 1986, 414, ST 4021 6095; 19, 1988, 470, ST 402 579. JRS 58, 1968, 199. Scott 1993, 13, SMR 214, AV 5, AV 4,

bath-house. *VCH* 1, 1906, 307-8, item 14. *TIRCGLL* 1983, 23, bath-building; pottery late 3rd to mid 4th c., when abandoned.

Bar Hill, Strathclyde.

Britannia 10, 1979, 276, 'the bath-house and latrine block', and referring to the frigidarium and caldarium, 'a culvert along N side of the baths collected water from furnace and bath-rooms; this and a 2nd culvert from the intervalum road, flushed the latrines...'. 11, 1980, 48, fort; 14, 1983, 288; 15, 1984, 276; 16, 1985, 267; 18, 1987, 21, 25, 29. Hanson 1970, 358, 'The terminal tank of an aqueduct was found inside the fort and this in turn supplied the internal bath-house. Neither source nor means of supply are certain but the discovery of channelled stones in the vicinity of the water tank suggest that these had either formed the water channel or, as at Balmuildy, had carried a pipeline'. Macdonald 1934, (2nd ed.), 271-85. Macdonald & Park 1906. Robertson, et al, 1975, BAR 16. Roy 1793, Plate XV. *TIRBS* 1987, 5, small fort (1.6ha) at NS 708 759, and a small marching camp at NS 707 757. *RIB* 2165-73.

Barkby Thorpe, Hamilton, Leicestershire.

JRS 39, 1949, 104. Scott 1993, 109, NAR 60 NW BH, LE 4, bath; occupation 1st to 4th c. *TLAHS* 28, 1952, 47; 32, 1956, 94-5; 50, 1974-5, 59-60; 51, 1976, 58-9; 52, 1977, 87-8. Whitwell 1982, 189. Occupation 1st to 4th c.

Barming Heath, Kent.

Scott 1993, 103, TQ 72 53, KE 9, and TQ 72 54, KE 8, numerous small rooms and hypocausts; possibly there was a bath. *VCH Kent*, 3, 1932, 104, item 6, near the building 'was a curious and ragstone pit, 4ft (1.2m) deep, 9.5ft (2.89m) long and 4.5ft (1.37m) wide....Its walls were of Kentish rag and tuffa, cemented with pink mortar and bonded with tiles; its floor was paved with tiles measuring 12 x 16 inches (0.3m x 0.4m)'. Possibly a water tank.

Barnack, near Peterborough, Cambridgeshire.

Antiquity 47, 1973, 145-6, pl. XV A. *Britannia* 2, 1971, 180, quarries; 5, 1974, 257, '...A square stone-lined well lies on the west side close to the presumed position of the front door, of a small house presumed to be near the front door, 2.5km W of the villa. *JRS*, 55, 1965, 74-89. Simpson 1966, 23. Whitwell 1982, 112. *TIRBS* 1987,

5, (i) Villa (Basilican type) at TF 080 066; (ii) small house 2.5km W of villa with a well at TF 056 065. (*Catuvellauni*).

Barnsley Park, Gloucestershire.

Arch Review 1973, 26. *Britannia* 1, 1970, 293; 2, 1971, 274; 3, 1972, 338; 4, 1973, 307, 331; 5, 1974, 446; 6, 1975, 271; 7, 1976, 352; 9, 1978, 455; 10, 1979, 318; 19, 1988, 465, settlement. *Current Arch.* 72, 1980, 11. *JRS* 41, 1951, 135; 53, 1963, 143, 164; 54, 1964, 171; 55, 1965, 216; 56, 1966, 212. McWhirr 1981, 89-90. *RCHM* 1976, 9-11, Figs, at pp.9b, 10, 11. It is noted that in the *RCHM* article figure, 3 wells are shown, while in the *Britannia* Fig.16 only two wells are shown and two stone-lined pits, of which the previously mentioned well 3 is one. *TBGAS* 86, 1967, 74-87, Webster comments that the villa 'is sited on almost flat ground with ample water supplies near by. It consists of a building...nearly 100ft long ..., with a bath-house in the corner,...Occupation of site originated in the 2nd c. ...the main building and bath-house, associated with domestic occupation, were erected c. AD 350-60. Wells 1 & 2, were both dug to a depth of about 7.6m (25ft)'. The site may have changed from Roman use after c. AD 380. 2nd c. Main building and bath-house associated with domestic occupation were erected c. AD 350-60; continued in use after c. AD 380 and evidence that site was occupied into 5th c.; 99, 1982, 121-78. Scott 1993, 68, SMR 1, GS8. *TIRCGLL* 1983, 24; built 2nd c., flourished especially between AD 330 and 375. Bath-house and two wells, depths c. 7.6m (25ft), plus a 3rd well. (*Dubonni*).

Barnwell(1), North Lodge Farm, Northamptonshire.

Britannia 5, 1974, 434, bath-suite dated to 4th c.; 18, 1987, 324; 19, 1988, 450-2, several sections of lead-pipe; 20, 1989, 290; 21, 1990, 332; 22, 1991, 252; 25, 1994, 224-6. *Peterborough Citizen & Advertiser*, 13-11-1973. Scott 1993, 140, NH 11. Whitwell 1982, 190.

Barnwell(2), North Lodge, Northamptonshire.

Britannia 5, 1974, 434, bath-suite; 18, 1987, 324; 19, 1988, 450-2; 20, 1989, 290 villa; 21, 1990, 332; 22, 1991, 252. *Citizen & Advertiser*, 13 Nov. 1973, news report. *Durobrivae* 2, 1974, 27-8. Hadman & Upex, 1974, 27-8. Northamptonshire SMR 395, 1312. *Peterborough Peterborough Museum Record* nos.393, 394. Bath-suite, 4th c.

Barochan, Strathclyde.

Britannia 1, 1970, 224; 4, 1973, 275; 5, 1974, 144, 148; 16, 1985, Fig.10, drain led out of South Gate; 17, 1986, 371, drain, v-shaped; 18, 1987, 312-3; 19, 1988, 467. *PSAS* 104, 1971-2, 147-200.

Barrington, Gloucestershire.

TBGAS, n.d., MS Notebook of Dr J Moore, 9 March 1882, 14-16. *RCHM* 1976, 11-12. Scott 1993, 68, SMR 365, GS 10. *VCH Gloucestershire* 6, 1965, 17.

Bartlow(1), Cambridgeshire.

Antiq. J. 17, 1937, 138. *Archaeologia* 25, 1834, 1; 26, 1835, 310, 463. *Arch. J.* 10, 1853, 14, 17-21; 19, 1862, 279; 21, 1864, 1. *Britannia* 4, 1973, 157-8. Fox 1923, 185. *JBAA* 19, 1913, 249-56, at 252. *RCHM Essex* 1, 1916, xxiv-xxv, 4-5, 24. Scott 1993, 32-3, SMR 06164, CA 18, baths, lead pipe, cistern. *VCH Essex* 3, 1963, 39-45.

Bartlow(2), Essex.

Arch. J. 10, 1853, 17-21, bath, plan of building opp. p.18: '...we were opening an old well,... and at a depth of 31ft (9.43m) reached the water'. Well structure not described. The well was 0.91m from the edge of the building on its N side. A 0.15m long piece of lead-pipe still in place in the excavated wall (p.17). Dunnett 1975, 101-2. Frere & St Joseph 1983, 224-6. *VCH Essex* 3, 1963, 40. *TIRBS* 1987, 5, TL 586 449, a small villa 100m NE of a set of two rows of 4 barrows. (*Catuvellauni* or *Trinovantes*).

Barton Court Farm, Radley, Abingdon, Oxfordshire.

AEx. 1974, 61-2; 1975, 74; 1976, 95. *Britannia* 5, 1974, 456, Fig 22; 6, 1975, 279; 7, 1976, 372, well: 'To the east was found a well 50 cm square built of large Corallian Ragstone placed within a clay-lined construction-shaft, each course of stone being bedded on moss. It was 7m deep, and the base of the steining rested on two superimposed square frames of oak(?). A well-hook and bucket-binding was recovered'; 8, 1977, 419-20, Fig.28 shows a well discovered in an earlier quarry. *Current Arch.* 30, 1972, 332. Miles 1986. Scott 1993, 161, SMR 8376, OX 45.

Bath, Avon.

Britannia 1, 1970, 58 *Ant. Itin.*, 259, 295; 2, 1971, 275-6; 3, 1972, 341; 4, 1973, 311; 7, 1976, 1-32 (Cunliffe), pls I-VIII; 8, 1977, 444, Roman reservoir; 10, 1979, 148; 11, 1980, 387-8, Roman reservoir;

12, 1981 370-81; 13, 1982, 396-406; 14, 1983, 336-7; 15, 1984, 333-6; 16, 1985, 199-200, water supply, 322-4; 17, 1986, 415, 430; 18, 1987, 341-3, 364-5, 369; 20, 1989, 178, 312-3, sewer; 21, 1990, 348; 22, 1991, 278; 23, 1992, 296. Cunliffe 1971, 39-41, See notes on ceramic pipes and discussion of its uses, and see Fig.14, pp.28-32. Cunliffe 1969, 126-7. Hanson 1970, 358, comments, 'A lead pipeline feeding fresh water to the baths, in addition to the mineral water supply, was discovered but apart from its existence nothing else is known'. *PNRB* 1979, 255-6. Ross 1967, 30ff. Rodwell & Rowley (eds.) 1975, 131-8. *TIRCGLL* 1983, 24, shrine of Celtic goddess *SULIS*; temple of *SVLIS MINERVA*, 3 baths, built late 2nd c. Taken by Saxons after battle of Dyrham in AD 577.

Bathford, Waverleigh Lodge Farm & Horselands Farm, Avon.

Scott 1993, 13, *SMR* 1739, 1742, AV 11, bath, AV 12. Skrine 1871, 23, bath. VCH Somerset 1, 1906, 300-1, items 2 & 3: A spring of water found beneath the building.

Beadlam ,Yorkshire.

Britannia 1, 1970, 277-9; 4, 1973, 90, 279, 334; 8, 1977, 381; 9, 1978, 321. *JRS* 57, 1967, 179. Ramm 1978, 52, 90, 91, 96, 106. Tyler 1980, 30. *Yorkshire Arch.*, 1973, 5. *YAJ.* 43, 1971, 178-86; 45, 1973, 201. *Yorkshire Gazette & Herald*, 24/06/1976. *TIRBS* 1987, 6. (*Parisi*).

Bearsden, Strathclyde, Dumbarton.

Breeze 1984, 32-68. *Britannia* 5, 1974, 405-6, bath-house, drain; 7, 1976, 1-32, 302-4 vicus; 8, 1977, 365, 433-4, inscription of *Legio XX*. Macdonald 1934 (2nd ed), 324-6. Robertson 1960, 1990, 88-92. Roy 1793, pl.xxxv. *TIRBS*, 1987, 6, small fort unoccupied in Antonine period.

Red House, near Corbridge, Northumberland.

AEx. 1974, 60. *Arch. Ael.*(4), 38, 1959, 85-176, at pp. 105, 143, 167, *Arch. Ael.*(5) 7, 1979, 1-88, fort and supply-base. *Britannia* 1, 1970, 141, 153; 2, 1971, 127, 141, bath-house; 6, 1975, 230: 'Agricolan bath-house, extramural to fortress, was supplied by a lead pipe-line fed from Caw Burn, and completely demolished c. AD 87... a possible well'. *CBA Gr.3, Archaeol. News Bulletin*, 9, 1975, 2-3. *Current Arch.* 46, 1974, 325-9. Daniels 1959, 85-176. Stephens 1985b, 223.

Beauport Park, Sussex.

Britannia, 2, 1971, 289 inscription; 3, 1972, 350; 10, 1979, 139-56; Brodribb & Cleere, 1988, 217-74. The bath-house was well preserved. Built during 1st half of 2nd c., but fell into disrepair during 1st half of 3rd c. Appears to have been abandoned by c. AD 250. *SyAC* 29, 1879, 168. Straker 1931, 331-2. *TIRCGLL* 1983, 25. (*Regni*).

Beckfoot, Cumberland.

Arch. J. 132, 1975, 28. Birley 1961, 214-6. Bruce 1978, (13th ed.); idem. 1867, 365, plan at 536; idem. 'The Roman Stations in the West', *Arch. Ael.*(2) 5, 1861, 137-41. Frere & St Joseph, 1983, 71-3. Hanson 1970, 262, 359, discusses some of the problems (262) associated with this aqueduct, with its unique construction of flag-stones sloping outwards over a hewn channel which carried the water in a wall, which is raised towards the terminal end as it enters the fort. At p.359: 'The terminal end of a raised aqueduct channel, made of channelled stones, was found entering the fort near its S-E angle. The water was delivered into two stone tanks only fragments of which remained'. Robinson 1880, 138-9. *TCWAAS*(1) 5, 1880, 136-48; 36, (2nd ser.), 1936, 76-84, Collingwood, (Fig 1 shows a plan by J B Haney, 1879-80), who comments, '...The other structure was a raised water-channel at the S-E corner associated with stone troughs. From his description of it, I suppose it to have been the end of an aqueduct leading water to the fort at that corner' (p.79). *JRS* 41, 1951, 56, with pl.IV.2. *TIRBS* 1987, 6-7. (*Brigantes*).

Beddingham, Preston Court Villa, Sussex.

Britannia 18, 1987, 353; 19, 1988, 481; 20, 1989, 319 + pl.xxii; 21, 1990, 358-9; 22, 1991, 289; 23, 1992, 306; 24, 1993, 307, Fig.21. *SxAS News Letters* 53, 1988, 4, bath; 54, 1988, 10; 57, 1989, 11, detailed report on the bath. Occupation from c. AD 1st c. to 4th c. 'Found that the villa overlaid an earlier bath-building'.

Beddington, Park Farm Sewage Plant, Greater London.

Adkins & Adkins 1986. *Britannia* 13, 1982, 375-6, 'excavation...relocated the bath-house first discovered in 1871 (no.221), and showed it to have undergone at least one phase of rebuilding (Fig 19). ...Immediately to the west of the bath-house was a large ditch dated to the late 2nd c., and a recut at least 4 times....Pottery suggests a mainly unbroken occupation from the late 1st c., to well into the 4th c.'; 14, 1983, 312-3; 16, 1985, 298; 17,

1986, 409-10, a tufa and chalk-lined well; 18, 1987, 337; 19, 1988, 464; 22, 1991, 273. *PSA* 5, 1870-3, 149-50. *SyAC* 6, 1874, 117-121; 60, 1963, 37-44. *SASB* 84, 1971. Scott 1993, 78, GT 1. *VCH Surrey* 4, 1912, 358-9. Whimster 1931, 154.

Beenham, Berkshire.

Berkshire Arch. J. 69, 1977-8, 1-36, bath-house. *Current Arch.*, 54, 1976, 221. Scott 1993, 21, SMR 2856, BK 5.

Benwell, Hadrian's Wall, Tyne and Wear, Northumberland.

Arch. Ael.(4), 4, 1927, 135-92; 5, 1928, 46-74, mansio, bath, tank, drains, 52; 19, 1941, 1-43, pls.1-5, a plan which shows a bath, watertank, pipe, 2 drains; 38, 1960, 233-5. Birley 1961, 163-5. Breeze & Dobson 1976. *Britannia* 1, 1970, 150; 2, 1971, 127, 129-30; 3, 1972, 183, 193; 10, 1979, 280 *vicus* not located; 11, 1980, 319, 338-9; 12, 1981, 22, 24; 22, 1991, 234; 23, 1992, 112. *JRS*, 45, 1954, 147. *NCH* 13, 1930, 521-7. Petch 1928 46-74. Simpson & Richmond 1941, 1-43, comments, a possible aqueduct water supply from Denton Hill Head, from a spring, 3 miles away. Water tank, with filtering arrangements, Fig.2 (*Arch. Ael.* 19, p.15. *TIRBS* 1987, 7, at NZ 216 647; *RIB* 1327-1352. (*Brigantes*).

Bere Regis, Bere Down, Bagwood, Dorset.

Archaeologia, 39, 1853, 85-92. *RCHM County of Dorset*, 3(3), 1970, 594, 'A well, supposed to lie some 36m (120ft) N of the Roman Road, was excavated in 1860,... to a depth of 18m (60ft) to 21m (70ft) without reaching bottom. It was 2.4m (8ft) in diameter and cut in chalk with the upper 3m to 3.6m (10 to 12ft) revetted with regularly laid blocks of chalk and 'green sandstone' about 0.3m (1ft) square....'. Note 1: 'Another well and remains, possibly of a religious nature, were found by J C Mansell-Pleydell in 1888 in a "neighbouring field" in Winterbourne Kingston Parish'. There appears to have been Roman buildings in the area of Bere Down at SY 8401 9723. *PDNHAS*. 85, 1962, 103-5; 86, 1963, 100; 87, 1964, 111; 88, 1966, 116. Warne 1853, 85-92.

Berinsfield, Oxfordshire.

Britannia 10, 1979, 302-3, well, wattlewood-lined and a number of water holes. Original site dates from Neolithic through Bronze Age, Iron Age to Roman period.

Bewcastle, Cumbria.

Birley 1961, 231-3. *Britannia* 9, 1978, 474-6; 19, 1988, 474. Bruce 1978, (13th ed). *CW(2)* 22, 1922, 169-85; 31, 1931, 137-40; 38, 1938, 195-237; 49, 1949, 216-8 baths; 54, 1954, 265-7 baths. Gillam, Jobey & Welsbey 1993. Dating from Hadriannic period, c. AD 120, and functioned to c. early to mid 4th c., dated by coin of Constantine the Great AD 309-310, and a pot rim dated c. AD 360. The drain consists of stone slabs (Fig 5, Sect. 7), and is 0.84 m wide and 0.1 m deep. The fort is on Hadrian's Wall and the bath is within the ramperts. *JRS* 47, 1957, 228; 51, 1961, 193. *TIRBS* 1987, 7, *RIB* 985-997. (*Brigantes*).

Bibury, Gloucestershire.

Britannia 16, 1985, 298: '...a stone culvert, 0.6m wide and 1.07m high running S-W to N-E on the west side of the site. A length 12.5m was traced...; 19, 1988, 465. *Glevensis* 21, 1987, 42-5. Gough 1789, Vol.I, 282. *RCHM* *Glos.* 1976, 14-5. Scott 1993, 68-9, *SMR* 366, *GS* 12. Witts 1883, 55.

Biddenham, Bedfordshire.

AASR 4, 1858, 283-90, well, stone-lined. Scott 1993, 19, *SMR* 307, *BD* 4.

Biglis, Glamorgan, Wales.

Arch. in Wales, CBA Gr.2, 19, 1979, 28-9. *Britannia* 11, 1980, 348-9: '...a hardstanding, upon which stood two stone plinths probably supporting water cisterns....To the South a drainage system and timber buildings,...'; 21, 1990, 306. Dating from c. 2nd c. BC to end of Roman occupation. Summary of excavations in Glamorgan-Gwent Archaeological Trust Ltd., Annual Report 1978-9, 1-13.

Bignor, Sussex.

Applebaum 1975. *Archaeologia* 18, 1817, 203-21; 19, 1821, 176-7. Black 1987, 153. He suggests an earlier bath to late 1st to early 2nd c. nearby. *Britannia* 2, 1971, 169-93, 233 terminal date; 4, 1973, 95-6; 5, 1974, 457; 17, 1986, 421-3; 18, 1987, 351-3; 19, 1988, 478-9; 20, 1989, 320-1; 22, 1991, 189-90: refers to lead pipe and channel, and other pipe-lines; 24, 1993, 307; 25, 1994, 288; 26, 1995, 370, mentions continued excavations, but still no indication of a water supply of any kind. Frere 1982, with pls.vi-xiii. Herbert 1927, *Sussex MS.* *JRS* 53, 1963, 155-6. Lysons 1813, Vol.3. *Oxford J. Arch.* 2(1), 1983, 93-107. *SxAC* 67, 1926, 84-88; 121, 1983, 203-8. Scott

1993, 182-3, SMR 1674, WS 15, NAR SU 91 SE 1. A good summary is given of the site. Dated from c. AD 200 (timber building), replaced c. AD 225-250. Steer n.d., 'The Letters of John Hawkins and Samuel and David Lysons 1812-1830'. VCH Sussex 3, 1935, 22. *West Sussex Gazette* 26-07-1973. Winbolt & Herbert, 1934. *TIRCGLL* 1983, 27, occupied 2nd to 4thc. No water supply has been located for Bignor villa up to March 1995. (*Regni*).

Billericay, Essex.

Britannia 2, 1971, 331; 3, 1972, 331; 4, 1973, 330, well, but not clear whether from Roman period; 8, 1977, 405; 9, 1978, 449; 19, 1988, 457; 22, 1991, 261. Rivet 1964, (revised ed.), 147. Rodwell & Rowley, (eds.), 1975, 85-101. VCH Sussex 3, 1963, 48. *TIRCGLL* 1983, 27. (*Trinovantes*).

Binchester, County Durham, North Yorkshire.

Britannia 1, 1970, 40 Ant. Itin.; 2, 1971, 127-8; 3, 1972, 355; 8, 1977, 229, 379; 9, 1978, 425-6, 477; 10, 1979, 284 bath, 347-9; 11, 1980, 361, 367, 409; 12, 1981, 327, 383; 18, 1987, 318; 20, 1989, 277; 22, 1991, 238 final bath in *praetorium*, destroyed in 5th c. Original bath dates from c. 2nd c. and final bath constructed c. AD 360. Hooppell 1891, 'Vinovia'. *JBAA* 43, 1887, 111-23, 299-306; 46, 1890, 253-87. Hanson & Keppie (eds.), 1979, 233-54, plans. Sommer 1984, pls.5, 6, *vicus*. *TAASDN* 10, 1953, 363; 11, 1958, 115-27. Wilson 1988, 343-4. *TIRBS* 1987, 7-8, *RIB* 1028-1040. (*Brigantes*).

Binstead, Wyck, Hampshire.

Arch. J. 1, 1845, 393. *Britannia* 16, 1985, 327; 20, 1989, 319; 22, 1991, 287. *PHFC* 44, 1988, 25-39. Scott 1993, 82, NAR SU 73 NE 2, HA 14, bath.

Birdoswald, Cumbria.

Arch. Ael(1) 4, 1855), 63-75, 141-9; *Arch. Ael*(2) 4, 1860, 249. Birley 1961, 196-203. *Britannia* 3, 1972, 201, 205-6; 4, 1973, 152; 5, 1974, 148, 462-3; 19, 1988, 436-7; 494; 20, 1989, 274-5 drains; 21, 1990, 317, 365; 22, 1991, 296-7; 23, 1992, 315-6, 318-9, 365; 24, 1993, 284; 25, 1994, 298. Bruce 1867, (3rd ed.), 261; 1978, (13th ed.), 198-206. *TCWAAS*(1) 14, 1897, 413-6; 15, 1899, 172-90, 197-210, 345-76; *TCWAAS*(2) 28, 1928, 377-84; 29, 1929, 306-14; 30, 1930, 169-205; 31, 1931, 122-34; 32, 1932, 141-5; 33, 1933, 246 62; 34, 1934, 120-30. Frere & St Joseph 1983, 69-71. Stephens 1985b, 226, 230, at

item 31 he comments, 'The fort was supplied by a triangularly-shaped stone channel from the west. This fed a distribution tank near the centre of the fort, where water was filtered through charcoal (Bruce 1867, 261). Percolation was mentioned by Vitruvius (de architectura, 8.6.15), but is not otherwise attested in Roman Britain; the medieval supply to West Minster Abbey seems to have been filtered through sand (Micklethwait 1892-93, 166). The shape of the channel suggests the aqueduct was almost certainly a wooden pipeline held in a stone duct. It is undated'. Water was filtered through charcoal in the tank (Bruce). *TIRBS* 1987, 8, *RIB* 1872-1929. (*Brigantes*).

Birrens, Dumfries & Galloway.

Arch. J. 142, 1985, 216-36, Stephens comments, 'The fort was supplied by a line of channelled stone running through the north gate. This probably fed a distribution tank behind the gate, from which water was distributed in pipes - probably wooden - held in stone casings (Richmond 1937-38). Another channel, a "large drain" of triangular section, pierces the north-east angle rampart (Christison et al, 1895-6, 99). Crop marks in this area have been tentatively interpreted as those of the *mansio* (St Joseph, 1951, 57). The triangular channel should be re-interpreted as a casing of a wooden pipeline that supplied this building. The system is Antonine' p.225. *Britannia* 1, 1970, 42, 67 n.96, 201; 3, 1972, 38, 41, 47, 49, 153, 274, 314, well in fort; 4, 1973, 317; 5, 1974, 154, 159; 11, 1980, 19; 16, 1985, 326; 23, 1992, 317-8. Bruce 1978, (13th ed.), 315-20. Hanson 1970, 359, 'An aqueduct of channelled stones was discovered entering the fort by the north gateway and its construction can be dated to early in the 4th c. The source of water is unknown'. *PSAS* 72, 1938, 275-347. Bath is within the fort in the commander's quarters. The aqueduct is stone-lined, Fig.13 p.298. The two pipe-lines are of wood, Fig.19 p.304. Macdonald & Barbour, 1897. Miller (ed.), 1952, 85-7. Robertson 1975. Roy 1793. *RCAHMS Dumfriesshire* 1920, 100-6. St Joseph 1951, 57. *TIRBS* 1987, 8, *RIB* 2091-2116.

Bitterne, Hampshire.

Antiq. J. 27, 1947, 151-71, drain, Fig.5, pl.xxiiib. Black 1995, 93, 103, 86, 118, 192-3, Fig.70, small bath. *Britannia* 1, 1970, 49-50, n.48, 70 Ant. It. 478.1 (*Clausentum XX*); 2, 1971, 169-94, building materials; 4, 1973, 160-72; 6 1975, n.47; 10, 1979, 161-2; 11, 1980, 393; 22, 1991, 287, stone-lined well; 23, 1992, 302; 25, 1994, 287. Cotton & Cathercole 1958. *PNRB* 1979, 308-9, comments that it is not

established whether *Clausentum* was at Bitterne (SU 474 132), or at Wickham (SU 57 11). *TIRCGLL* 1983, 27, *RIB* 97, 2222-8; small town and port near mouth of river Itchen; dates from Claudian period to 4th c. (*Belgae*).

Bittesby, High Cross, Venoe, Leicestershire.

Scott 1993, 110, SMR SP 48 NE AP, LE 10. *TLAHS* 18, 1935, 47, remains of a bath.

Bitton, Avon.

Britannia 1, 1970, 58-60, Ant. Itin. Scarth 1864, 125-6, see maps facing p.106 and p.119. Scott 1993, 14, SMR 1237, AV14, SMR 1992, AV 7, ST 71 70, SMR 1255, AV 13, Cheyney Court Farm, ST 69 69.

Bledlow-Cum-Saunderton, Buckinghamshire.

Britannia 5, 1974, 254, 258; 20, 1989, 298. Head 1955, 114, 165. *JRS* 28, 1938, 185; 29, 1939, 210-11, 288-9; 55, 1965, 88. *PSA* 31, 1918-19, 67-8. A large villa with no water supply. *Records of Buckinghamshire*, 13, 1940, 398-426; 17, 1965, 410; 18, 1969, 261-76: Branigan suggests a bath-suite for certain rooms in the villa, 272. Scott 1993, 25, SMR 364, BU 5, SMR 0366, BU 6, SMR 0498, BU 7, SMR 0878, BU 8, SU 79 99.

Bletchingley, Surrey.

Scott 1993, 175, SMR 1218, SY 8. Manning and Bray's (n.d.) 'History of Surrey', original MS letters and plans at Minet Library, Camberwell. Wooler 1917, 188-90, Appendix: 'Roman Baths', item 9, p.189.

Blisworth, Northamptonshire.

BNFAS 4, 1970, 38. George 1904, 10. *RCHM County of Northants, South-West* 4, 1982, 17-19, items 3 (some wells SP 735 530) & 7, Fig.32. *VCH Northamptonshire*, 1, 1902, 216. Whitwell 1982, 195.

Blyborough, Lincolnshire.

Directory of Lincolnshire, (3rd ed.), 1972, 15. Dudley 1949, 181. Whitwell 1982, 195.

Boreham, Great Holts Farm, Essex.

Britannia 25, 1994, 279-80; 26, 1995, 359, 'a late Roman farmstead immediately to the N of the site excavated in 1992-93, of 2nd to 4th

century date, was examined, when structural remains (4th c.) of aisled building 12m by 4.5m were found associated with field boundaries and trackways, and a boxed cremation of the 2nd c. The trackway leading to a large enclosure c. 140m square and to a field...., its 4th c. timber successor 15m by 28m, a bath-house,... Two Roman wells, a pond, and a cremation burial'.

Borough Hill, Northamptonshire.

Condron 1996, 322. *Northants. Arch.* 13, 67-86. Northamptonshire SMR 631. *RCHM(E) Northants.* 3, 1981, 62-7. Woodfield 1978.

Bothwellhaugh, Bothwell, near Glasgow, Lanarkshire, Strathclyde.

Britannia 6, 1975, 20-35; 7, 1976, 304-5, Fig.8, showing bath with 'decorating cover in the middle of the cold room, feeding a drain outside the east wall....The cold plunge bath drained by a lead pipe', (pl.XXVI A); 8, 1977, 370, bath-house, c. 100m west of the fort. Two phases of construction, both dated within the Antonine period; both ended in destruction. *Glasgow Arch. J.* 8, 1981, 46-94. Miller 1942, 172-87. *TIRBS* 1987, 9, at NS 731 578.

Bottesford, Lincolnshire.

Arch. J. 91, 1934, 160, Roman water pipes. Scott 1993, 118, SMR SE 80 NE 8, LI 18. Whitwell 1982, 197.

Boughton, Northamptonshire.

BNFAS 4, 1970, 16; 5, 1971, 22. *RCHM Northants, N-W*, 3, 1981, 14-6, item 5 no.6, Fig.24. Well, located south of Boughton Grange, on Northampton Sand at 105m above OD.

Boughton Monchelsea, Kent.

Archaeologia 29, 1842, 414-20, pl.xliv opp. p.414. *Britannia* 7, 1976, 96, coin of Adminius. Scott 1993, 103, KE 12. *VCH Kent* 3, 1932, 105-6, Fig.22 bath-house, sited in a large sloping field 'The Slade'.

Bourne, Lincolnshire.

AASRP 22, 1989-90, 10. *LHA Arch. Notes* 1961, 21. Stukeley, *Surtees Society* 76, 1883, Vol.2, 300. Whitwell 1982, 198, aqueduct/leat, bath.

Bourne/Morton, Lincolnshire.

Stukeley, *Surtees Society* 76, 1883, Vol.2, 300. Whitwell 1982, 198.
Leat(?) TF 108 205 to TF 152 245.

Bourton-on-the-Water, Salmonsbury, Gloucestershire.

Antiq. J. 29, 1949, 85-6. *Britannia* 10, 1979, 318; 12, 1981, 271, 273-5, 354; 13, 1982, 377; 14, 1983, 314; 20, 1989, 234. *RCHM* 1976, Gloucestershire & Cotswolds, 17-20, Fig., p.18, structures include walls, wells, shallow pits, ovens and floors'. *TBGAS* 56, 1934, 99-128, wells; 57, 1935, 234-59; 87, 1968, 29-55.

Bowes, Durham County, Yorkshire.

Arch. J. 142, 1985, 216-36, aqueduct. *Britannia* 1, 1970, 42, 47 *Ant. Itin.* 468.1 (*Lavatras*); 2, 1971, 251; 3, 1972, 41-2; 11, 1980, 18; 12, 1981, 327; 16, 1985, 203, 325; 19, 1988, 491; 20, 1989, 277. Hanson, 1970, 359, comments, 'It brought water to the fort from Laverpool (modern Levypool, NY 9675 1535), some 2km north-west of the fort'. *JRS* 58, 1968, 179-81, plan. Tomlin in *YAJ* 45, 1973, 181-4; 12, 1913, 400-10. *CSIR* 3, 1983, No. 28. *TIRBS* 1987, 9, *RIB* 730-741; dating from the Flavian period to late 4th century. NOTE: There is controversy about the levels along this leat. The leat is not dated, but probably dates from time when the bath-house was restored (*RIB* 730), Stephens 1985b, p.227, item 41.

Box, Wiltshire.

Arch. J. 61, 1904, 1-32. *Britannia* 15, 1984, 348. *JBAA* 43, 1887, 47-55, there is a stream which flows now and appears to have done so during Roman times discharged into the pond next to the bath, which possibly could have been the water supply for the bath. Scarth 1864, 119. Scott 1993, 198, *SMR* NW 301, WZ 29. *VCH* Wiltshire 1, 1957, 44-5. *WAM* 33, 1903-4, 236; 43, 1925-7, 335; 45, 1930-2, 177; 57, 1958-60, 104, 422; 63, 1968, 109; 64, 1969, 123-4; 66, 1971, 194, 197; 69, 1974, 185. *WANHM* 64, 1969, 123-4. *TIRCGLL* 1983, 30, coins chiefly of late 3rd to mid 4th c.

Boxted Farm, Upchurch Marshes, Kent.

Arch. Cant. 15, 1883, 104-7. *Britannia* 1, 1970, 304, Romano-Celtic temple; 4, 1993, 321-2; 7, 1976, 182. Payne 1883, 105. Payne 1893, 61-69. *KAR* 17, 1969, 32; 18, 1969-70, 9, well. *PSA* 9, 1882, 162-3, a very long building 217 ft, 50 ft wide, with many rooms, but no trace or record of a hypocaust system. *VCH* Kent 3, 1932, 106-9, item 10, Fig.23. *TIRCGLL* 1983, 30. (*Cantiaci*).

Bozeat, Northamptonshire.

Beds. Arch. J. 3, 1966, 3; 5, 1970, 57-65. *BNFAS* 6, 1971, 3. *JRS* 55, 1965, 210; 56, 1966, 207. *Northants. Arch.* 24, 1992, 77-82, drains. *RCHM Northhamptonshire, Central, II*, 1979, 3-5, drains. *TIRBS* 1987, 10, SP 906 587. (*Catuvellauni*). (Note: Many entries in *Britannia*, but only about small finds and nothing about water-related structures).

Bradford Down, Bradford Abbas, Pampfill, Dorset.

Arch. Rev. 3, 1968, 14; 4, 1969, 36-7; 7, 1972, 28. Branigan 1976, 36. *Britannia* 1, 1970, 298, a simple bath-house; 2, 1971, 279. *PDNHAS* 76, 1954, 98; 90, 1968, 171; 91, 1969, 189, the structure of a small building located in 1968, probably a small bath-building. During the 4th final phase the villa proper was constructed. The site was occupied from the Iron Age and to Roman periods. Villa dated later than c. AD 200; 92, 1970, 151; 104, 1982, 71-92.

Bradford-on-Avon, Wiltshire.

Scott 1993, 198, SMR SW 309, WZ32, bath.

Brading, Morton, Isle of Wight.

Antiq. J. 23, 1943, 153. Aspinall-Oglander & Oglander (rev. ed.) 1965, (Ashmolean Libr., 30.14 Wiltshire pamphlet), comment 1) 'But with the exception of a fountain pool, a heated bath, and a well-house...', A figure shows the plan of the villa with a small bath and the position of the well (p.10). 'The well itself - the superstructure of which is a reconstruction - was found to be 30.5m (100ft) deep;...' (p.25). 2) the 'semi-circular fountain, the bath-house, and the well, were covered in again after being excavated' (p.4). The well was near the stoke-hole furnaces. Basford 1980, 123. *Britannia* 22, 1991, 145-53. *Bull. Inst. Arch. London*, 1, 1958, 55-74. Price and Price, 1881. Rivet 1969, 43-4. Scott 1993, 101, SMR 1017, IW 3, well. Tomalin 1987, 19-28. *VCH Hants.* 1, 1900, 313-16. *TIRCGLL* 1983, 30, occupied 3rd and 4th c. (*Belgae*).

Bradley Hill, Somerton, Somerset.

Britannia 1, 1970, 295-6; 2, 1971, 276; 4, 1973, 310-11; 12, 1981, 177-252. Leech, et al, 1981, 177-252, Figs.7 & 14 for location, and Fig.2 for 1968-92 excavations. Stone-lined drains outside building 2 and a stone-lined drain with a cistern in building 3, item F109, p.188.

Braintree, Essex.

Britannia 6, 1975, 262; 9, 1978, 449, (TL 7685 2310 at Blyth's Meadow); 12, 1981, 348; 15, 1984, 307; 16, 1985, 241-2, 295, 327; 19, 1988, 457, settlement; 20, 1989, 302, a timber-lined well. *Essex Arch. & Hist. Soc.* 8, 1976, 1-143. Drury 1976. Rivet 1964, 147. *VCH Essex* 3, 1963, 55. *TIRCGLL* 1983, 30, major settlement on the road between Braughing and Colchester. (*Trinovantes*).

Braishfield, Hampshire.

Antiq. J. 14, 1934, 247, bath-house. *PHFCAS* 41, 1985, 69-80, bath-house, c. 1st c. to c. AD 370. Scott 1993, 82, NAR SU 32 NE 17, HA 19.

Brampton, Norfolk.

Britannia 1, 1970, 19, 27, 290; 2, 1971, 270; 3, 1972, 330, well; 4, 1973, 300; 6, 1975, 260, 4 clay-lined cisterns; 7, 1976, 209-16; 8, 1977, 213-6, 209-11, 405; 9, 1978, 448; 11, 1980, 375: '(a) Three wells, each 1m square,...two were timber-lined, one with oak planks 1.15m long and 0.25m wide. A clay-lined cistern 1m by 1.15m deep and probably dating to late 3rd or 4th c.'; 13, 1982, 369-70; 14, 1983, 307-8; 15, 1984, 306; 16, 1985, 294; 18, 1987, 44, 330. *CBA Norfolk and Suffolk Bull.* 32, 1987, 26-27, Fig 7. *EAA* 5, 1977, 31-95. *JRS* 57, 1967, 189; 58, 1968, 194; 59, 1969, 223. Knowles, 1976, 209-76, 3 timber-lined wells, Fig.1, bath and drain Fig 3, and 2 timber-lined soak-aways; the cistern is c. 1m x 1.5m x 1.15 m deep, and dated to late 3rd or 4th c. The bath dated to c. AD 80 to 350. Scott 1993, 130, SMR 7604, NF 23. *TIRBS* 1987, 10, TG 223 237. (*Iceni*).

Brandon, Hereford and Worcester.

Antiquity, 53, 1979, 51-5. Black 1995, 26-7, 62, 139, Figs.20a, b. *Britannia* 13, 1982, 360; 15, 1984, 294, Fig.13; 17, 1986, 393, Fig.16 shows a drain about 57m long, traced for 45.7m (p.294) on side of a street leading west from direction of east gate; 18, 1987, 11, 49-92. Frere 1987. Roy 1793, 172, pl.xix. Wright 1854, 196-8. *TIRBS* 1987, 10, Iron Age hillfort occupied by Roman army c. AD 55-60.

Braughing, Mentley Farm and Wickham Hill, Hertfordshire.

Archaeologia 93, 1949, 32. *Britannia* 1, 1970, 118, 120, 123, 127, 313; 2, 1971, 180, 188, 192; 4, 1973, 299; 5, 1974, 437, pl, xxxviii B, 3-roomed bath-building 22m x 4.5m and was abandoned during the 3rd

c.; 10, 1979, 349. Burnham & Wachter 1990, 103-11, Figs.27, 28. Rodwell & Rowley, (eds.), 1975, 152. Scott 1993, 92, SMR 222, HT 19. Braughing is a complicated site; occupation from the Iron Age through to 4th century, and probably later. There was a villa at Mentley Farm, north of the small town at the Wickham Hill site, where there is evidence of a street system. A bath-house, dating from the Flavian period (c.AD 70-90), went out of use in early to mid 2nd c., situated in the bend of the River Rib, presumably its water supply. *TIRCGLL* 1983, 30, major settlement on the road between London and *Durovigutim*, Godmanchester; occupied 1st to 4th c. (*Catuvellauni*).

Brecon Gaer, Y Gaer, Fenni Fach, Powys, Wales.

Britannia 1, 1970, 257; 2, 1971, 127-9; 3, 1972, 75; 10, 1979, 112-3; 14, 1983, 280; 16, 1985, 183-4; 18, 1987, 10; 22, 1991, 224; 25, 1994, 246. Hanson 1970, 396. Nash-Williams 1969, 48-51. *PNRB* 1979, 307. Wheeler 1926, 41, well, unlined. *TIRCGLL* 1983, 108, *RIB* 403-5, 2258-9; fort occupied c. AD 75-200, together with a small settlement. (*Silures*).

Brewood, Engleton, Staffordshire.

Historical Collections, Staffordshire, 1938, 267-93. *JRS* 28, 1938, 183-4. Scott 1993, 172, SMR 217, ST 5. Villa with bath.

Brislington, Bristol, Avon.

Barker 1901. Branigan 1969a, 18, Fig.3, well. *Britannia* 20, 1989, 183. Poulton & Scott 1993, 115-33. *PSANHS* 116, 1972, 78-85. Scott 1993, 14, SMR 1390, AV 16. *VCH Somerset* 1, 1906, 303-5, item 9, Fig.64 showing villa with bath. *TIRCGLL* 1983, 31. (*Belgae*).

Bristol(1), Avon.

Britannia 26, 1995, 366 stone-lined well. Scott 1993, 14, SMR 775, AV 18, well? described as a stone-lined pit.

Bristol(2), King's Weston Park, Avon.

Britannia, 8, 1977, 410; 9, 1978, 484; 15, 1984, 316, ST 591 692; 16, 1985, 302; 21, 1990, 348, ST 5870 7339. Smith 1978, 139. Scott 1993, 14, SMR 744, AV 21, bath-suite. *TBGAS* 69, 1950, 5-58. Villa assigned period c. AD 270-367/8.

Brithdir, Gwynedd, Wales.

Arch. Wales, 1974, 26. *Britannia* 6, 1975, 221-2, vicus; 7, 1976, 292, 295-6; 10, 1979, 272, withdrawal from; 14, 1983, 162-5; 24, 1993, 269. *CAAMC* 1, 1978, 29. *J. Merioneth Hist. & Record Soc.* 5, 1965-8, 359-63. *JRS* 51, 1961, 130, bath-house, cistern, slate-lined. Nash-Williams 1969, 130-2. *TIRBS* 1987, 11. (*Ordovices*).

Brixworth, Northamptonshire.

BNFAS 2, 1967, 7-8. *Britannia* 3, 1972, 322-3, Fig.7; 4, 1973, 135; 9, 1978, 371; 16, 1985, 324; 22, 1991, 252, SP 7498 6914. *CBA Gr.9 Newsletter* 2, 1972, 9. Woods 1972, 9. *JNMAG* 1, 1967, 4-28. *JRS* 56, 1966, 207; 57, 1967, 186; 58, 1968, 192. Northamptonshire SMR 2878, 2968, 3009. *RCHM County of Northants*, N-W 3, 1981, 26-31, item 16, no.11. The bath-suite appeared not to have been fired. The site dates from c. AD 160, and bath built in 4th c. Scott 1993, 141, SMR 738, NH 19. *VCH Northamptonshire* 1, 1902, 200. *TIRBS* 1987, 11, small 5-roomed house built late 1st c., partly rebuilt late 2nd c. or early 3rd c.; additions including bath-house at beginning of 4th c. (*Catuvellauni* or *Corieltavi*).

Broadfields, West Sussex.

Britannia 4, 1973, 320; 5, 1974, 457; 6, 1975, 282. This site was occupied from 1st c. to 4th c., and had 36 iron smelting furnaces, a large industrial enterprise, including agricultural activities on the settlement. *TIRCGLL* 1983, 31, Iron workings. Well. (*Regni*).

Bromham(1), Wiltshire.

Scott 1993, 198, SMR NE 303, WZ 35. *VCH Wiltshire* 1, 1957, 51. *WAM* 6, 1859, 260; 35, 1907-8, 441; 45, 1930-2, 178-9, bath; 72-3, 1977-8, 180 well(?); 74-5, 1979-80, 205. At ST 96 66 WZ 37 (Scott) and ST 97 66 WZ 39 there appear to have been evidence of villas. (*Belgae*).

Bromham(2), Bedfordshire

Bedfordshire Arch. J. 6, 1971, 84. *Britannia* 3, 1972, 327. *CBA Gr.9 Newsletter*, 1972, 12. Wooler 1915, 190. *YAJ* 23, ?, 401-41.

Brough-by-Bainbridge, North Yorkshire.

Britannia 1, 1970, 155, 279; 3, 1972, 41-2 occupation, destruction, rebuilding; 5, 1974, 205; 11, 1980, 319. Frere & St Joseph 1983, 113-5. *JRS* 51, 1961, 192-3; 59, 1969, 207. *PNRB* 1979, 506-7. Stephens 1985b, 227, 230, comments that a 'A triangularly-shaped stone channel running to the north of the *principia* was probably the casing of a

pipeline' (Wade, 1952, 13). This must date from the Severan period, since it cuts through the foundations of an Antonine granary and is overlain by an apparently Severan road. The pipeline will have formed part of a distribution system, whose existence shows that the fort was supplied by an aqueduct. The pipeline - although not necessarily the aqueduct - no doubt formed part of the rebuilding programme attested c. 205-08 (RIB 722, 723). Wade 1952, 1-19 Figs.3 & 11; *Proc. Leeds Phil. Soc.* 1, 1928, 261-84; 8, 1955, 153-6. *Notitia Dignitatum* xl, 56, (Trib. Coh, Sextae Nerviorum Virisido), occupation 3rd to late 4th c. CSIR 1.3, 1983, Nos. 106-7. TIRBS 1987, 4 & 12, RIB 722-724, attested c. AD 205-208; Flavian fort or fortlet; 2nd c., fort burnt at end of 2nd c., rebuilt c. AD 205; annexe. (Brigantes).

Brough-on-Humber(1), Humberside.

Hanson 1970, 360, item 9: 'Excavations revealed the gulley probably formed by a wooden water pipeline entering the fort by the West Gate. Its source may well have been the upper reaches of one of the streams that run down into the Humber to the west of the fort' (Wacher 1969, 16); item 10: 'The civitas capital: Another possible pipeline was discovered at the North Gateway of *Petvaria* and could be dated to the end of the 3rd c. Its source, if pipeline it was, could very well have been the springs on Elloughton Hill about 2km (1.25 miles) to the north of the town', (Wacher 1969) 41-42. JBAA (3rd ser.) 7, 1942, 1-30. PNRB 1979, 437-8, 443. Stephens 1985b, 227, item 46, comments 'Gullies found in both the Vespasianic fort and the later naval base may have been pipe trenches'. Wacher 1969, 41-2. TIRBS 1987, 12, RIB 707 (*aediles vici Petuariensis*); *Not. Dig.* xl, 31, (*Pf. numeri supervenientium Petueriensium*); ?Itin. Ant. 466.4 (*Praetorio*)?. Flavian fort c. AD 70-80; stores depot, c. AD 80-125. Late 2nd-c. earthwork defences walled c. AD 270; external towers added in 4th c. Presumed civitas capital. Theatre and *vicus* epigraphically attested. (*Parisi*).

Brough-on-Humber(2), Humberside.

Britannia 24, 1993, 287; 26, 1995, 347 '(a) immediately east of the defences at SE 9410 2675 considerable evidence for activity was present. Four phases of ditch-systems, wells, and a timber building, etc...., suggest agricultural activity through much of the Roman period'.

Brough-on-Noe, Derbyshire.

Britannia 1, 1970, 283; 2, 1971, 131-2; 3, 1972, 41, 45; 5, 1974, 24; 9, 1978, 432; 10, 1979; 293; 11, 198, 318-20; 15, 1984, 289, *vicus*; 16, 1985, 282, 326; 18, 1987, 321, 370; 22, 1991, 244-5. Dearne 1993, The site lies on a low spur of land 170m (545ft) OD, in a bend of the river Noe, near the confluence with the Bradwell Brook. 1st phase Flavian c. AD 68-98; 2nd phase c. AD 158-300; 3rd phase after AD 300, i.e. 4th c. *Derbyshire Arch. J.* 59, 1938, 53-65, Figs.1 & 2; 85, 1965, 123-6; 86, 1966, 99-101; 87, 1967, 154-8; 88, 1968, 89-93, Fig.1, Jones G D B & Wild J P, 'Excavations at Brough-on-Noe (Navio) 1968', drain; 89, 1969, 99-106. Hanson 1970, 360, 'A covered stone water channel feeding an underground water tank at the fort could represent the point of entry of an aqueduct'. Hart 1981, 83-7. *JRS* 29, 1939, 206; 30, 1940, 168; 42, 1952, 204; 44, 1954, 108ff, full account; 49, 1959, 108; 50, 1960, 216; 53, 1963, 160; 56, 1966, 201-2; 57, 1967, 181; 59, 1969, 211, Fig.33, aqueduct. Stephens, 1985b, 228, 230, 'The fort was supplied by a stone channel passing through the s-w gate. This fed a distribution tank constructed below ground level, from which water was distributed in another stone channel (Taylor & Collingwood 1940, 108, pl. XII.2). The tank's west rim has a round inlet hole, showing that it was supplied by a pipeline - probably wooden in view of the size of the hole - although water may have been distributed either in stone channels, or in pipelines supported by such channels. The aqueduct dates from Phase II, c. AD 158 (*RIB* 283)'. *TIRBS* 1987, 12, *RIB* 281-283, 2243 (A *NAVIONE MP XI*). (*Brigantes*).

Bryncross, Gwynedd, Wales.

Britannia 24, 1993, 269, two round houses, with external drainage gully, and the 2nd house had a stone-lined drain internal to a number of concentric wall slots.

Buchley, Strathclyde, Dunbartonshire.

Britannia 12, 1981, 320; 18, 1987, 28. Robertson 1979, (2nd ed.), 32. Camp on the Antonine Wall. 2 drains, stone-lined culverts c. 12.5m apart, one to east of the enclosure and the other, roughly at its centre, which apparently was deliberately blocked when the wall of a structure was repaired.

Bucknowle Farm, Corfe Castle, Dorset.

Britannia 7, 1976, 360; 9, 1978, 459-62; 10, 1979, 326; 11, 1980, 389 drains; 12, 1981, 359 bath; 13, 1982, 384; 15, 1984, 318-20, bath, water supply, Fig 25, drain; 16, 1985, 306; 17, 1986, 417 'An Iron Age round house together with pits and Durotrigan burial underlay this

group of buildings'; 18, 1987, 345-6; 19, 1988, 474; 20, 1989, 314-5; 21, 1990, 350; 22, 1991, 282-4; 23, 1992, 297. *PDNHAS* 97, 1975, 66; 98, 1976, 54; 99, 1977, 120; 100, 1978, 112; 101, 1979, 133; 102, 1980, 88; 103, 1981, 88; 104, 1982, 183; 105, 1983, 146; 106, 1984, 116-7; 107, 1985, 164; 108, 1986, 181; 109, 1987, 129; 110, 1988, 151-2; 111, 1989, 107; 112, 1990, 117-9; 113, 1991, 173-4. Scott 1993, 51, SMR 6 008 268, DO 9 (under Corfe Castle), 'Villa built after AD 250, with a bath-suite, lying to the east of the main range of rooms'.

Buckton, Hertfordshire.

Black 1995, 118, lists an official *mansio*, which would almost certainly have had a bath. *Britannia* 3, 1972, 69-70; 5, 1974, 27; 10, 1979, 21, 23, 44. Hanson 1970, 360, 'Remains of a wooden pipeline were found passing through the East Gateway of the fort and could represent the point of entry of an aqueduct'. Frere & St. Joseph 1983, 98-102. *JRS* 50, 1960, 222; 51, 1961, 123-4; 52, 1962, 169; 67, 1977, 145, *mansio*. Nash-Williams 1969, 93-4. Stanford 1968. *TWNFC* 1968, pt. II, 242-3. *TIRBS* 1987, 13, fortress and extramural *mansio*.

Bunny, Nottinghamshire.

EMAB 9, 1966, 38, pottery found dating from c. AD 250-300; remains in very poor state; no buildings found. Well 12.2m (40ft) deep, 0.76m (2.5ft) to 1.41m (3.67ft) diameter. Nottinghamshire SMR 13, 14, 5195. *TTSN* 71, 1967, Alvery 1967; 72, 1969, 42-9. Whitwell 1982, 203, well.

Burgh, Suffolk.

Britannia, 2, 1971, 172, 188, 191; 6, 1975, 261 village; 7, 1976, 341; 10, 1979, 307; 18, 1987, 46, *vicus*; 25, 1994, 305, lead sealing. *EAA* 40, 1988, 73, bath. Moore 1988. Johnson 1975. Scott 1993, 173, SMR BUG 002, SU 4.

Burham, Kent.

Arch. Cant. 34, 1920, 155. *Britannia* 2 1971, 189, 193; 8, 1977, 328. Scott 1993, 103, KE 16. *VCH Kent* 3, 1932, 108-110, Figs.25 & 26, pls.xvi, 1 &2, xvii, 1-3, villa with bath.

Burrow-in-Lonsdale, Lancashire.

Arch. J. 142, 216-236. *Britannia* 1, 1970, 53-4 Ant. Itin.; 5, 1974, 418. Bruce 1851, (3rd ed.), 161-2, 260. Stephens 1985b, 227, 230, A

`moat' discovered by amateur excavations indicated a leat. *TCWAAS* 54 (2nd ser.), 1954, 66-101. Hilyard 1954, 99.

Burton, Lincolnshire.

Arch. J. 111, 1954, 106-28. Settlement, ?water-pipe, ?aqueduct.

Buxton, Derbyshire.

Britannia 6, 1975, 242; 7, 1976, 321-2. Hart 1981, 87-91, plan. *JDANHS* 25, 1903, 161; 38, 1916, 87-91. Lewis 1966, 71. *PNRB* 1979, 254-5. *VCH Derbyshire* 1, 1905, 223-4, 235-6. Whitwell 1982, 205, SK 07 SE 29 & SK 07 SE1. *TIRBS* 1987, 14, SK 060 735; *RIB* 2243, milestone. Two sets of natural springs, one cold, one tepid, with bath-buildings at St. Anne's Well and St. Anne's Crescent, found in 18th c.

Cadder, Wilderness Plantation, Lanarkshire.

Britannia 3, 1972, 7, 12, 19; 8, 1977, 365, 433 *RIB* 2187; 10, 1979, 19, 21, 31, 3 stone-lined drains. Clarke 1933, 62-3. Hanson 1970, 360, comments that there is no known water supply, but that the supply could have come from 'the east, and the existence of a spring cased in Roman masonry was noted on an old estate map of the area'. *JRS* 41, 1951, 61; 54, 1964, 153; 57, 1967, 175-6, Fig.4. Macdonald 1934, 297-312. *RCAHMS Lanarkshire*, 1978, 121-4. Robertson 1990, (4th ed.), 81-3, Fig.52, 2 baths, (2) internal within the fort, (6) external to fort. *TIRBS* 1987, 14, *RIB* 2187.

Caerhun, Gwynd, Caernarvonshire, Wales.

Arch. Camb. 81, 1926, interim reports through to 1936. Bailey 1938, Excavation Reports 1-6. External bath-house, drains, and a well inside the fort is reported on. *Britannia* 1, 1970, 54; 6, 1975, 94; 7, 1976, 291, vicus. *JRS* 59, 1969, 123. Wooler 1917, 190. *CSIR I.5*, 1986, No.552. *TIRBS* 1987, 14, *RIB* 437-8, 2265 (A *KANOVIO M P VIII*); Flavian fort with extensive settlement. (*Ordovices*).

Caerleon, Gwent, Wales.

Antiq. J. 9, 1929, 1-7. *Arch. in Wales*, CBA Gr.2, No.18, 1978, 51-2. Boon 1972, 107. *Britannia* 1, 1970, 55-8, Ant. Itin., 484.4, 484.10, 485.8, 187, 254-8, 261-5, 272 cross-hall *palaestra* of internal baths, 305-7; 2, 1971, 127, 130 n.54, 133, 290; 4, 1973, 261; 5, 1974, 147; 7, 1976, 279-80; 8, 1977, 198, 202-6, 263-6; 9, 1978, 409-10; 10, 1979, 273-4; 11, 1980, 351; 12, 1981, 288-9, 317, 379, 395-6; 13, 1982, 334, 420-1; 15, 1984, 260, 337-41, 348; 16, 1985, 257-9, 262 Fig

9, 324; 17, 1986, 367-9; 18, 1987, 305 Fig.4, 307, 377; 19, 1988, 180-4, 421-2, 'Late in the 1st c. the *tabernae* were rebuilt in stone and the colonade in brick; a colonade with drain was also now added along the side of the basilica....; an original lead water-main was replaced and the street replaced. At the end of the century the drains became filled, the porticoes were dismantled and the lead pipe dug out; new metalling of the street and the porticoes after AD 330; coin of Valentinian I'. Originally wooden structures from c. AD 74-75, but replaced by stone c. AD 80s. Conjectural whether disused by c. AD 290. So the site dates from c. AD 80s; extensive modifications in late 1st c. and early 2nd c. and coins indicate activity still in 1st half of 4th c.; 20, 1989, 263-4, 342, 345; 21, 1990, 221, 260, 300-7; 22, 1991, 226; 24, 1993, 274-5; 25, 149, 250-1. Glamorgan-Gwent Arch. Trust's Annual Review 1987-8, 8-9. Hanson 1970, 180-1, aqueduct, 4 external baths(p.180), 1 internal, 2 wells, spring, tank and sewer. Stephens 1985b, 223, 229, 'Wooden and lead piping dating from c. AD 80 has been found near the amphitheatre (Wheeler & Wheeler 1928, 144, pl. xx). They imply the existence of an aqueduct. Distribution was by lead mains (Nash-Williams 1929, 145, Fig.5).' Nash-Williams 1969, (2nd ed.), 29-33. Zienkiewicz 1986. *TIRCGLL* 1983, 32, *RIB* 316-94; important port and legionary fortress, established c. AD 75, gradually rebuilt in stone c. AD 100. *Legio II Augusta* withdrawn c. AD 293(?). (*Silures*).

Caernarvon, Gwynedd, Wales.

Arch. Cambr. 109, 1960, 136-72; 111, 1962, 111-24; 123, 1974, 54ff. *Arch. of Wales, CBA Gr*, 2, 18, 1978, 75, 53; 76, 54; 77, 29. Flavian fort, dismantled c. AD 300-25. *Britannia* 1, 1970, 54 Ant. Itin. 482.5, *Seguntio*; 2, 1971, 127, 128 n.47, 130 n.54; 6, 1975, 208-9; 7, 1976, 292, bath-building, drains, water-pipe, 358; 8, 1977, 288, 299, 356-8, Fig.2; 9, 1978, 404-6, wells; 10, 1979, 30, 60, 269-71: '... in the annexe or ordnance depot WNW of Segontium, in a well containing other leather objects...'. Hanson 1970, 360-1, 'The discovery of an inscription, *RIB* 430, recording the reconstruction of the fort's aqueduct channels in the early 3rd c.', indicating the fort had an aqueduct water supply prior to this period. *JRS* 43, 1953, 104; 50, 1960, 236; 53, 1963, 125, 160. Stephens 1985, 228, 230, 'An inscription dating from AD 198-209 (*RIB* 430) commemorates "*riuos aq[uaeducttium uetu]tate cola}bs{os*". Use of the genitive shows that there was more than one aqueduct or channel, whilst restoration "*uetustate conlabsos*" shows that more than one aqueduct or channel also supplied the Antonine fort. No doubt one channel supplied the

fort and a second its extramural bath-house. Wheeler 1924, 110-11, 'The fort could only have been supplied by pipelines'. *Y Cymmrodor*, 31, 126-7, 1921 excavations; 32, 267, 1922 excavations. *CSIR* I.5, 1986, Nos.8-10, 43, 48. *TIRBS* 1987, 15, *RIB* 429-36. (Ordovices).

Caersws, Powys, Wales.

Arch. Cambr. 111, 1962, 147-57. Bitnell 1989, the fort seems to have been occupied from c. AD 75 to the late 3rd c., or early 4th c. The vicus seems to have ceased functioning commercially after about AD 130 (p.4). It is suggested that the function was 'chiefly as a base for administrative personnel and held by a caretaker garrison'. *Britannia* 1, 1970, 188, role of early fort; 2, 1971, 132-3; 9, 1978, 406; 17, 1986, 364-5 vicus; 18, 1987, 303-4; 20, 1989, 343, 22, 1991, 224-5, vicus; 23, 1992, 258; 24, 1993, 273-4; 25, 1994, 246-8. *JRS* 67, 1977, 150. *Montgomeryshire. Coll.* 42, 1931, 17-67; 59, 1965, 112-5; 60, 1967-8, 64-6; 61, 1969-70, 37-42. Nash-Williams 1969, 66-70. *TIRBS* 1987, 15, SO 029 920, occupation to 4th c. fortress with bath and well. (Ordovices).

Caerwent, Gwent, Wales.

Archaeologia 58, (1901-3), 1901, 1-34; 1902, 1-16: Ashby, et al; 1903, 1-38; 59, 1905, 1-22: Ashby; 60, 1906, 1-20; 1907, 1-14; 1908, ?; 62, 1910, 1-20; 1911, 405-47, plates; plate 64, p.446, shows 9 wells, pipes unspecified and drains; 70, 1930, 229-88. *BBCS* 15, 1952-4, 159-67. *Britannia* 1, 1970, 58 Ant. Itin. 485.9, 114, 122; 2, 1971, 20; 3, 1972, 363-4; 4, 1973, 38 n.29, 108 n.13, 190; 6, 1975, 190-2, 200-1, 233; 7, 1976, 176, 181, 187; 8, 1977, 323-4; 9, 1978, 336-8; 10, 1979, 102, 168, 174-5; 13, 1982, 132-4; 14, 1983, 283-4; 15, 1984, 241, 271; 16, 1985, 201 water supply, 259-61; 17, 1986, 367-70; 18, 1987, 45, 201-2, 307-9; 19, 1988, 422-3; 20, 1989, 264; 21, 1990, 307-10; 22, 1991, 225; 23, 1992, 258-9; 24, 1993, 275, 322; 25, 1994, 251-2. Hanson 1970, 361, comments that 'the remains of a wooden pipeline coming from a spring to the north-east of *Venta Icenorum* was found in 1938 and, from its line of direction, it would seem to have been intended primarily to supply the public baths near the West Gate of the town'. Ross 1967, 191. Wachter 1995, 380, Fig.170, (1974, 375-89), 2 baths. *TIRCGLL* 1983, *RIB* 309-15. (Silures).

Caister-on-Sea, near Great Yarmouth, Norfolk.

Britannia 9, 1978, 394-5; 16, 1985, 189; 18, 1987, 330, drains and corn drier; 19, 1988, 485, 502; 22, 1991, 71. Darling & Gurney, *EAA*

60, 1993, items F16 & F36, 2 tanks, Fig.7 opp. p.6; occupation from c. AD 180 to c. AD 370-390. *JRS* 42,1952, 96; 43, 1953, 122; 44, 1954, 97; 45, 1955, 136; 52, 1962, 175-6; 53, 1963, 137; 56, 1966, 209. *Norfolk Arch.* 32, 1962-5, 94-107; 34, 1966-9, 45-73. Rivet 1964, (2nd ed.), 84. *TIRBS* 1987, 15, town and port, with 'hostel for soldiers'; dating from 2nd c. (*Iceni*).

Caistor-by-Norwich, Norfolk.

Antiquity 3, 1929, 182-5. *Arch. J.* 106, 1949, 62-5. *Britannia* 1, 1970, 52-3, *Ant. Itin.* 474.6 (*Icinos*), 479.10 (*a Venta Icinorum*); 2, 1971, 1-26; draining ditch, 270, 300 baths; 3, 1972, 293-6, 359; 4, 1973, 108 n. 13, 125; 6, 1975, 176, 207, 222; 7, 1976, 175, 180; 9, 1978, 358; 10, 1979, 307; 13, 1982, 408-9, inscription; 15, 1984, 110, 344; 16, 1985, 201, 203; 17, 1986, 447; 18, 1987, 42-4, 263-272, 330; 20, 1989, 300-1; 21, 1990, 340; 23, 1992, 288. *EAA* 60, 1993, p.xvi, 'The Roman defended site at Caistor, hitherto viewed as a small town, can now be seen to be an early coastal fort.....built on unoccupied ground in the early 3rd c....and may be related more to a reorganization of both army and naval forces than purely coastal defence....and probably contemporary with Reculver Braucaster.... both named as forts in the *Notitia Dignitatum* on the Saxon Shore'. Occupation appear to have been from c. AD 70 to c. AD 370-90. Frere, 1971, 1-26, Figs.2, 4, 9. Frere 1967, pl.18a, on the fort next to the river Tas. See reconstruction isometric view of the Caister forum, Vol ii, 17, Figs.6-8, p.19, showing bath, and draining ditch leading into a timber-lined sump, 2 watertanks in fort area. *JRS* 18, 1928, 201, Roman Britain in 1914-28, 83-9; 22, 1932, 33-46; 29, 1939, 214, 'A line of flanged iron rings for jointing wooden water-pipes was traced some 4ft south of the road running apparently from a spring westwards and eastwards'; 51, 1961, pl.X,I (vert). *Norwich Arch.* 26, 1937, 197-230. Stephens 1985b, 197-208, 'Caistor-by-Norwich was also supplied by a single wooden pipeline'. *VCH Norfolk* 1, 1901, 288-93. *TIRBS* 1987, 15, *RIB* 214; *Civitas capital Icenorum*. (*Iceni*). The site is also known as Caistor St. Edmund.

Calne, Studley, Wiltshire.

Scott 1993, 199, *SMR SE* 302, WZ 43; *SMR se* 306, WZ 44. *VCH Wiltshire* 1, 1957, 54. *WAM* 45, 1930-2, 180, villa with bath and cistern.

Cambridge, Castle Street, Cambridgeshire.

Britannia 1, 1970, 47 Ant. Itin. 474.8 (*Duroliponte*), 116, 290; 2, 1971, 178, 188, 191; 4, 1973, 300; 5, 1974, 438; 7, 1976, 340-1, 'item e: of several wells, one was timber-lined, 1m square, with foot-holes down one corner;...Another circular well had staggered foot-holes cut into opposite sides....Another produced a collection of bone shafts...', and evidence of pre-Claudian occupation by the Belgics; 10, 1979, 346-7; 11, 1980, 17; 12, 1981, 271, 273, 275, lead tank; 15, 1984, 296; 19, 1988, 450; 20, 1989, 293-5. Burnham & Wacher 1990, 246-9, 347. CBA Gr.7, Bull. 1984, 14; 1987, 13-5. Fox 1923, 174-5. JRS 54, 1964, 167-8; 55, 1965, 213; 58, 1968, 194. VCH Cambridgeshire, 7, 1978, 39-43, ritual pits and wells. TIRBS 1987, 16, TL 445 595, pre-Roman settlement; possible 1st century fort or fortlet; civil settlement 1st to 5th c. (*Catuvellauni*).

Camelon, Stirling, Scotland.

Black 1995, 53-4, 166 Fig 47. *Britannia* 1, 1970, 202; 4, 1973, 273 fort; 5, 1974, 405, bath; 6, 1975, 266; 7, 1976, 300; 8, 1977, 362-4; 9, 1978, 411; 10, 1979, 275; 11, 1980, 47; 13, 1982, 337; 15, 1984, 348; 24, 1993, 321; 25, 1994, 257. Crawford 1949, 12. DAES 1972, 40; 1973, 52. Frere & St Joseph 1983, 128-9. Hanson 1970, 194. JRS 9, 1919, 128, plan. PSAS 35, 1900-1, 329-47; 109, 1977-8, 112-8, 151-65. RCAHMS Stirlingshire 1, 1963, 107-12. Robertson 1990, (4th ed.), 6, 20, 34, 54-5. Roy 1793, pl. xxix. SAF 12, 1981, 69-78. CSIR I.4, 1985, Nos.160-4. TIRBS 1987, 16, NS 863 810; RIB 2210.

Camerton, Somerset.

Britannia 1, 1970, 117-25, 129; 10, 1979, 174, 176; 20, 1989, 183. Rahtz & Fowler 1972, 200, in Fowler P J, (ed.), 1972, 187-217. Smith 1987, 295-7. Wedlake 1958, 96-7, pl. III. TIRCGLL 1983, 33, RIB 180; occupation 1st to 5th c. (*Belgae*).

Camphill, Northamptonshire.

Britannia 11, 1980, 372; 13, 1982, 366. Condron 1996, 327. *Northants. Arch.* 1974, 86-101. Northamptonshire SMR 1671.

Canterbury, Kent.

Antiquity 23, 1949, 153. *Antiq. J.* 36, 1956, 40-56. *Arch. Cant.* 92, 1976, 235-44. *Britannia* 1, 1970, 42, 44-6 Ant. Itin 472.5 (*Duroruerno*), 473.4 (*Durarueno*), 473.9 (*Duraruenna*); 6, 1975, 78; 8, 1977, 423; 9, 1978, 468-71 well, timber-lined, water tank; 10, 1979, 334-6, 2 baths, sewer; 11, 1980, 400-1 mansio, water tank; 16, 1985,

202, water supply. *PNRB* 1979, 353-4. *JRS* 38, 1948, et seq. Tatton-Brown & Frere et al., 1982. *VCH Kent* 3, 1932, 61-80. Wachter 1995, 189-207. *TIRCGLL* 1983, 33-4, *RIB* 15; important town, capital of the *CIVITAS CANTIACORUM*, following a Claudian fort which succeeded a pre-Roman settlement. (*Cantiaci*).

Cantley, near Doncaster, South Yorkshire.

Annable 1960. More than 40 kilns were recorded, a large pottery industrial complex, one well recorded. *Britannia* 5, 1974, 416, Iron Age and Roman enclosures, pottery kilns; 6, 1975, 237-8 (also Besacarr); 11, 1980, Buckland, et al, 1980, 145-64. *JRS* 44, 1954, 90-1; 50, 1960, 220. *YAJ* 37, 1954 12?; 38, 1955 536-45. Gilmour 1955, 536-45, the well was excavated to a depth of 27ft (8.21m) without reaching bottom, and it was c. 5ft (1.52m) in diameter. *TIRBS* 1987, 16, large pottery works, active from mid 2nd to late 4th. Also workings during Iron Age period. (*Corieltavi* or *Brigantes*).

Cappuck, Borders, Scotland

Arch. J., 142, 1985, 216-36, Stephens at p.224, comments '...a "roughly made watercourse channel which had probably once contained a pipe or wooden channel" runs through the courtyard of the central building....This might have formed part of a distribution system, for there are too many water channels for them to have been connected with drainage'. *Britannia* 3, 1972, 9, 14, 20, 41, period of occupation c. AD 163-196. *JRS* 61, 1971, 121, large marching camp south of the fortlet at NT 698 209; 63, 1973, 216. Stevenson & Miller in *PSAS* 1911, 446-83, see p.461 & Fig 3: This figure shows ten unspecified type drains or branches of the main drains marked as such. Three pits are shown, one in the main building and two in the S-E corner just inside the inner rampart; both appeared to have been used as drainage pits. *RCAHMS Roxburghshire* 2, 1956, 381-3. *CSIR I.4*, 1985, No.44. *TIRBS* 1987, 16-7, *RIB* 2117-9.

Cardiff Castle, South Glamorgan.

Britannia 10, 1979, 272; 11, 1980, 349, drain within the fort; 12, 1981, 316; 13, 1982, 331-2.

Carisbrooke, Isle of Wight.

Basford 1980, 123. *Britannia* 1, 1970, 300. *Gentleman's Mag.* 7, 1859, 399-401. *PIWNHAS* 3, 1944, 413-34. Scott 1993, 101, *SMR* 503, *IW* 6. *VCH Hampshire* 1, 1900, 316-7. *TIRCGLL* 1983, 34; villa; baths.

Carlisle, Northumberland.

Archaeologia 64, 1913, 299-301; *Arch. J.*, 1893, 20-36; 135, 1978, 115-6. *Britannia* 1, 1970, 42, 47, Ant. Itin. 467.2 (Luguvallo), 474.1, 476.6 (Luguvalio), *RIB* 2015?, 149, 155; 5, 1974, 142, 410-1 water supply; 8, 1977, 376; 10, 1979, 281; 11, 1980, 359-60 hypocausts; 13, 1982, 79-89, 343-4 fort; 15, 1984, 113; 16, 1985, 197-207, at p.202 Stephens states that 'At Carlisle, where a public fountain was still in working order when St Cuthbert visited the city in AD 685, the evidence comprises a wooden pipeline and a fountain'; 21, 1990, 112-3, 360-7; 22, 1991, 235, 299-301, aqueduct, bath building at NY 400 561, drains; 23, 1992, 45-109, excavations of the first Flavian fort, 112-3, 141-58, 319; 24, 1993, 316; 25, 1994, 263. Burnham & Wachter 1990, at p.55 it is stated that 'The famous aqueduct seen working by St Cuthbert remains elusive, but the water tank inside the portico of a building...was presumably fed by it', and presumably the fountain was fed from the tank if it was high enough. *TCWAAS*(1) 12, 1893, 344-64. Hanson 1970, 361, item 18, 'Even as late as the 7th c. Carlisle possessed a Roman fountain that was still in working order and from the fact that a fountain can only work from a supply of running water it seems fairly safe to assume that Luguvalium had an aqueduct'. *JRS* 42, 1952, 104; 44, 1954, 88; 46, 1956, 124; 47, 1957, 202, water tank; 48, 1957, 202, 'water tank found in the grounds of the Tullie House Museum implies a working aqueduct. *PSAS*(2) 14, 1892, 222-4. Salway 1969, 43. Wachter 1975, states that the fort area seems to have grown into a town of about 28ha (70 acres). 'St Cuthbert perambulated its walls in the 7th c., and also saw a fountain': Bede, 'Vi ta Sancti Cuthberti', iv, 27; also 1995, 2nd ed., 21, 32, 88, 421. *TIRBS* 1987, 17-8, *RIB* 943-64; *Civitas Carvetiorum*. Flavian fort (but probably not pre-Agricolan); fort demolished c. AD 100 and rebuilt soon after; held till late 2nd c.; early 3rd c. re-occupation continuing to c. AD 300; S-E an extensive settlement (*vicus*) (c. 27ha), late 1st to 4th c. (*Brigantes*).

Carlisle-Old, Northumberland.

Arch. J. 122, 1975, 24-5, plan. *Britannia* 8, 1977, 'Ateco of Old Carlisle', 271-4. *CW*(2) 28, 1928, 103-19; 15, 1951, 16-39; 59, 1959, 15-31. Frere & St. Joseph 1983, 117-9. Jones & Mattingly 1990, 174, Map 5.22, suggests that the building shown outside the fort is probably a *mansion*, and therefore may have had a bath. Sommer 1984,

BAR 129. Wilson 1980, (3rd ed.), 88 n.47, 92 No.104. Possibly Augusta or Augustiana. OS Map, 'Roman Britain', 1991, 4th rev. ed.

Carmarthen, Dyfed, Wales.

Arch. J. 142, 1985, 216-36, item 53, 228, Stephens comments 'A first-century leat running N-E to S-W has been traced (*Britannia* 10, 1979, 272). Its date and the fact that it underlies the 2nd c. defences of the *civitas* capital show that it is military'. *Britannia* 1, 1970, 55-6, Ant. Itin. 482.9 (*Muridino*), 483.5 (*Muriduno*), 270; 2, 1971, 102, 243-4 amphitheatre; 8, 1977, 360; 16, 1985, 202-3, water supply, 254; 17, 1986, 366-7 fort; 20, 1989, 260; 25, 1994, 248. *Carm. Antiq.* 5, 1969, 2-5; 6, 1970, 4-14. James 1980, No.2, 17, Fig. 2.3. Nash-Williams 1969, 23-6. Ross 1967, 88. Wachter 1995, 391-4, Fig.175, (1975, 389-93). *TIRCGLL* 1983, 34, *RIB* 412-3; fort and town, the latter probably capital of the *Civitas Demetarum*; fort occupied under Flavians; town from late 1st to 4th c.; walls enclosing c. 6ha. (*Demetae*).

Carpow, Perthshire, Tayside, Scotland.

Arch. J. 142, 1985, 216-236, at 217, 223, 229, Stephens comments 'A battery of wooden pipelines entered the fortress through the south gate...Distribution was by both wooden and lead pipes (*JRS* 59, 1969, 202). A channel measuring 2.6m wide by 0.6m deep has also been traced approaching the S-W angle (*JRS* 48, 1958, 91) ...This is far too large a pipe trench, which suggests that it was a leat cut to supply the extramural bath-house. (Additional information from Prof J J Wilkes)'. Birley 1967. *Britannia* 1, 1970, 273; 2, 1971, 248; 3, 1972, 29, 36, 40, 48; 5, 1974, 207, 289-92; 7, 1976, 156, 238, 299, 11, 1980, 351; 12, 1981, 305-6; 15, 1984, 57; 18, 1987, 27; 21, 1990, 310; 24, 1993, 278. Hanson 1970, 'The aqueduct, first recognised from air photographs in 1958 and excavated in 1962, consisted of a ditch 2ft deep and 8.5ft wide. No trace of any lining for this ditch was found, and it would seem therefore that it had contained a pipeline, although no remains of piping were discovered....excavations on the S Gateway in 1969 did reveal " the lines of two channels, running below the passageways....The east one contained fragments of iron collars from a wooden water pipe"' 194-5. Similar iron collars found inside the fort, 3 1/2 inches in diam. {My comment: The 'ditch' described could have been a leat, not usually lined, particularly if it was constructed in clayey soil.} *JRS* 48, 1958, 86-101, St. Joseph, 1958, at p.91; 52, 1962, 163; 53, 1963, 127, 164; 59, 1969, 202. Leach & Wilkes 1977,

47-62. *PSAS* 35, 1901, 329ff, 358; 96, 1965, 184-207, 'Excavations of the Roman fortress at Carpow, Perthshire, 1961-2', by R E Birley. Wilkes & Leach 1969. *CSIR* I.4, 1985, Nos.171-2. *TIRBS* 1987, 18; Flavian enclosure; Severan vexillation fortress (9.7ha); annexe (0.7ha), aqueduct.

Carrawburgh, Northumberland.

Allason-Jones & McKay 1985. *Arch. Ael.*(2) 8, 1877-80, 60-87, 88-107. *Arch. Ael.*(4) 36, 1958, pl. 25; 40,1962, 59-81 nymphs; 45, 1967, 1-16; 50, 1972, 81-144. *Britannia* 1, 1970, 136, 275-6; 2, 1971, 122; 3, 1972, 193-6, 249 n.148 Coventina's well, 360; 8, 1977, 198; 9, 1978, 420; 11, 1980, 318 fort; 14, 1983, 349; 20, 1989, 178. Hope 1893, 112-5. *JRS* 51, 1961, 193; 55, 1965, 222; 56, 1966, 218. Longstaffe, 1877-80, 88-107. *PNRB* 1979, 284-5. Somer S, 1984, pl.10, Mithraeum. Wall 1877-80, 60-87. *TIRBS* 1987, 18, *RIB* 1520-63; *Rav. Cos.* 107.26 (*Brocolitia*); *Not. Dig.* xl, 39, (*Procolitia*); baths, well.

Carsington, Brough Field, Shiningford Farm, Derbyshire.

Britannia 12, 1981, 333-5, Fig.8: well & drains; 15, 1984, 290; 16, 1985, 282; 23, 1992, 233-6; 25, 1994, 270. Occupation appears to have been from Period I c. AD 125-50 to Period III 4th c. A well 'at the N end of the site, a large cobbled yard associated with a timber structure of uncertain size. To the south lay a well which appears to have collapsed soon after completion'. A drainage ditch cut across a building of the 2nd half of the 2nd c. Other drainage ditches during Period III, 4th c.

Carvoran, Magnis Fort, Northumberland.

Arch. Ael.(2) 8, 1877-80, 75, 'Well near the Roman station of Carvoran (Magna)'; *Arch. Ael.*(3) 13, 1916, 85-102; *Arch. Ael.*(4) 31, 1953, 82-94; 34, 1956, 130. Birley 1961, 192-6. *Britannia* 1, 1970, 136, 189, 'Paulinus baptised many people at this well during the 5th c.', 346, *Cohors I Batavorum quingenaria* unit left an inscription on Hadrian's Wall (mentioned in the *Not. Dig.*), holy well near the wall at Mile Castle 46; 3, 1972, 41, 193, this fort additional to Hadrian's Wall, and rebuilding at Carvoran and other forts in c. AD 163; 4, 1973, 275; 10, 1979, 346; 12, 1981, 380, near MC 46; 17, 1986, 381; 19, 1988, 494; 20, 1989, 333, inscriptions. *JRS* 55, 1965, 222. *TIRBS* 1987, 19, *RIB* 1775-1842; *Rav. Cos.* 107.11 (*Magnis*), *Not. Dig.* xl, 43 (*Magnis*); dating c. AD 135-8 to 4th c.

Castell Collen, Powys, Radnorshire.

Alcock 1955, 46ff. *Arch. Cambr.* 11, 1911, 411-20; 12, 1912, 183-98; 13, 1913, 448-9; 14, 1914, 1-58 Fig.6, excavations by H G E White; 113, 1964, 64ff, esp. 81-82. *Britannia* 1, 1970, 192, occupation c. AD 75; 257, n.56: 'Flavian foundation'; 8, 1977, 438. *JRS* 45, 1955, 121; 46, 1956, 119-20, bath-house, 110 ft (33.5m) long, to the south of the fort. Nash-Williams 1969, 74-7. *Trans. of the Radnorshire Soc.* 24, 1954, 62-75; 25, 1955, 46ff;; 27, 1957, 5-11. *CSIR* I.5, 1985, No.36. *TIRBS* 1987, 19, *RIB* 414-7; large Flavian fort (2.04ha), later reduced (1.44ha).

Castle Greg, Lothian Region, Scotland.

PSAS 1, 1852, 58-9; 52, 1917-18, 221. *RCAHMS* Midlothian, 1929, 140-1. *TIRBS* 1987, 20; well.

Castle Hill(1) East Bridgeford, Nottinghamshire.

Antiq. J. 48, 1968, 192-209. *Arch. J.* 115, 1958, 49-98. *Britannia* 1, 1970, 49, 51, 84, 117, 119-22, 124-6; 2, 1971, 238; 6, 1975, 98; 8, 1977, 18, 263. Bromhead 1942, 142-51, 183-96, 3 wells, stone-lined. Oswald 1941, *JRS* 31, 41-4 bath-house. *PNRB* 1979, 413-4, *Ant. Itin.* 477.6 Iter VI, 479.1 Iter VII, *Margidvnm.* Rodwell & Rowley, 1975, 211-5. Smith 1987, 285-7, a possible fort preceded the settlement. Todd 1973, 29, 36-7, 68. Todd 1969. *TTSN* 31, 1927, 55-84; 40, 58-9, 62-5, Figs.24, 25, 29 & 30, bath, stone-lined drain, stone-lined tank; 73, 1969, 7-112. *VCH* Nottinghamshire 2, 1910, 15-7. *TIRBS* 1987, 55. (*Corieltavi*).

Castle Hill(2), Nottinghamshire.

Bromhead 99, 1942, 142-51, 183-96, at 144, comments, 'Felix Oswald mentions that a 6ft square hole was dug to water-level in a framing of oak planks, but this was then lined with rammed clay to leave a 0.6m (2ft) diam., circle....That just mentioned was of Claudian age, but on the same site, 3rd century. Wells, filled in about AD 296, were stone-lined'. Oswald 1948; 1952; 1956. *PNRB* 1979, 413-4. Todd 1973, 29, 36-7. *TTSN* 73, 1969, 7-112. Rodwell & Rowley (eds.), 211-5. *VCH* Nottinghamshire 2, 1910, 15-17. Webster 1980, 162. *TIRBS* 1987, 55. (*Corieltavi*).

Castle Nick, Mile Castle 39, Hadrian's Wall, Northumberlandshire.

Arch. Ael(1). 4, 1855, 273. *Britannia* 14, 1983, 290-1 Fig 6; 15, 1984, 280; 16, 1985, 271; 17, 1986, 378-80, Fig.11; 18, 1987, 316,

large stone drain adjacent to road leading to milecastle. Bruce 1978, (13th ed.), 169.

Castle-Dykes, North Yorkshire.

Arch. J. 32, 1875, 135-54. Heslington 1867. JRS 11, 1921, 83; 18, 1928, 197; 19, 1929, 190. Lukis 1875, 135-54 plan I, & plan II. Scott 1973, vol. 1, 39-44. Scott 1993, 151, NK 26. Tyler 1980, 33. YAJ 38, 1955, 257-9. TIRBS 1987, North Stainley, SE 292 756; baths probably before 3rd c.; drains. (*Brigantes*).

Castleford, West Yorkshire.

Arch. J. 142, 1985, 216-36, Stephens comments that the aqueduct may have been a stone culvert which carried a piped water supply from a spring. *Britannia* 1, 1970, 47, 51-2, 64 Ant. Itin. 475.6 (*Legeolio*), 478.7 (*Lagecio*, var. *Laiecio*), Rav. Cos. 107.8 (*Lagentium*, var. *Laguentium*); 6, 1975, 93, 238; 7, 1978, 428; 10, 1979, 288-9, Fig.7, bath-house; 11, 1980, 18 as *Lagentium*; 12, 1981, 330; 13, 1982, 349-50 vicus; 14, 1983, 294-5, 337; 16, 1985, 279-80; 17, 1986, 385; 18, 1987, 376; 19, 1988, 505; 20, 1989, 278; 24, 1993, 287. West York CC, 1984, 'In Search of Roman Castleford'. YAJ, 51, 1979, 1-13, at 4. TIRBS 1987, 19-20, RIB 628, 2273-5; large fort, c. AD 71-84; smaller fort (3.2ha) c. AD 84-95, to 4th c.; external bath. (*Brigantes*).

Castleshaw, West Yorkshire.

Andrew & Lees 1911, 33-6. *Britannia* 2, 1971, 132, 253; 9, 1978, 429; 17, 1986, 385 fortlet; 19, 1988, 444; 20, 1989, 280-2. Current Arch. 114, 1989, 225-9, 'Castleshaw'. Hanson, 1970, 396. *The Archaeology of Greater Manchester*, Monograph 4, 1989. TLCAS 38, 1915, 257-8; 40, 1925, 154; 67, 1957, 118; 71, 1961, 163-5; 77, 1974, 1-18. Bruton, 1st Interim Report 1908 & 2nd Interim Report 1911. See Fig.6 for well and drains. Since there is a *mansio* at the fort there is likely to be a bath establishment. YAJ 20, 1909, 100-3. TIRBS 1987, 20, SD 999 097; Flavian fort (1.29ha) reduced to a fortlet size 0.34ha (Trajanic). (*Brigantes*).

Castlesteads, Hadrian's Wall, Northumberland.

Birley 1961, 228-9. *Britannia* 5, 1974, 463; 12, 1981, 11. Bruce 1867, 3rd ed., '...conduits... in all directions, and channel stones', within *Uxellodunum*, and Hanson interprets: 'and presumably these formed part of the fort's drainage system' (259). TCWAAS(2) 34, 1934, 159-65; 85, 1985, 77-80. Hanson 1970, 259. The OS 'Historical Map &

Guide: Hadrian's Wall, at p.7, under 'Castlesteads Roman Fort, gives the Roman name of 'Camboglanna'; this fort is unique, since it was built between the Vallum and the Wall opposite MC 57. The remains of the fort was completely destroyed when Castlesteads House was built in 1779. *TIRBS* 1987, 20, *RIB* 1976-2009; fort of Hadrian's Wall (c. 1.46ha). (*Brigantes*).

Castor(1), Water Newton, Normangate Field (South), Huntingdonshire.

Arch. J., 131, 1974, 152, 164-5. *Artis* 1828, pls.iii-viii, xi-xiii (plan). *Britannia* 1, 1970, 286; 2, 1971, 243-89; 3, 1972, 320; 5, 1974, 431; 7, 1976, 332-4. *Durobrivae* 9, 1954, 22-5. *Gentleman's Mag.* 2, 1826, 366. *JRS* 53, 1963, 135; 54, 1964, 164, 2 wells; 59, 1969, 219, mausoleum, dedicated to St Kyneburgha, source Bede. Lewis 1966, 61. *RCHM* 1969, 'Peterborough New Town', 24, 27, sites 21-2. Rivet 1958, 114. Scott 1993. 35, SMR 01873, CA 45. Swan 1984, fiche 367, TL 1165 9764, 1154 9770, 1153 9781, 1149 9790, 2 wells, bath-house.

Castor(2), Normangate Field (East), Huntingdonshire.

Artis 1828, pls.5 & 6. Condron 1996 417. *Durobrivae* 4, 1976, 26. *JRS* 53, 1963, 135; 54, 1964, 164, bath-house. *Medieval Arch.* 3, 1959, 18. Peterborough Museum record no. 899, 945, 946, 950, 953, 954, 959, 960, 966, 968. *RCHM(E)* 1969, 25, site 31; 24, site 28, Fig.10. Wild 1976. Swan 1984, fiche 368, TL 1175 9781- 1185 9770, 2 wells. *VCH Northamptonshire* 1, 1902, 171-6. Whitwell 1982, 208.

Catsgore, Somerton, Somerset.

Arch. Review 6, 1971, 33. *Britannia* 2, 1971, 276-8; 4, 1973, 311-2; 3, 1972, 343; 10, 1979, 323-4; 11, 1980, 388-9; 15, 1984, 316. Leech 1982. Radford, *PSANHS* 96, 1951, 41-77. Scott 1993, 170, SMR 54503, SO 54, 3rd to 4th c. occupation, bath.

Catterick, North Yorkshire.

Britannia 1, 1970, 40, 42-3, 47: Ant. Itin. 465.2 (Cataractoni), 468.2, 476.2, 418; 2, 1971, 200-2; 3, 1972, 260-1; 7, 1976, 137-8, 314 drain, 380; 8, 1977, 288; 9, 1978, 481-2; 10, 1979, 355; 11, 1980, 18, 363; 13, 1982, 420; 16, 1985, 197-207, water supply, 277, 330; 17, 1986, 83; 20, 1989, 277; 21, 1990, 327-8; 22, 1991, 238-40 fort defences, 306-7. *JRS* 41, 1951, 125; 43, 1953, 90; 45, 1954, 82; 50, 1960, 217- 8, 237, 240, pl.xxii.1; 51, 1961, 193; 57, 1967, 204; 58,

1968, 208; 63, 1973, 214. Frere & St. Joseph 1983, 179-81. Hanson 1970, 362: 'Part of a stone channel aqueduct was found supplying a fountain in the public baths of *Cataractonium* fort'. Stephens 1985a, '... whilst at Catterick channels supplied both domestic quarters and baths of the the 2nd c. *mansio*', 199, 200, 207. Wacher 1971, 170. Wacher 1966, 96-7. Wilson 1984, 75-82. *CSIR* I.3, 1983, Nos.20, 94-7, 127-8. Occupation from 2nd to 4th c. *TIRBS* 1987, 21, *RIB* 725-9; extensive civil settlement from middle of 2nd c., walled in mid 3rd c. (*Brigantes*).

Cattybrook, Almondsbury, Avon.

Bennett 1980, 167, drainage channel. *Britannia* 5, 1974, 448; 6, 1975, 271. (Much of the site was destroyed by quarrying operations before excavations started.)

Caversham, Berkshire.

Britannia 1, 1970, 210; 12, 1981, 271-6; 20, 1989, 319, 333, no.13, pl.26, circular lead tank and timber-lined well, with 4 square timbers each about 1.5 m long supporting vertical sides.

Chalk, Kent.

Arch. Cant. 73, 1959, 220-3. Black 1987, 145, no.35. *Britannia* 2, 1971, 186, building materials; 3, 1972, 112-48; 6, 1975, 282-3, no.192, small bath-house, in use during 2nd and 3rd c.; 7, 1976, 374-6, Fig.27, bath; 8, 1977, 348, wine cellar; 10, 1979, 336, paths and ditches. *JBAA* 4, 1849, 393-4. Johnston 1972, 112-48. *KAR* 40, 1976, 282-5, Interim Report. *VCH Kent* 3, 1932, 130-1. *TIRCGLL* 1983, 35; villa, 1st and 2nd c. (*Cantiaci*).

Chapel Hill, Grampian, Scotland.

Wooler 1917, 190.

Charmy Down, Avon.

Britannia 22, 1991, 278: 'nearby lay a stone watertank and gutter-blocks. Associated pottery suggests a 4th c. date'; 23, 1992, 296, '...further buildings ...examined;...A monolithic cylindrical water-cistern c. 1m diam. found'.

Chedworth(1), Gloucestershire.

Archaeologia 59, 1905, 207-32. *Arch. J* 44, 1887, 322-36; 59, 1905, 210-14 (fulling theory); 78, 1921, 451-5. *Britannia* 2, 1971, 222-2; 3,

1972, 270-5; 4, 1973, 227; 7, 1976, 178; 9, 1978, 329-30; 10, 1979, 318-9, hypocaust; 11, 1980, 292-3; 12, 1981, 355; 13, 1982, 377; 15, 1984, 312; 16, 298, channelled hypocaust; 18, 1987, 337-9; 19, 1988, 465, quarry and hypocaust; 20, 1989, 309-10, 2 bath-suites; 23, 1992, 294, floor-swilling drain. Goodburn 1972. *JBAA* 24, 1968, 129-35; 25, 215-27, 400-5; 26, 251-2. *JRS* 45, 1955, 139, 149 no.27; 55, 215-6; 56, 212. *PSAS* 6, 1865-6, 278-83. Scott 1993, 69-70, SMR 547, GS 22. Courtyard type villa. Early 2nd c. to late 4th c., probably destroyed by fire. (Scott lists 38 refs.) *RCHM* 1976, 24-28. *TBGAS*, 76, 1957, 160-4(room 4, the latrine); 78, 1959, 5-23 (reinterpretation of the *laconium*). *The Gentleman's Magazine* 1865, i, 595; ii, 302-3. Chedworth is probably one of the best known villas in Britain, discovered in 1864 by chance and excavated by James Farrer and the site was recovered by his nephew Lord Elton; now the property of the National Trust, which comments is: '...development from the early 2nd c. to the late 4th c., with evidence of fire in the early and late phases. ..The main water supply to the villa was from a spring, S, at N.W. corner of the site; it was channelled into a cistern just outside the suggested N.W. angle of the precinct wall. A roughly circular sinking 6ft across, possibly the site of a wall, occurs at H, some 30yds E of room 12'. The villa had two bath-suites, and a latrine, with so far 4 drains identified. A long list of references are given but many relate to small finds and mosaics. McWhirr 1981, 90-12, 150-3. Ross 1967, 50ff. *TIRCGLL* 1983, 36, RIB 126-8; a probable cult centre, two temples, one Romano-Celtic, the other a *nymphaeum*. (*Dobunni*).

Chedworth(2), Listercombe Bottom, Gloucester.

Britannia 20, 1989, 309-10. *JRS* 21, 1931, 240, water pipes and possible bath. Scott 1993, 70, SMR 548, GS 23, Listercombe Bottom is c. 2.8km N of Chedworth villa, further up the valley; Mr C E Key, 1930, 'found fragments of tessellated pavement, a stone-built wall, "90 ft long", pierced by water conduits, a flagged corridor and a small pillared hypocaust'.

Chells Manor, Near Stevenage, Boxfield Farm, Hertfordshire.

Britannia 19, 1988, 455; 21, 1990, 338-9 Fig 20; 22, 1991, 259, well, 4.4m diam at top, narrowing to 1.1m at depth 14.5m. With such a large diameter at the top it appears as if the mouth was enlarged by caving in of the soil.

Chelmsford, Essex.

AEx 1972, 47-8. *Britannia* 1, 1970, 47, 52 Ant. Itin. 474.3 (Caesaromago), 480.6 (Cesaromago); 2, 1971, 249, 270, bath; 3, 1972, 304, 306-7; 4, 1973, 300; 5, 1974, 408; 7, 1976, 342-3; 9, 1978, 449; 16, 1985, 199, wooden pipeline supply; 19, 1988, 457; 20, 1989, 302, mansio, baths; Occupied 1st to 2nd c. Burnham & Wacher 1990, 4, 8, 10, 19, 20, 22, 30, 31, 314. Drury 1988, CBA Res. Rept. 66. CBA Gr.7 Bulletin 1988, 5. Dunnett 1975, 81-6. *Eng. Hist. Rev.* 52, 1937, 198. *Essex Arch. & Hist.* 4, 1972, 3-29. *JRS* 59, 1969, 223. Rodwell & Rowley 1975, 159-73. *VCH Essex* 3, 1963, 5, 63. Wacher 1995, 207-14, 207-9 Fig.95, vicus, mansio, bath, drains, 212-3 aqueduct. *TIRBS* 1987, 37, 'possibly capital of the Civitates Trinovantum'. (Trinovantes).

Cheshunt, Hertfordshire.

Smith 1987, 177. OS NMR, TL 30 SW/5, (personal communication by J Edwards). Well, tile-lined channel capped with stone, c. 4th c.

Chester, Cheshire.

Britannia 1, 1970, 42-3, 54, 65, 469.2, 482.8 (Deva), fortress of *Legio II Adiutrix*, c. AD 75-87, *Legio XX*, c. AD 87- 4thc.; 2, 1971, 253, 292-3 lead water-pipes; 3, 1972, 313, sewer; 8, 1977, 387; 11, 1980, 58, 318, 364-5, 407-8; 16, 1985, 197-8; 17, 1986, 387-8 Fig.14; 20, 1989, 282-3 baths. Hewitt 1895, 328-9. *JCAS* 68, 1985, 53-7, 59-69 aqueduct. *JRS* 45, 1955, 146; 46, 1956, 148; 50, 1960, 221; 57, 1967, 180, 203; 58, 1968, 207; 59, 1969, 235. Hanson 1970, 185-91, 363, comments, 'The (legionary) fortress was supplied by an aqueduct from springs two miles to the east of Chester. Finds of clay piping along the projected line of the aqueduct can probably be taken as indicating the kind of supply system in use and a pipeline would have been necessary to negotiate a rise in ground level near the East Gate of Deva'. Stephens 1985(b), 223, 229, comments, 'The aqueduct was formed of earthenware pipelines...This was almost certainly a multiple pipeline aqueduct fed from springs at Broughton c. 1.5 km away, where a dedication to the 'Nymphis et Fontibus' (RIB 460) has been found; "fons" in the plural suggests that more than one spring was tapped. Distribution was by lead mains dating from AD 79', and in 1985a 206, he comments, '...Thus aqueducts were not essential to the functioning of municipal thermae (see note 12), but it can hardly be a coincidence that the fortress bath-house at Chester, for example, was constructed in AD 79 (RIB 463), the same year that its water mains were manufactured, nor that at Exeter the legionary fortress bath-house and

the service pipes supplying it were contemporary'. Thompson 1965, 51-2, lead pipe. Wright & Richmond 1955, 48.199, pl.XLIV.199. There is an extensive literature dealing with Chester, see *TIRBS* 1987, 22, *RIB* 445-573, 460, 2434; occupation from AD 79 to after c. AD 330 when garrison was reduced. (Cornovii).

Chesterholm, Vindolanda, Northumberland.

Arch. Ael. (4th s.) 8, 1931, 181-212; 9, 1932, 216-21; 11, 1934, 127-37; 13, 1936, 218-57; 15, 1938, 222-37; 48, 1970, 97-155; *Arch. Ael.*(5) 1, 1973, 111-22, 123-31. Birley 1977, 65. *Britannia* 1, 1970, 276-7 fort; 2, 1971, 249; 3, 304, 306-7; 4, 1973, 275-6, 347-8; 5, 1974, 360-73, 408-9, 471-80; 7, 1976, 342; 8, 1977, 198; 9, 1978, 480-1; 10, 1979, 346; 11, 1980, 319; 12, 1981, 323, 380; 13, 1982, 418-9; 14, 1983, 347-8; 16, 1985, 199-200, water supply; 17, 1986, 453; 19, 1988, 434, 502-3; 20, 1989, 273, 342; 21, 1990, 317; 23, 1992, 110-2, 315, 346; 24, 1993, 314. Stephens 1985a, 197-208, comments, '... whilst at Chelmsford, the *mansio* was supplied by a wooden pipeline...the *mansio* and external bath-house of the fort were fed by channels tapping a nearby well or enclosed spring,...' Hanson 1970, 362, item 23, fort/*vicus*/*mansio*, 'An aqueduct of channelled stones that came from a spring just to the west of the fort, refs. *RIB* 1049'. See R Birley's new excavation reports(1993). Aqueduct *RIB* 1049; drains. There is an extensive literature on Chesterholm or Vindolanda.

Chester-le-Street, Northumberland.

Arch. Ael.(4) 22, 1944, 83-90; 46, 1968, 75ff. *Britannia* 2, 1971, 251; 9, 1978, 426 sewer; 10, 1979, 285; 11, 1980, 361-2, cobbled street; 15, 1984, 281, 342; 22, 1991, 238, in the N-E room '...a stone-lined latrine', 342. Hanson 1970, 362, comments 'The aqueduct at this fort is known only from an inscription attesting its construction during the early 3rd c., *RIB* 1049, inscriptional evidence of the aqueduct. *TIRBS* 1987, 23, *RIB* 1043- 50; *CIL* vii, 1234 inscription; fort (2.52ha), occupied c. 160-400. (*Brigantes*).

Chesters, Northumberland.

Archaeologia 46, 1878?, 1ff: refers to a 'finely made stone-lined well in the principia courtyard...', p.247. *Arch. Ael.*(4) 8, 1931, 219-340 *vicus*; 19, 1942, 163-4; 20, 1943, 134ff; *Arch. Ael.*(5) 7, 1979, 114-26. Birley 1960, 16. *Britannia* 1, 1970, 140, 264; 2, 1971, 127-9, 184 n.72, 201 n.6; 3, 1972, 7, 193-5, 197 n.66, 204-5; 7, 1976, 157, 162, 232; 8, 1977, 199-200; 10, 1979, 346; 11, 1980, 314, 319, 338;

12, 1981, 268; 14, 1983, 289-90; 15, 1984, 278-9 baths; 18, 1987, 45 vicus; 22, 1991, 234. Bruce 4th ed., 1895. He comments on a rain-water tank in the North Chamber of West Gate, with gutter stones still in place, pp.89-90. 'Going along the South rampart we come to one of these (a tower, marked C on the plan) - a square building with a door on its inner side. On this side are a number of gutter-stones for receiving the rainfall from the roof, which were found, when the excavation was made, previously in the position in which they are now', p. 90, 2nd para. Bruce's comments were originally made during the 1850s. Hanson 1970, 243-8, item 7, 363, items 25 & 26, 'The terminal end of a raised aqueduct channel, the channel itself formed of channelled stones, was found entering the north guardchamber of the west gateway where it delivered water into a stone-built tank. As it was inserted into the guardchamber (and was not contemporary with the latter's construction) it is possible that this is the aqueduct referred to by an inscription RIB 1463, dating to the reign of Severus'; see no.1 p.245. Scott makes comment on a suggested 3rd aqueduct, p.247. JRS 41, 1951, 55; 45, 1955, 146; 47, 1957, 229; 62, 1972, 193. Somers 1984, Fig.8, plan. TIRBS 1987, 23, RIB 430, 1049, 1060, 1448-1495; extensive civil settlement; bridge carrying the wall over the North Tyne; water-mill; fort on Hadrian's Wall overlying Turret 27A. (Brigantes).

Chesterton(1), Cambridgeshire.

Artis 1828. Condron 1996, 415, well. Peterborough Museum record Nos. 780, 782, 797. Swan 1984, fiches 369-70, 382-4.

Chesterton(2), Cambridgeshire.

Condron 1996, 416-7 ?bath-house. Peterborough Museum record Nos. 901, 913, 926, 927, 951, 961, 1868. RCHM(E) 1969, 264-5, site 42. Swan 1984, fiche 369. (possible bath-house).

Chesterton(3), Staffordshire.

Britannia 10, 1979, 103-5; 16, 1975, 1-15. JRS 48, 1958, 150. NSJFC 9, 1968, 104-17, bath. VCH Staffordshire 1, 1908, 189. TIRBS 1987, 23, Flavian fort (1.9ha, or more probably 2.2ha); bath-house. (Cornovii).

Chichester, West Sussex.

Britannia 1, 1970, 49-50 Ant. Itin. 477.10 (Regno); 3, 1972, 350-1 sewer; 5, 1974, 457; 6, 1975, 282; 7, 1976, 372-3 baths; 8, 1977, 421-2; 9, 1978, 466-7 wells; 10, 1979, 332-3; 11, 1980, 396-8; 14,

1983, 332-3; 16, 1985, 202, 207 leat; 17, 1986, 423; 18, 1977, 353, 372; 19, 1978, 479; 20, 1989, 5, 320; 22, 1991, 27, 290; 25, 1994, 289. Cunliffe 1973, 47-68. Down & Rule 1971. Down II, 1974; III, 1978; IV, 1981. Hanson 1970, 98-99. *JRS* 53, 1963, 151. Ross 1967, 196. *SxAC* 90, 1951-2, 164-220; 100, 1962, 73-79, 80-110. Wacher 1995, 255-71, Fig.121, bath, drains, 2 wells. *TIRCGLL* 1983, 37, *RIB* 89-96. (*Regni*).

Chigwel, Essex.

Black 1995, 102 Route 9, 118 item 42, 119 Fig 1 position 42, 120 item 18, 121, Fig.2 position 18, *mansio* with bath. *Britannia* 1, 1970, 42-3, 65, 73, *Ant. Itin.* 480.7 (*Durolito*); 6, 1975, 81, 93 discounted as *Durolitum* at Romford; 11, 1980, 17. *Essex Arch. Hist.* 11, 1979, 102. *Essex J.* 15, 1980, 3; 16, 1981, 4. Gould 1983, 197-8; *idem.* 1985, Fig.3, bath-house, 2 wells. *RCHM* 1921, Essex, Central and South-West, 47, 'In each of these two main sites a well has also been found, ...'. Rivet 1964, 147. Rodwell & Rowley (eds.), 1975, 85-101. Scott 1993, 61, *SMR* 4057, ES 17. *VCH Essex* 3, 1963, 88. *TIRCGLL* 1983, 37. (*Trinovantes*).

Chilgrove(1), West Dean, Wellmeadow, West Sussex.

Black 1987, 153. Down 1979, occupation 1st to 4th c., bath-house. *JRS* 54, 1964, 177; 55, 1965, 219.

Chilgrove(2), near Warren Down, West Sussex.

Black 1987, 153. *Britannia* 1, 1970, 302-3 bath; 2, 1971, 286; 3, 1972, 351; 4, 1973, 321; 5, 1974, 458 well, depth excavated 37m; 6, 1975, 282; 8, 1977, 422. Chichester Civic Soc., Excavations Committee, 'Report for 1975, 3, 5 phases of occupation: 2nd to 5th c. Destroyed late 4th c. Cunliffe 1973, 87-8. Down 1979, 92-3, 96-100. Scott 1993, 192, *SMR* 0970, WS 101, NAR SU 81 SW 59, *SMR* 0973, WS 102, NAR SU 81 SW 60. *TIRCGLL* 1983, 37. (*Regni*).

Chipping Warden, Northamptonshire.

Baker 1830, 530-2, small well. Beezley 1841, 27. *JBAA* 5, 1850, 83, 168. Morton 1712, 526. *RCHM County of Northants, S-W*, 4, 1982, 27-32, item 3, No.13, Figs 36-39, bath. Scott 1993, 141, *SMR* 95, NH 26. *VCH Northants I*, 1902, 200. *TIRBS* 1987, 23, (*Catuvellauni*).

Chiseldon, Berricot Lane, M4, Wiltshire.

Arch. Rev. 5, 1970, 9. JRS 37, 1947, 249. Scott 1993, 199, SMR SE 304, WZ 53; at SU 19 76, SMR NE 303, WZ55, SMR NE 304, WZ 56. WAM 49, 1940-2, 117; 57, 1958-60, 24-9; 67, 1972, 174; 69, 1974, 185; 70-1, 1975-6, 135; 74-5, 1979-80, 91-111. Occupation c. AD 50-60 to 4th c.

Churchill, Oxfordshire.

Britannia 13, 1982, 367, spring.

Churchill Hospital, Oxfordshire.

AEx 1972, 63. *Britannia* 4, 1973, 296; 5, 1974, 436, well. CBA Gr.9 Newsletter No.3, 1973, 30; No.4, 1974, 21-2. *Oxoniensia* 37, 1972, 10-31; 38, 1973, 207-14, Fig.1 well, belonging to 1st c. occupation; possibly pre-Roman.

Cirencester(1), Gloucestershire.

Antiq. J. 41, 1961 to 47, 1967 inclusive; 49, 1969, ?; 53, 1973, ?. *Britannia* 1, 1970, 57-8, 64, Rav. Cos. 106.31 (*Cironium Dobunorum*), 184, 196 early fort, 227-36 defences, 293 amphitheatre; 3, 270-5, 339-40 houses; 4, 1973, 122-269 pottery, 307-9 defences, bath; 5, 1974, 7, 283; 6, 1975, 271-3; 7, 1976, 163-4, 354, 384; 8, 1977, 198, 323-4 fifth-century plague, 413, 439-40; 9, 1978, 359, 362, 455; 10, 1979, 112-3, 118, 148, 167-8, 176, 319; 11, 1980, 299-300, 411; 12, 1981, 355; 14, 1983, 343-4; 15, 1984, 68; 16, 1985, 181, 183, 190, 202-3 water supply; 19, 1988, 465-7; 22, 1991, 274-5; 23, 1992, 217-8, 294-5; 24, 1993, 303; 25, 1994, 285. Wachter 1995, 302-22 Fig.136 'Cirencester'. Darvill & Gerrard 1994, 72 water supply. McWhirr 1981, 21-58; idem. 1986, 30-6, bath-suite in western half of building XII. *TIRCGLL* 1983, 38, *RIB* 101-18; Capital of the *Civitas Dobvnnorvm*; military occupation c. AD 45 to 75(?) (*RIB* 108-9); town developed under the Flavians and eventually became the second largest town in Roman Britain in the 4th c.; probably the capital of *BRITANNIA PRIMA* (*RIB* 103); survived into 5th and 6th c. when taken by the Saxons after the battle of Dyrham in AD 577. (*Dobunni*).

Cirencester(2), Barton Farm, Gloucestershire.

Scott 1993, 70, SMR 2092, GS 26, wigged-corridor villa. *TBGAS* 33, 1910, 67-77, bath(?).

Claydon Pike, Lechlade & Fairfield, Gloucestershire.

Britannia 15, 1984, 312-4, Fig 21 'three wells associated with Roman rectangular timber buildings, one of them entered by steps of which

one was formed of reused timber' (314). 'two (312) deep tanks at back of two rooms'. *Oxford Arch. Unit*, Newsletter 9, 1983, Nos 2-4.

Clayton, West Sussex.

Black 1987, 154. Scott 1993, 184-5, SMR 4149, NAR TQ 31 SW 5, WS 28; SMR 3779, NAR TQ 21 NE 13, WS 29, TQ 29 15. *SxAC* 56, 1914, 197-98; 66, 1925, 34 (WS 29), 2 wells, bath (WS 28). *VCH Sussex* 3, 1935, 53.

Cliffe House, North Yorkshire.

Britannia 6, 1975, 235, drainage trenches, 4th c. settlement. Tyler 1980, 60. *YAR* 1974, 3, under Crambe. *YAJ* 44, 1972, 220.

Cnut's Dyke, Huntingfordshire.

Antiquity 5, 1931, 106-9. *Antiq. J.* 29, 1949, 145-63, excavation at Cottenham, Cambridgeshire. *Arch. J.* 91, 1934, 118-22. *Durobrivae* 5, 1977, 27-30; 6, 1978, 32-4. Phillips 1970, (ed.), Vol.5. OS 'Map of Roman Britain', 4th ed., 1991. *South Lincs. Arch.* 4, 1980, 19-23. Whitwell 1982, 212, TL 28 NE1. *TIRBS* 1987, 17, 'A canal, flat-bottomed and 10-13m wide, running from the river Cam near Cambridge to the Witham at Lincoln and making use of rivers where convenient'. Much of its earlier sections pass through the Fens. Whether it flowed or held water permanently is uncertain. The altitude along the length of its profile must vary up and down in elevation. It forms part of the Car Dyke.

Cobham, Surrey.

Black 1987, 150, No.89, suggests possibly 2 bath-buildings; constructed c.AD 320-30, abandoned c. AD 355-65. Frere 1947, constructed c. AD 320-30 and abandoned c. 355-65. Scott 1993, 175-6, SMR 490, SY 10. *SyAC* 50, 1947, 73-98.

Cobham Park, Kent.

Arch. Cant. 76, 1961, 88-109. Philp, 1968, Fig.22. Scott, 1993, 103, KE18. *TIRCGLL* 1983, 39, corridor villa with bath.

Coddenham, Suffolk.

Britannia 1, 1970, 45-53, 52-3, Ant. Itin. 480.2 (*Conbretoivio*, var. *Combretoivio*), 71; 5, 1974, 439, well, timber-lined, c. 9.25m deep; 6, 1975, 207; 7, 1976, 341-2; 8, 1977, 405 fort; 9, 1978, 448;; 11, 1980, 19; 18, 1987, 8. Dunnett 1975, 43, 62, 89. Rodwell & Rowley

(eds.), 1975, 85-101. VCH Suffolk 1, 1911, 303. Webster 1980, 133-4. TIRBS 1987, 24, occupation early 1st c. to 3rd c. (Trinovantes).

Colchester, Essex.

Arch. J. 123, 1967, 32; 142, 1985, 216-36, 'A possible leat has been identified at the Sheepen site to the west of the fortress'. *Britannia* 1, 1970, 18 Ant. Itin. 474.4 (Colonia), 480.4 (Camoloduno), 149, 181-2, 258, 290; 2, 1971, 168-94; 3, 1972, 164-81; 4, 1973, 302-4 fortress and colonia; 5, 1974, 210-1; 6, 1975, 79-83, 176, 198-9, 263-4; 7, 1976, 176-7, 180, 182, 189-90, 343-4; 8, 1977, 92-5, 97, 100 water supply, 198-9, 407, 437-8; 9, 1978, 449-51 sewer; 10, 1979, 157-63, 148, 308-9; 11, 1980, 378-9; 12, 1981, 289-90; 13, 1982, 371; 15, 1984, 105, 343; 16, 1985, 178-90, 201-2 water supply, 295-6; 17, 1986, 356-8, 405-7, 442; 18, 1987, 273-4, 332-3; 19, 1988, 196; 20, 1989, 178, 302-3; 21, 1990, 276, 297, 342; 24, 1993, 1-6, 302; 25, 1994, 324-5. Crummy 1977, 65-105, at 100, Figs.11, 20, where distribution by wooden pipelines is attested. Idem. 1984, 5, leat, wells timber-lined, 26-8, water supply as water mains, wells, leat, spring and aqueduct, Figs.84, 96, 99, 101-4, 107-9, 111, 115-7, water-mains and iron collars, tanks 140-2, Fig 102, 104, 106, 131, baths 146; idem. 1992, baths 71, 268, tanks 31, 40, 63, 78, 89-90, 105, 255, 355-6, water-pipe junctions collars 72, 101, 105, 358 and micro-fiche 995, wells 36, 335-6, 365, 388, 390-2, and micro-fiche 799, 820, 876, 879, 970, 1003 1019, 1048, water supply 24, 30, 40, 44, 47, 67, 69, 72, 101, 105, 355-6, 358; idem. 1990-1, bath(?). Dunnett 1966, 27-61, at 31, Fig.2, pl.IIIA; idem, 1975, 128, n.17, it has been conjectured that water was pumped uphill from the Sheepen springs but the aqueduct was most certainly a pipeline aqueduct employing an inverted siphon to convey water from the springs to the south or west. It is conceivable that this aqueduct was first laid to supply the fortress'; idem. 1971, 1-106. Hanson 1970, 35-42, 363. Hawkes & Hull 1947, 73, 76, Fig.13, pl.VI, 106-7, 282-4, pl.XII. This runs at too low an elevation to have supplied the fortress and the fort at Gosbecks. The colonia was supplied by a battery of four wooden pipelines which entered through the Balcerne Gate. These date back to the pre-Boudicean period. Hull 1958, 13, 17; 1963, 147. Swan 1984b, fiche 277, Colchester(7) TL 9865 2517, well V; fiche 286, Colchester (13), well nearby at TL 9874 2566, Sheepen, east-side of Hull's region 4; Colchester (14), Middleborough Castle Market site TL 9926 2556: 3 timber-lined wells in the vicinity of kiln 36, with another well nearby, (6 wells). Wachter 1995, 112-32. TIRCGLL 1983, 39, RIB 63-9; Pre-Roman capital of the Trinovantes, then of the Catuvellauni under

their king Cunobelinus; fort, legionary fortress (*Legio XX Valeria*), then *colonia* AD 49; destroyed by Boudica AD 60; rebuilt and given name *Victricensis*; possible capital of the *Civitas Trinovantum* (cf Chelmsford); temple of Claudius, and 7 Roman-Celtic temples; walls enclosed c. 40ha. (*Trinovantes*).

Cold Brayfield, Buckinghamshire.

Scott 1993, 26, SMR 1280, BU 22: 'head of spring'. *Wolverton and District Arch. Soc. J.* 2, 1969, 10.

Cold Knap Point, Glamorgan.

Black 1995, 118-9, 179, Fig.60, (?)bath. *Britannia* 12, 1981, 316; 13, 1982, 332-3; 16, 1985, 57-125. Evans, Dowdell & Thomas 1985, 57-125. *JRS* 51, 1961, 158. *RCAHM Glamorgan* 1(2), 1976, 120.

Coldharbour, Gloucestershire.

Britannia 16, 1985, 93f.

Colerne, Wiltshire.

Scarth 1864, 120-1. *VCH Wiltshire* 1, 1957, 59. *TIRCGLL* 1983, 39. (*Belgae*).

Coleshill, Warwickshire.

Britannia 10, 1979, 300 bath, 3 tanks shallow mortared-lined, c. 1 x 1.5m, drain, imbrex-lined, occupation from Iron Age, and abandoned by Romans c. end of 2nd c.; 11, 1980, 369; 12, 1981, 339; 13, 1982, 419; 16, 1985, 183. *TIRBS* 1987, 24, Romano-Celtic temple. (*Corieltavi* or *Cornovii*).

Collingham, West Yorkshire.

AEx 1976, 102. *Britannia* 8, 1977, 384; 9, 1978, 428; 10, 1979, 288 well in rock-cut, 2m diam., 17m deep, with substantial well-house, remains of 8 wooden buckets, stone cisterns; 12, 1981, 330; 18, 1987, 377; 19, 1988, 505-6. Faull & Moorhouse (eds), 1981, 147. *Proc. Yorkshire Phil. Soc.* 1849-55, 270-81. Scott 1993, 195, SMR 1972, WY 3. Sumpter 1988, 176-96 in Price & Wilson (eds.) 1988. Small finds and coins of 3rd and 4th c. Wrathmell & Nicholson (eds.), 1990. *YAJ* 37, 1949, 237-9. *TIRBS* 1987, 24. (*Brigantes*).

Colliton Park, Dorchester, Dorset.

Britannia 2, 1971, 170, 178, 180; 4, 1973, 158, 171. *Dorset Proc.* 59, 1937, 1-14; 60, 1938, 51-65; 84, 1963 113, another well at the New Clinic site, 17.33m deep and 1.2m in diameter, of which the upper 2.1m was steined with flint and limestone blocks. *RCHM* 1970, County of Dorset 2(3), 553-61, 'Colliton Park, Fig. on p.554 shows 3 wells, Fig. p.556 shows two of these wells in vicinity of building I and 3rd well in vicinity of building III: 1) 1.1m (3.5ft) diam., 10.4m (33.5ft deep, lay to N of the S range (p.558a), 2) 'A well to the south over 15.8m (52ft deep had a limestone coping' (p.560a), 3) 'To the N-E a stone well-head of hexagonal plan with circular shaft 0.6m (2ft) iam., contained late Roman material in its partially excavated upper filling, SY 6909 9050'. Page 562, item 190, boiler house at SY 6905 9055; at SY 6904 9053, a stone-lined covered drain (2.13m, 7ft, section); p.561, item 189, well-head, stone-lined, 0.6m (2ft) diam at SY6909 9050. Figure also shows several drains. Colliton Park Villa was situated too high to obtain water from the Dorchester aqueduct.

Colsterworth, Lincolnshire.

Antiq. J. 12(3) 1932, 262-8; 13(2), 1933, 166ff. *Arch. J.* 91, 1935, 164. *Grantham Journal* 13 February, 1932. Tylecote 1962, 230. Whitwell 1982, 132-3, 213, SK 92 SW 17; idem. 1970, 113-4. *TIRBS* 1987, 24 at SK 926 242. (*Corieltavi*).

Combe Down, Somerset.

VCH 1, 1906, Somerset, 309-10, item 19, probable fort, bath(?). *TIRCGLL* 1983, 39, *RIB* 179; villa, courtyard; coins of 4th c. (*Belgae*).

Comberton, West Cambridgeshire.

Arch. J. 6, 1849, 210. Babbington 1880, 22-4. *Cambridge Antiquarian Soc.* 9, 1849, 7. Fox 1923, 185. *Gentleman's Magazine*, (n.s.) 8, 1842, 526. *RCHM* 1968, County of Cambridgeshire, 48-55, item 9, p.55, bath and lead pipe. *VCH* Cambridgeshire 7, 1978, 45. Rellan Drawings, p.148. Samian pottery, coins: Septimus Severus and Gordian, probably also Vespasian and Gratian, c. 4th c. pottery. *TIRBS* 1987, 24. (*Catuvellauni*).

Combley, Isle of Wight.

Basford 1986, 123. *Britannia* 2, 1971, 282, dating villa by pottery to 3rd c.; 5, 1974, 456; 7, 1976, 364-6 baths; 11, 1980, 393; 22, 1991, 289. *PIWHAS* 6(4), 1969, 271-82; 6(6), 1971, 420-30. Scott 1993,

102, SMR 883, IW 8. *The Isle of Wight City Council*, 1974, 'The Roman Wight: A Guide Catalogue'. Tomalin, 1987.

Compton(1), Pitlands Farm, Upmarden, West Sussex.

Black 1987, 154. *Britannia* 20, 1991, 320; 22, 1991, 290 settlement; 25, 1994, 289 bath-house. Scott 1993, 185, SMR 0263, NAR SU 71 SE 12, WS33. Occupation from earlier rather than late 3rd c., probably c. AD 90-110 based on stamped tiles, and as late as 4th c.

Compton(2), Surrey.

Scott 1993, 176, SMR 1630, SY 11. *SyAC* 28, 1915, 41-50, 3 pls. of the baths.

Compton(3), Berkshire.

TNFC 7, 1934-7, 211-6. *VCH Berkshire* 1, 1906, 205. *TIRCGLL* 1983, 40. (Atrebates).

Congresbury, Taylor's Wood, Avon.

Britannia 18, 1987, 343. *PSANHS* 108, 1963-4, 172-4. Scott 1993, 15, SMR 394, AV 34, 2 small buildings, one with bath and hypocaust. *TIRCGLL* 1983, 40. (Belgae).

Corbridge, Northumberland.

Arch. Ael.(2) 6, 1865, 189; *Arch. Ael.*(3) 1907, 161-86; 4, 1908, 205-303; 5, 1909, 305-424; 6, 1910, 205-72; 7, 1911, 143-267; 8, 1912, 137-263; 9, 1913, 230-80; 11, 1914, 279-310; *Arch. Ael.*(4) 11, 1934, 158-75; 14, 1937, 95-102; 15, 1938, 243-94; 17, 1940, 85-115; 21, 1943, 127-224; 28, 1950, 152-201; 30, 1952, 239-66; 31, 1953, 116-26, 205-53; 33, 1955, 218-52; 36, 1958, 227-41 vicus; 37, 1959, 59-84 baths; 45, 1967, 17-26; 46, 1968, 115-26; 49, 1971, 1-28; *Arch. Ael.*(5) 5, 1977, 47-74 forts. Bishop 1994. Bishops & Dore 1988. *Britannia* 1, 1970, 40, *Ant. Itin.* 464.3 (Corstopitum), 254-5; 2, 1971, 127, 219; 3, 1972, 45-7 defences, 306, 354; 4, 1973, 276; 5, 1974, 409 Agricolan occupation; 6, 1975, 66-8 fountain and granaries, 74-5 dating of structures, 230-2, item ii, excavation of Drere Street South of Car Burn (NY 984 653) revealed the aqueduct approaching from the N-E and crossing beneath the road in a culvert on the west side, all traces of the aqueduct had been removed by ploughing (232); 11, 1980, 165-71; 16, 1985, 200-1 water supply; 18, 1987, 45 town plan. Dore 1989, two aqueducts: 1) stone-lined, 2) leat. *JRS* 46, 1956, 148-9. Rowland 1991, 146, Fig p.14, 'There was an Agricolan fort here on

the Stanegate, overlooking the crossing of the Tyne. It still had use when the forts were moved to the Wall, and in time it became an important supply base on the route to Caledonia. It eventually became a small town covering some 40 acres... The civilian areas are in the fields to the west and south of the fort... The water supply is brought down to the site from the North by aqueduct. It fed a great stone cistern in the centre of the fort. The fountain head was the famous sculptured lion, shown with prey...The bath-house was situated nearer the river'. *TIRBS* 1987, 24-5, *RIB* 1120-97, 2296-7. (*Brigantes*).

Corhamby, Hertfordshire.

Britannia 6, 1975, 258 Fig.10, well, bath-suite. Period of occupation from Iron Age to the 1st-half of 4th c., at least 15 phases can be recognised. Original timber structures probably burnt down during revolt by Boudica in AD 60.

Corton, near Lowestoft, Suffolk.

Bromehead 1942, 99, 142-51, 183-96, at 192, Fig.3 opp. p.187 item 5. Well, brick-steined.

Cosgrove, Northamptonshire.

BNFAS 1, 1966, 7; 4, 1970, 7-8. *Britannia* 1, 1970, 288, bath, built c. AD 150, disused before AD 300; 24, 1993, 293. *CBA 'Summaries of Excavations'*, 1969, 11. *JRS* 48, 1958, 140; 49, 1959, 115. Quinnell 1991, 4-66, site given as at SP 7947 4212. *RCHM County of Northants*, S-W 4, 1982, 34-5, item 2, No. 15. Scott 1993, 141-2, SMR 533, NH 29. *VCH* 1, 1902, 216. *WDASN* 4, 1959, 7; 7, 1962, 2. Occupation c. AD 100 to early 5th c. *TIRBS* 1987, 26. (*Catuvellauni*).

Cotterstock, Northamptonshire.

Britannia 22, 1991, 252. *Durobrivae* 5, 1977, 24-5. *Nene Valley Research Comm. Annual Rep.* 1989-90, 4. *Northants. Arch.* 12, 1977, 211-2. *RCHM Northants.* 1, 1975, 32 site 2. Scott 1993, 142, SMR 1729, NH 29. Stuckeley, *Surtees Soc.* 76, Vol.II, 1884; 80, Vol.III, 1887, 49-53 (spring?). *VCH Northamptonshire* 1, 1902, 192. Whitwell 1982, 214, Fig.17, 382. *TIRBS* 1987, 26. (*Catuvellauni*).

Covehithe Suffolk.

PSIA 7, 1891, 303-4. *VCH Suffolk* 1, 1911, (reprinted 1975), 303 well.

Cow Roast, Northchurch, Hertfordshire.

Britannia 5, 1974, 438; 6, 1975, 257, 8 well shafts; 7, 1976, 338-9; 8, 1977, 401; 9, 1978, 444, well, 3.7m deep; 10, 1979 338-9; 21, 1990, 338; Smith 1987, 235 wells. Scott 1993, 94, SMR 1874, HT 43, deep pits. BDAS 1978, 'Excavations by Berkhamstead and District Archaeological Soc. 1973-4'. Occupation from Iron Age.

Cowbridge, South Glamorgan, Wales.

Black 1995, 104, 118-9, 190-1. *Britannia* 9, 1978, 409; 11, 1980, 349, evidence of Roman occupation; 12, 1981, 316-7; 13, 1982, 333-4; 14, 1983, 282, fort; 15, 1984, 268; 16, 1985, 246, 255; 19, 1988, 420; 25, 1994, 154-5 Fig.1, bath-building. *JRS* 56, 1966, 220. *Current Arch.* No.81, 7(10), 1981, 308-9. *Morgnnwg* 17, 1973, 59-60. Parkhouse 1981, 308-9. Parkhouse & Evans (eds.), 1996. *TIRCGLL* 1983, 41; *Ant. Itin.* 484.3 (*Bomium*). (*Silures*).

Cox Green, Maidenhead, Berkshire.

Berkshire Arch. J. 59, 1961, 24; 60, 1962, 62-91. *JRS* 48, 1958, 99; 50, 232-3 Figs.31 & 32, bath-suite, c. AD 2nd to 4th c. Scott 1993, 23 (under Maidenhead), SMR 403, BK 30, bath-suite. *TIRCGLL* 1983, 41, (*Atrebates*).

Cramond, West Lothian Region, Edinburgh.

Britannia 3, 1972, 304 vicus; 5, 1974, 163-224; 7, 1976, 305-6 bath-house; 8, 1977, 368-70 plan bath; 9, 1978, 418 well, c. 3.5m deep, 1.4m diam.; 10, 1979, 278-9; 11, 1980, 354; 2, 1981, 321; 14, 1983, 289; 19, 1988, 429; 23, 1992, 264-5, Fig.7: '...an annexe which may have included an external bath-house', and also 'observed a pipe-line along the N side of Kirk- Crammond road'. *Current Arch.* 55, v(8), 1976, 241-5; 59, v(12), 1977, 378-81 (2 pictures). Rae A & V 1974, drains and latrine, tank Fig.12. Severan pottery probably indicates earliest occupation, and latest activity was in late 3rd or 4th c. *TIRBS* 1987, 26, *RIB* 2134-7.

Croy Hill, Cumbernauld, Strathclyde, Dunbartonshire.

AEx 1977, 165. *Britannia* 3, 1972, 12; 7, 1976, 301-2 vicus; 8, 1977, 364-5; 9, 1978, 413-5 Fig 5; 10, 1979, 276-8; 11, 1980, 47; 13, 1982, 338; 22, 1991, 228. *DAES* 1977, 12f. Macdonald 1934, 258-71. *PSAS* 66, 1931-2, 264. Robertson 1990, 65-71, Figs.45, 46. *CSIR* I.4, 1985, Nos.87-91. *TIRBS* 1987, 27, *RIB* 2158-64.

Dalginross, Tayside, Scotland.

Britannia 15, 1984, 55. Crawford 1949, 41-5. *JRS* 55, 1965, 81; 59, 1969, 109; 63, 1973, 224. Frere & St. Joseph 1983, 129-31. Hanson 1970, 196, 365, item 34, (south camp) comments: 'This Roman fort was reported,..., to have been fed by an aqueduct coming from Roachell Water to the west of the site...', item 35 (north camp), Hanson further comments, 'the same writer,...also recorded that the subterranean stone-built channel delivered water to the north camp at Dalginross (on OS map) from a stream running to the west of the site'. Macdonald 1939, 253 Fig.2, 'aqueduct from Roachell Water to the West of the site'. Roy 1973, pl.xi. *PSAS* 97, 163-4, 196-8. Stephens 1985b, 224, comments, 'A "small aqueduct" was observed in the 18th c. This will have been a stone channel, a wooden pipeline would probably not have been recognized, whilst reference to a "subterranean passage" shows that it was not a leat. Undated but presumably 1st c.'. *SAF* 12, 1981, 30 pl.1. *TIRBS* 1987, 27.

Dalswinton, Dumfries and Galloway, Scotland.

Britannia 2, 1971, 145 fort; 3, 1972, 11, 14; 18, 1987, 1-48. *GAJ* 4, 1976, 7-11, plan. Hanson 1970, 364, comments: 'An open leat feeding a mill-pond to the south of Dalswinton from the Brandy Burn has been noted crossing the site of the Roman fort. Since the Brandy Burn, which runs directly to the north of the fort, is the nearest source from which the external gravity-fed water supply could have been laid on to the site, it is possible that the leat represents the older, Roman supply system'. *JRS* 41, 1951, 59; 48, 1958, 89; 51, 1961, 122; 55, 1965, 79; 67, 1977, 131-3, plan. Maxwell & Wilson 1987, 30, with comment: '...Woodhead...It is possible that this was a labour-camp, perhaps accommodating troops engaged in felling timber for the Flavian fort-construction programme. The only comparable site until recently was the southernmost structure of the military complex at Dalwiston (NX 986 839)'. *Trans. of the Dumfries & Galloway Nat. Hist. & Antiquarian Soc.*, 34, 1957, 10-11. *TIRBS* 1987, 28, Large fort with annexes (3.48ha enlarged to 4.6ha), (NX 933 848).

Darenth, Kent.

Arch. Cant. 22, 1897, 49-84. *Britannia* 1, 1970, 304: 'a small detached bath-house at the S-W corner of the known villa complex', 5 major periods c. AD 180-350; 2, 1971, 184, building matls., 297-8, inscriptions; 4, 1973, 176, pottery; 6, 1975, 176; 10, 1979, 148, voussoir tiles; 12, 1981, 164-5. Bromhead 1942, 186 aqueduct - earthenware pipes(?). *KAR* 18, 1969, 18-21, drains; 19, 1970, 16.

Rivet 1969, 132-49. Scott 1993, 103, KE 20. VCH Kent 3, 1932, 111-3 Figs opp. pp.110, 111, pls xviii, cistern, xix, xx, and Fig.27, plan of villa, bath-house, cistern. Morris 1979. TIRCGLL 1983, 43. (Cantiaci).

Daventry, Borough Hill, Northamptonshire.

Archaeologia 35, 1853, 383-95. Barker 1830, 345. Edgar 1813, 40. JNNHS 26, 1932, 177. RCHM County of Northants, N-W 3, 1981, 62-72, item 18, No.23, Figs.54-58, villa near S-W corner of the northern fort on a small knoll at 191m above OD; stone-lined well S-W of building, Fig.55. Not clear if villa occupied before 3rd c., but went into 4th c. Scott 1993, 142, SMR 223, NH 33. Smith 1, 1848, 113; 3, 1854, 208. VCH Northants 1, 1902, 195. Whitwell 1982, 219. TIRBS 1987, 28, dating from 3rd to 4thc. (Catuvellaunni).

Dean Hall, Gloucestershire.

Britannia 16, 1985, 299-300, Fig.24, paved drain leading from a probable springhead (from 2nd period); 17, 1986, 410-2; 19, 1988, 467. Dating from 2nd to 3rd c., much evidence of Roman occupation around the Hall.

Denton, Lincolnshire.

Allen 1834, 2, 215. *Archaeologia* 22, 1829, 28. *Arch. Notes Lincs.* 2, 1949-50, 189. *Arch. Rev.* 3, 1968, 179. *Britannia* 2, 1971, 176; 4, 1973, 138. Camden 1586, 2, 251. EMAB 2, 1959, 8. Greenfield, 1971, 29-57, the well was completely destroyed by machine during excavations to examine the small finds; a square well, 0.86m by 0.91m and 5.78m deep. JRS 40, 1950-1, 100; 50, 1960, 221-2, plan at 221. LHA 5, 1970, pt. II, 29-57, (see refs on pp.50 & 55, and notes on p.35 for a simple classification of type of baths); 6, 1971, 29-57; 7, 1972, 7. LAASRP 10(2) 1964, 75-104. Scott 1993, 120, SMR 6663, SK 83 SE 12, LI 53. Scott 1973, Vol.2, bath, Fig.74, and well 6m deep, steined, Figs.72-4, drains, Fig 72. Todd 1973, 86-8. Whitwell 1982, 111, 220, SK 83 SE 12. idem. 1992, 81-2. TIRBS 1987, 28, c.AD 300, rebuilt c.AD 370. (Corieltavi).

Derby, Little Chester, Derbyshire.

Antiq. J. 51, 1971, 36-69, Trajanic well at SK 3613 3755; 60, 1980, 8-47. Brassington 1980, 8-47. *Britannia* 1, 1970, 283, well (SK 353 375); 4, 1973, 285; 5, 1974, 419-20, vicus; 6, 1985, 242-4, 6 wells, showing a variety of of constructional techniques in stone and timber,

ranged from Flavian late 1st c. to early 4th c., 2 tanks; 19, 1988, 445-6 fort; 20, 1989, 283-6. *DAJ* 87, 1967, 70-85; 89, 1969, 115-9; 92, 1972, 5-14. *EMAB* 10, 1974, 6, (SK 3550 3760); 11, 1977, 5. *JRS* 14, 1924, 224, (SK 252 373) bath; 58, 1968, 184; 59, 1969, 211-3, plan. *JDANHS* 47, 1925, 256-8; 81, 1961, 85-110, plan; 82, 1962, 110; 101, 1981, 90, plan; 102, 1982, 74-86. Webster 1961, 85-110. *TIRBS* 1987, 29, Rav. Cos. 106.46. (Corieltavi).

Dersingham, Ingoldisthorpe-Snettisham Bypass, Norfolk.

Britannia 21, 1990, 340, 2 wells with good timber-linings. Occupation from late Iron Age to 3rd or 4th century.

Desborough, Northamptonshire.

PSA 22, 1908, 333. *RCHM* County of Northants, Central, 2, 1979, 33-4, Fig.36, 3 wells. OS Record Cards.

Desford, Leicestershire.

Liddle 1982, vol.1, 42. *TLAS* 37, 1961-2, 67 well, stone-lined 4.6m (15ft) deep. Whitwell 1982, 222. *TIRBS* 1987, 29. (Corieltavi).

Dewlish, Dorset.

Britannia 1, 1970, 298; 2, 1971, 279; 3, 1972, 345; 4, 1973, 314-5; 5, 1974, 453-4 bath, water containers in the floor Figs 21 & 22; 6, 1975, 277 bath; 7, 1976, 360-1. *PDNHAS* 94, 1972, 81-6. *RCHM* County of Dorset, 1980, 88, houses at SY 770 973, '...the pavement was bordered by a gutter of red tiles'. Scott 1993, 52, SMR 1 040 011, DO 11, bath. *TIRCGLL* 1983, 43-4. (*Durotriges*).

Diddington, Little Paxton Quarry, Cambridgeshire.

Britannia 18, 1987, 367; 19, 1988, 450; 24, 1993, 296; 25, 1994, 274-5, Fig.11, c. mid 2nd c. to late 4th c., 3 phases identified, 2 wells, tank.

Dicket Mead, Hertfordshire.

Britannia 1, 1970, 289; 2, 1971, 269-70, Fig.10, compact bath-suite, suggests a period of disuse before final demolition c. AD 300; 4, 1973, 331-2; 10, 1979, 349-50; 11, 1980, 410; 12, 1981, 386. *Hertfordshire Arch. Rev.* Spring 1971, 45-6, summary article.

Ditchley, Oxfordshire.

Britannia 2, 1971, 169, building materials; 6, 1975, 199-202, types of houses, well. *Oxoniensia* 1, 1936, 24-69, two periods of occupation, c.AD 70-200, and c.AD 30-400. *VCH Oxfordshire I*, 1939, 311-13, Figs.29 & 30. *TIRCGLL* 1983, 44. (*Dobunni*).

Dolaucothi, Dyfed, Wales.

Britannia 1,1970, 270, 2nd aqueduct recognized; 2, 1971, 244, Fig.3, 3rd aqueduct recognised; 4, 1973, 271; 10, 1979, 168; 12, 1981, 268 model wheels; 24, 1993, 247-9; 25, 1994, 248 leat. Bick & Boon 1993, 247-9. Boon & Williams 1966, 122-7. Burnham, Burnham & Walker 1992, 32, 2-8. Burnham B & H, 1993, 33, 16-9. Burnham 1994, 41-7. Davies 1935, 94-139, at 101-2; idem. 1936, 51-7. Hanson 1970, 330-30, 365, note: the directions Hanson gives in both items 36 & 37 is incorrect. Where she uses west it should read east. Jones, Blakey & Macpherson, 1962, 71-84, pls.i-v. Jones & Lewis 1971(a); idem. 1971(b), 171, 288-300. *JRS* 8, 1918, 53-102; 56, 1966, 122-7; 59, 1969, 198-9, Fig 25. Jones & Maude 1991, 210-11. Lewis & Jones 1969, 244-72. Lewis & Jones 1982, 10-4. Lewis 1976-77, 16pp. Nash-Williams 1950, 79-84. Pliny (The Elder), *Nat. Hist.* 33.74. *RCAM Carmarthenshire Inventory*, Nos. 113, 115, 128. Tacitus c. 1st c. AD, *Agricola* 12, 'Britain produces gold and silver and other metals which are the rewards of victory'. *TIRBS* 1987, 29, *RIB* 406. (*Demetae*).

Doncaster, Yorkshire.

Britannia 1, 1970, 47, 51, Ant. Itin. 475.5, 478.8 (*Dano*, var. *Ano*); 2, 1971, 253; 3, 1972, 311; 4, 1973, 282; 6, 1975, 68; 7, 1976, 317; 8, 1977, 331, 384; 9, 1978, 247-70; 428; 10, 1979, 290; 11, 1980, 415-6; 13, 1982, 420; 25, 1994, 267. *Current Arch.* 33, 273-9. Magilton 1972, 34-5, occupation from Flavian to c. AD 388-92, Valentinian II coin. *PNRB* 1979, 329: Ant. It. 475.5 Iter V; 478.8 Iter VIII for *Danum*. several wells. *CSIR I.3*, 1983, No.32. Selkirk 1972, 275. Smith 1987, 207. *TIRBS* 1987, 29, *RIB* 618. Flavian to Hadrianic large fort (over 2.6ha) of two phases separated by burning; c. AD 125-160; civil settlement 4th c. (*Brigantes*).

Dorchester(1), Dorset.

Antiq. J. 20(4), 1940, 429-48, (K M Richardson), pl.LXXII facing p.440, showing Foster's proposed route to Notton. *Britannia* 1, 1970, 60-1 Ant. Itin. 483.6, 486.15 (*Durnovaria*); 2, 1971, 279-81; 3, 1972, 345; 4, 1973, 172, 315; 7, 1976, 361 water supply; 9, 1978, 462 bath-building, wells; 10, 1979, 327 first bath-house c. AD 75-100, disused

by c. 320-60 and a 2nd public bath built after 4th century; 14, 1983, 324-6 water supply; 15, 1974, 320; 16, 1985, 197-207, 199, 201, 203-4, 306; 18, 1987, 345; 20, 1989, 315; 21, 1990, 350-2; 22, 1991, 284-7, 350-2. *Dorset Proc.*, 1952, 152. Frere, 1967, 246. Hanson 1970, 104-10, and at 365 item 38, comments 'This open channel aqueduct, about 13 miles long is one of the most impressive structures of its kind in Britain. Allowing for an average fall of only some 0.38m per kilometre or 1 in 2640 (2ft per mile) it followed a circuitous route to bring water from the river Frome to Durnovaria'. Hanson assumes that the start of the aqueduct is as suggested by the early engineers, but which has not been substantiated by later archaeological investigations. *JRS* 30, 1940, 175-6; 35, 1945, 80. Moule 1906, 2nd ed., 27-9, drainage system. *PDNHAS* 77, 1955, 133-4; 78, 1956, 80-3; 90, 1969, 171ff, where at pp.172-3, C J S Green describes his excavation of the aqueduct next to the Poundbury cemetery and the cross-sections he took of the profile of the aqueduct. He concludes that the information obtained from sherds shows a primary phase of the 1st c. AD with a channel of a flat base and sloping sides and lined with clay in the lower portion (confirmed by Bill Putnam 1990-5); and a second phase when it was cleared out in the later 1st century to a new U-shaped profile, but given no clay lining, and remained in use into the 4th c. AD. *PDNHASFC* 22, 1901, 80-3, article by R A Coates with a plan of his original survey and cross-sections; 46, 1925, 1-13, article by P Foster and the plot of his speculated line towards a source for the aqueduct; 59, 1938, 13. *RCHM* 1970, County of Dorset, 2(3), 531-592, esp. 3rd para. at 534, and 585-9. This article gives a detailed description of the aqueduct and includes the map numbered 227a (p.586, pl.221), based on the work of J N Coates in 1900, and P Foster in 1922, both of the Royal Artillery, and the levelling survey of the Royal Engineers in c. 1925, based on the Liverpool datum. Currently (1994-7) Prof. Bill Putnam from University of Bournemouth is excavating to determine the route from the start of Penn Plantation, the last attested section of the aqueduct. He has established its existence into the plantation for about 250m, when it disappears. Wachter 1995, 323-35. Woodward, Davies & Graham 1993, *PDNHAS* Monograph 12. *TIRCGLL* 1983, 44-5, *RIB* 188-90; occupied from c AD 70 to early 5th c. (*Durotiges*).

Dorchester(2), Somerleigh Court site, Dorset.

PDNHAS 91, 1970, 182-3, a drainage ditch leading into a quarry; a well, which went out of use c.AD 300.

Dorn, Gloucestershire.

Cox 1720, 31-41. Haverfield 1901. Nash 1781, I, 101; II, 1782, postscript. McWhirr 1981, 60-2. Oswald 1963, 18-24. *RCHM* 1976, 12-3, occupation 1st to 5th c., 'there were two wells'. Smith 1987, 289-90, 2 wells. St Joseph 1961, 119-135. *TBGAS* 81, 1962, 194-5; 82, 1963, 18-24. *VCH* Worcestershire 1, 199-221. *TIRBS* 1987, 30, small town (4ha), pottery 1st to 4th c. (*Dobunni*). (Dorn = fort or gate).

Dover, Kent.

Archaeologia 93, 1949, 32. *Arch. J.* 126, 1969, 78-100. *Britannia* 1, 1970, 45-6, 65 Ant. Itin. 473.2, 473.5 (ad portum Dubris); 2, 1971, 172-92 building materials; 3, 1972, 252; 4, 10973, 322, 332; 5, 1974, 459 bath-ouse, aqueduct stone-lined channel, wood pipes two+, earthenware 2+, cistern; 6, 1975, 283 sewers; 7, 1976, 376; 8, 1977, 238, 424; 9, 1978, 471 water pipelines, 473 vicus; 11, 1980, 401; 12, 1981, 366; 13, 1982; 393 annexe; 14, 1983, 334-5; 15, 1984, 217-23, 330-2; 16, 1985, 315; 17, 1986, 426; 20, 1989, 323-5; 21, 1990, 364; 23, 1992, 306. *KAR* 23, 1971, 76-86. Philp 1981, 76, 79-80. Philp 1973. Stephens 1985b, comments 'The 3rd c. *Classis Britannica* fort was supplied by a chalk block channel, traces approaching the N-W angle. Distribution was both in ceramic and wooden pipes, so that a distribution tank must have lain close to this angle. One of the wooden pipes dates from Phase II, showing that the fort was supplied by an aqueduct not later than c. AD 155-80. The aqueduct was said to have been capable of delivering at least 45.6 cubic metres per day'. *SxAC* 107, 1969, 102-25. *TIRCGLL* 1983, 45, 3rd c. fort of the '*Litus Saxonicum*'. (*Cantiaci*).

Downshay Wood, Dorset.

Dorset Proc. 60, 1938, 66-72; 69, 1947, 42-4; 70, 1948, 29-59; 75, 1953, 52, 69; 84, 1962, 115. *RCHM* 1970, County of Dorset, 2(3), 620: 'Of 14 pits examined, 6 were Iron Age date and 2 were of Roman date, one of the latter stone-lined, was possibly a well'. Occupation c. mid 1st c. to late 4th c. AD. *Swanage Times* 20 Jan. 1954 and info from J B Calkin.

Downton, Wiltshire.

Britannia 2, 1971, 179-93 villa building materials; 4, 1973, 163; 21, 1990, 353 settlement. Scott 1993, 201, *SMR* SE 301, WZ 71. *VCH* Wiltshire 1, 1957, 64. *WANHM* 55, 1953-4, 176-8; 58, 1961-3, 303-41,

bath-house. *TIRCGLL* 1983, 45, villa founded late 3rd c., flourished early 4th c., and declined mid 4th c. (*Belgae*).

Drayton(1), Leicestershire.

EMAB 1978, 10. 'Leicestershire History' 2, No. 5, 1974, 8-11. Scott 1993, 111, SMR SP 89 SW C, LE 26. *TLAHS* 47, 1971-2, 68; 62, 1988, 90. *TIRBS* 1987, 30, SP 831 931. (*Corieltavi*).

Drayton(2), Leicestershire.

Britannia 20, 1989, 286; 22, 191, 245; 24, 1993, 289, Fig 13 near complete plan 19 roomed residential building and baths. Burnham 1993, 99-110. *idem.* 1995, 7-17. Scott 1993, 111, SMR SP 89 SW Q, LE 27. Condron 1996, 338. *TLAHS* 52, 1976-7, 98; 55, 1979-80, 95-7; 63, 1989, 7-17; 64, 1990, 101; 65, 1991, 85-8; 66, 1992, 172-3; 68, 1994, 161-2. Leicestershire SMR 2.1978. 2 bath-houses, lead-pipe drainage.

Droitwich, Hereford and Worcester.

Britannia 1, 1970, 129 Rav. Cos. 106.31 (*Salinis*); 2, 1971, 181 n.61; 3, 1972, 317, drainage ditches connected with latrine pits; 4, 1973, 287-8 'the well found in 1971. The circular masonry revetment of the well rested on a square timber framework 3.2m below the top of the shaft....pottery of the late 4th c. found in the well'; 7, 1976, 330-1, well, wood-lined, and later lined with red sandstone; 'the circular masonry revetment rested on a square timber framework 3.2m below the top of the shaft'; 5, 1974, 430; 6, 1975, 248; 8, 1977, 396-7; 9, 1978, 439; 10, 1979, 299; 12, 1981, 337-9; 15, 1984, 448; 19, 1990, 332; 23, 1992, 283. *JRS* 58, 1968, 187. *PNRB* 119-20. Scott 1993, 89, SMR 678/2328/ 2330-3/4906/677, HE 9. *TBAS* 51, 1925-6, 35-8; 52, 1927, 312-4; 62, 1938, 27-31; 64, 1941-2, 39-52; 75, 1959, 1-3. *TWAS* 1925, 176; 34, 1963, 55-8. *WMANS* 10, 1967, 7; 14, 1971, 17-9, plans; 15, 1972, 17-8; 16, 1973, 12-3; 17, 1974, 49-50; 18, 1975, 58; 19, 1976, 42ff; 20, 1977, 52ff. *VCH* Worcestershire 1, 1901, 212-6. Occupation before c. AD 250, destroyed end of 3rd c., and reconstructed in 4th c. Location of villa SO 897 635 (*WMANS* 18). *TIRBS* 1987, 30, (1) pre-Flavian fort (c. 5ha) (SO 90 63); (2) settlement and villa, (SO 898 639).

Ducklington, Oxfordshire.

Britannia 5, 1974, 386, 436; 7, 1976, 336, well, stone-lined; 20, 1989, 297 settlement; 22, 1991, 258. Benson & Miles 1974, 42. *CBA*

Gr.9 Newsletter 5, 1975, 41. *Oxoniensia* 40, 1975, 171-200. Scott 1993, 158, SMR 5991, OX 19. *Oxford Times* 3 Aug. 1973.

Duncton, West Sussex.

Black 1987, 154. *Britannia* 2, 1971, 193, building materials. Scott 1993, 185, SMR 1579, NAR SU 91 NE 9, WS 36. *VCH Sussex* 3, 1935, 24. Wooler 1917, 190. Winbolt 1935, 24. *VCH Sussex*, 3, 1935, 1-70, 24..

Dunsby, Lincolnshire.

Britannia 10, 1979, 293, well. *EMAB* 1978, 23. Whitwell 1982, 224, water supply, not clear in what form, probably a leat; well.

Dunstable, Bedfordshire.

Bedfordshire Arch. J. 7, 1972, 21-34. *Britannia* 1, 1970 42, 49, 51 Ant. Itin. 471.2 Iter II, 476.9 Iter VI, 479.7 Iter III; 2, 1971, 267; 8, 1977, 399-400; 11, 1980 17, 406. Mathews 1963, 55-66. Mathews & Hutchings 1972. *PNRB* 1979, 350. Smith 1987, 218. *VCH Bedfordshire* 2, 1908, 6. *TIRCGLL* 1983, 46, minor settlement; occupation 1st to 4th centuries; well and latrine pit. (*Catuvellauni*).

Duntocher, Antonine Wall, Dunbartonshire, Strathclyde.

Britannia 1, 1970, 142, 152, 274; 3, 1972, 19; 5, 1974, 136; 10, 1979, 278; 12, 1981, 321; 13, 1982, 101; 16, 1985, 197-207. *DAES* 1978, 26. Hanson 1970, 366, item 39, comments 'What would appear to have been the remains of a fountain were found in the external bath-house in the 18th c. Such a fountain would indicate the presence of a supply of running water, but nothing else is known...'. Macdonald 1934, 328-32. Robertson 1957, 5; idem. 1990, 96-8. Roy 1793, pl.xxxv. Stephens 1985a, comments '...; at Duntocher on the Antonine Wall, where an ornamental fountain in the extra-mural bath-house shows that aqueduct almost certainly supplied the building...', 206. *CSIR I.4*, 1985, Nos.151-3, 157. *TIRBS* 1987, 31, *RIB* 2201-2.

Durham, Co. Durham.

Arch. Ael.(4) 22, 1944, 1-21; 29, 1951, 203-12; 31, 1953, 116-26. *Britannia* 16, 1985, 276. *TIRBS* 1987, 31; 1.5km ESE of city, small house with small bath-house, cold plunge, and 2 heated rooms. Two phases of use, 2nd and 4th c. (*Brigantes*).

Duston, Northamptonshire.

Assoc. Archit. Soc. Rept. 8, 1885, 53-61. *Britannia* 7, 1976, 334. Condron 1996, 327. Northamptonshire SMR 4946. Dryden 1885. Northamptonshire SMR 4946. Swan 1984, fiche 519, 538, wells. Woods 1969, 33. *TIRBS* 1987, 31, major Iron Age and Roman settlement, wells, coins from Iron Age to Honorius, but mostly AD 280-300. Occupation c. AD 50-400. (*Catuvellauni*).

Earith, Cambridgeshire.

Britannia 6, 1975, 250; 11, 1980, 375; 12, 1981, 132. Phillips, 1970, 194. *VCH Huntingdonshire* 1, 1926, 256-7. *TIRBS* 31, wells; coins 2nd to 4th c. (*Catuvellauni*).

East Coker, Chessel's Field, Somerset.

Britannia 11, 1980, 290-2. *Collectanea Antiqua* 2, 1852, 51-2. Radford & Dewar 1954, 5-6. Scott 1993, 167, SMR 53911, SO 22. *VCH Somerset* 1, 1906, 329-31, item 51, very beautiful mosaic Fig 88. *TIRCGLL* 1983, 46, villa, hypocausts, coins mostly from 4th c. (*Durotriges*).

East Ilsley, Stanmore Farm, Berkshire.

JBAA 17, 1861, 290-2, 'A deep well, apparently of Roman construction, was closeby'. *VCH Berkshire* 1, 1906, 210.

Eastbourne, East Sussex.

Scott 1993, 58, NAR TV 69 NW 9, 42, NE 71, EA 9-12. *SxAC* 2, 1848, 257-8. *VCH Sussex* 3, 1935, 24, 54, bath-house.

Easter Happrew, Borders Region.

Britannia 3, 1972, 9, settlement. *JRS* 47, 1957, 200-1, plan; 51, 1961, 121. *PSAS* 90, 1956-7, 93-101. *RCAHMS Peeblesshire* 1, 1967, 169-71, plan, bath.

Easton, Suffolk.

JBAA 8, 1853, 159-60; 10, 1855, 383. *VCH Suffolk* 1, 1911 (reprinted 1975), 304, well.

Eaton, Leicestershire.

Britannia 11, 1980, 367. *TLAAS* 32, 1956, 17; 33, 1957, 63. Whitwell 1982, 227, SK 72 NE 8 & 1.

Eaton-by-Tarporley, Cheshire.

Britannia 12, 1981, 383; 13, 353 villa, bath-suite and drainage ditches; 19, 1988, 179. *TIRBS* 1987, 32. (*Cornovii*).

Ebchester, Durham.

Arch. J. 142, 1985, 216-36. Hanson 1970, 286, 366. Hunter C, *Phil. Trans. R.S.* 23, date?, 1129-32: 'part of the aqueduct that supplied the baths' south of the fort. Mothersole 1927, 128, 'a line of gutter stones burried in the grass'. Stephens 1985b, 217, 226, 'A stone channel is known at the south angle (Hutchinson 1794, 434), ... probably ...an aqueduct (Steer 1938, 228; Jarrett 1960, 200); undated'. Wooler 1917, 190 bath.

Ebrington, The Grove, Gloucestershire.

Britannia 13, 1982, 210. *JRS* 49, 1959, 127 bath, 'stone-lined drain from the cold plunge bath to the latrine and other drains, and a copious spring rises just above the site'; 51, 1961, 186. *PCNFC* 36, 1971-2, 87-93. *RCHM* 1976, 52-3, no.3, Fig, p.53. Scott 1993, 72, *SMR* 368, GS 41. *TIRBS* 1987, 32, villa, near a spring, bath-block with 9 rooms. (*Dobunni*).

Eccles, Aylesford, Kent.

Arch. Cant. 78, 1963, 125-41; 79, 1964, 121-35; 80, 1965, 69-91; 91, 1976. *Britannia*, 2, 1971, 114, 170-93, 286-8, 297; 3, 1972, 351; 4, 1973, 322; 5, 1974, 459, bath; 6, 1975, 196 bath; 17, 1986, 428. Jarrett & Dobson 1965, 105-8. *JBAA* 4, 1849, 81ff, probably a village. *JRS* 53, 1963, 158; 54, 1964, 177; 55, 1965, 220, 224, 226; 56, 1956, 217, 224. Scott 1993, 103, KE6; KE 7, TQ 73 60: various Roman buildings. *TIRCGLL* 1983, 47, large corridor villa, 1st to 4th c., and also Iron Age occupation. (*Cantiaci*).

Eckington, Hereford and Worcester.

OS Map of Roman Britain, 4th Ed., 1991. Scott, 1993, 89, HE10. *VCH* Worcestershire 1, 1901, 211, 3 stone-lined or goined wells, drains. *TIRBS* 1987, 32, building near River Avon. (*Dobunni*).

Elginhaugh, Dalkeith, Lothian, Scotland.

Britannia 12, 1981, 118; 14, 1983, 172-6; 16, 1975, 264-5 bath-house, annexe, *vicus*; 18, 1987, 18, extensive bath-house, 313; 19, 1988, 428-9. Flavian period.

Elsted, Batten Hanger Villa, West Sussex.

Black 1987, 154. *Britannia* 7, 1976, 373; 20, 1989, 230; 21, 1990, 359; 22, 1991, 290, bath-house (at least in two phases). Scott 1993, 186, SMR 0817, NAR SU 81 NW 38, WS 41. *BIAL* 12, 1975, 58-66. *SxAC* 118, 1980, 197-229.

Ely, near Cardiff, South Glamorgan.

JRS 11, 1921, 67-85. *TIRCGLL* 1983, 47; villa with bath; occupied 2nd to late 3rd c. (*Silures*).

Emberton, Buckinghamshire.

Condron 1996, 347. Buckinghamshire SMR 1151, four stone-lined wells.

Empingham, Leicestershire

AEx 1969, 59; 1970, 69. *Britannia* 1, 1970, 286; 2, 1971, 258 a well c. 5m deep; 3, 1972, 316; 6, 1975, 246. *CBA Calendar Summaries* 1971, 10, excavated 1969-71, currently being written up, (1993). *EMAB* 9, 1966, 46. McWhirr 1972, 75, 2 oak square stone-lined wells. Scott 1993, 111, SMR SK 90 NW N, LE 29, and SMR SK 90 NW P, LE 30: SK 94 08. *TLAHS* 60, 1986, 1-6. Whitwell 1982, 123, 229. *LHA* 6, 1971, 3-18, 258. *TIRBS* 1987, 33, occupation c. AD 180 c. AD 270. (*Corieltavi*)..

Enfield, Bulls Cross Farm, Burrough of Enfield, Greater London.

Britannia 1, 1970, 314; 7, 1976, 351 well; 11, 1980, 381; 25, 1994, 282. Gentry, Ivens & McClean, 1977, 101-89. Smith 1987, 177.

Engleton, Staffordshire.

Staffordshire Record Soc. 1938, 267-93. *JRS* 28, 1938, 183-4. Rivet 1969, 54-5. Todd 1978, 123, 140. Webster 1975, 87-9. *TIRBS* 1987, 33, winged corridor villa; bath-suite; occupation 2nd to 4th c. (*Cornovii*).

Epperstone, Nottinghamshire.

EMAB 1959, 13-4; 1961, 14; 1963, 15; 1964, 25; 1966, 40-1. Scott 1993, 154, SMR 01848, NAR SK 64 NE 3(2), NT 11, bath-house. *JRS* 53, 1963, 134; 54, 1064, 159, 162; 55, 1965, 207. Todd 1973, 33. *TTS* 65, 1961, 6. Whitwell 1982, 111, 323. *TIRBS* 1987, 33, villa, early 2nd c., timber; later rebuilt in stone foundations in 4th c., bath-house. (*Corieltavi*).

Ewell, Surrey.

Archaeologia 32, 1847, 451-55. *Britannia* 8, 1977, 445; 15, 1984, 330; 23, 1992, 304. Coles & Simpson 1968, (eds.), 284. Diamond 1847. *PSAL*, (2nd ser.), 1, 309-13. Pemberton 1973, 1-26; idem, 1974, 85-6. *SyAC* 50, 1947, 9-46; 69, 1973, 1-26. *The London Archaeologist*, 2(4), 1974, 85-6. Rodwell & Rowley 1975, 61. Smith 1987, 274-5, 6 wells, or ritual shafts, depths 3.65m-11.28m, 0.65m-1.2m diam. *VCH Surrey* 4, 1912, 361-3. Warne 1859-61, 309-13. *TIRCGLL* 1983, 49, large settlement, occupation c. 200 BC to AD 150, and then again in 4th c. (?*Regni* or *Atrebates*).

Ewhurst, Surrey.

SyAC 65, 1968, 1-70. Scott 1993, 176, SMR 447, SY 12, at Rapsley Farm, Ewhurst, Cranleigh. *TIRCGLL* 1983, 49, villa with bath; Flavian timber house rebuilt c.AD 200, burnt c.AD 350. (*Regni*).

Exeter, Devon.

Arch. of Exeter, 1983-4, 2-4, p.3, Fig 3, aqueduct of AD 100-1. Bildwell 1980, bath, 52-3, Figs.28, 30, 2 wells at insula iv Fig.31, 53-4; idem. 1979, 1-66, at Figs.7 & 12 the wooden pipeline with the iron collars is shown as the water supply for the bath which required a daily consumption of water of about 320,000 litres. *Britannia* 1, 1970, 60-1 Ant. Itin. 483.8, 486.8, 486.17; 4, 1973, 313; 5, 1974, 452; 6, 1975, 276; 7, 165, 278-80, 358-60, Legionary defences c. AD 55-75, to early 5th c.; 8, 1977, 415; 9, 1978, 459, 476; 10, 1979, 324-6; 11, 1980, 389; 12, 1981, 358; 13, 1982, 382; 14, 1983, 320-3, Figs.22, 23; 15, 1984, 318; 16, 1985, 201-2 water supply, 276, 303-5; 17, 1986, 72, 441-2; 18, 1987, 343; 19, 1988, 473-4; 20, 1989, 313-4; 21, 1990, 348-50; 22, 1991, 281-2; 23, 1992, 290-7; 25, 1994, 286. Fox 1973, 166-9. Hanson 1970, 111-6, 366, item 41, discusses in detail the uncertainty of the Roman aqueduct as its existence is masked by the medieval water supply to the town. Stephens 1985b, 223, item 9, comments 'The bath-house and a *fabrica* in the fortress were supplied by wooden pipelines (Selkirk 1973-4, 105; Bildwell 1979, 356, 60). These denote an aqueduct supply. The source was perhaps two springs c. 1km to the N-E, where the medieval catchment basin was situated (Tucker 1858); the basin overlies a 4.2m deep platform of clay, beneath which was found a Neronian coin. If these springs were tapped, the aqueduct was probably a pipeline, even though the *civitas*-capital was part supplied by a leat (Frere 1938b, 323). Wachter 1995, 335-43, Fig.151, 336 shows the line of the early aqueduct. *TIRCGLL*

1983, 49-50, a legionary fortress for *Legio II Augusta* (15.4ha) was established c. AD 55 and probably evacuated c. AD 75; a civil settlement developed c. AD 80 and continued until the 5th c. New baths, basilica and a forum and walls were built in the late 2nd c. enclosing an area of c. 37ha. (*Dumnonii*).

Exning, Landwade, Suffolk.

JRS 50, 1960, 228. Moore 1988. Phillips 1970, 235. Scott 1993, 173, SMR EXG 012, SU 9. VCH Cambridgeshire 7, 1978, 44-5. PCAS 11, 1907, 210; 76, 1987, 41-66. TIRBS 1987, 33, villa, timber huts of Flavian period, replaced in early 2nd c. In late 2nd c. aisle walls rebuilt in stone and small bath-suite added. In early 3rd c., complete rebuilding in stone and baths modified. Destruction by fire in 4th c. (*Icenii*).

Falkirk, Stirlingshire.

Britannia 3, 1972, 18, 303; 8, 1977, 364; 12, 1981, 320; 13, 1982, 102; 23, 1992, 262; 25, 1994, 255. Macdonald, 1934, 214-6. PSAS 111, 1980-1, 248-62. RCAHMS, Stirlinghamshire, 1, 1963, 99. Robertson, 1990, 51-3, Figs.35, 36. CSIR I.4, 1985, No.72. TIRBS 1987, 34, probably secondary fort, with bath.

Farley Hungerford, Temple Field Farm, Somerset

VCH Somerset 1, 1906, 300, item 1, bath.

Farmington, Clear Cupboard, Gloucestershire.

McWhirr 1981, 88. RCHM 1976, 55-6, Fig. Scott 1993, 72, SMR 2562, GS 49. TBGAS 88, 1969-70, 34-67; 90, 1971, 224. TIRCGLL 1983, 50, bath-house, drain; occupied early 4th c. (*Dobunni*).

Farmoor, Oxfordshire.

Britannia 6, 1975, 279-80. Lambrick & Robinson 1979, Oxford Arch. Unit Rep. 2, 1979 (CBA Res. Rep. 32), (1) well, stone-lined (Rep.2, item F43), 0.80m diam. and 1.6m deep; (2) two wells (items F1046 & F1050) Fig.19, stone-lined, 1.06m (3.5ft) & 1.37m (4.5ft) deep respectively, shallow depths, indicating high water table.

Farnham Royal, Buckinghamshire.

Records of Buckinghamshire 9, 1909, 449. Scott 1993, 27, SMR 1629, BU 28.

Farnham(1), Suffolk.

Britannia 3, 1972, 330. Moore 1988. Scott 1993, 173, SMR FNM 001, SU 10. *TIRBS* 1987, 34. (*Trinovantes*).

Farnham(2), Surrey.

Britannia 2, 1971, 170, 186, 193, building materials. Clark & Rankine 1939, 61-118. *JRS* 37, 1946-7, 175. Lowther 1955, 47-57, aqueduct Dwg. 1, bath, Dwg.3, lead pipes, pl.xv. Scott 1993, 176-7, SMR 1715, SMR 1681, SY 23 & SY 25. *SyAC* 37, 1927, 88; 54, 1955, 47-57. *TIRCGLL* 1983, 50, villa, detached bath-building, aqueduct; occupied 3rd and 4th c. (*Regni* or *Atrebates*).

Farnham(3), Dorset.

PDNHAS 104, 1982, 179; 106, 1984, 116: Roman well, depth 28.2m, av. diam. 1.15m, in solid chalk.

Farningham, Franks Villa, Kent.

AEx 1975, 66; 1976, 85. *Arch. Cant.* 61, 1948, 180-2; 76, 1961, 188. *Britannia* 7, 1976, 376; 8, 1977, 424. *Gentleman's Magazine* 1, 1866, 817, lead-pipe. *JRS* 15, 1925, 245; 18, 1928, 208; 39, 1949, 110. Rivet 1969, 134-50. Scott 1993, 104, KE 30-33, baths & lead pipe, channelled drain. *TDDAS* 1, 1931, 67-73, baths TQ 54 66. *VCH Kent* 3, 1932, 113-4. *TIRCGLL* 1983, 50 corridor villa, bath; 5th c. occupation. (*Cantiaci*).

Farnworth, Cheshire.

Hanson 1970, 399-400. O'Neil 1961, in Jope (ed.). 34ff, well, stone-lined.

Fawler, Oaklands Farm, Stonesfield, Oxfordshire.

Antiquity 1, 1927, 478-9. *Britannia* 18, 1987, 324-5. *CBA Gr. 9 Newsletter* 13, 1983, 127, bath-house, 2nd c. origin. *Oxford Arch. Unit Newsletter* 14, 2, 1986, 4f. Scott 1993, 159, SMR 1295, 1294, OX 22, OX 23. *VCH County of Oxfordshire* 1, 1939, 318f, pl.xxiiiA.

Feltwell, Little Oulsam Drove, Norfolk.

EAA No.31, 1986, 1-48, bath-house pp.9-14. Gregory 1982, 369. Phillips 1970, 249. Scott 1993, 131, SMR 4921/5205, NF 54, NF 55.

Fendoch, Tayside, Scotland.

Britannia 2, 1971, 123 n.7; 3, 1972, 69-70, 79, 86-7; 5, 1974, 436; 10, 1979, 21-5, 28; 12, 1981, 21-4, 27. Hanson 1970, 196-200, 366,

Fig. p.230, comments 'Part of the aqueduct channel which seems to have contained a water pipeline (probably of wood) was found to the south-west of the fort. The pipeline was required in order to cross a stretch of low-lying ground between the source of the aqueduct - either springs to the south-west of the fort or perhaps the higher reaches of the Fendoch Burn - and the plateau on which the fort was sited', item 42. *PSAS* 72, 1939, 110-154: 112, 138-40, discussion of water supply, aqueduct. Stephens 1985b, 224, 'The Agricola fort was supplied by a pipeline aqueduct (Richmond & McIntyre 1938-9, 138-40). The pipe trench is 0.6m wide, which suggests that it held two wooden pipelines', 224. *TIRBS* 1987, 34, Flavian fort (1.8ha).

Ffrith, Clwyd, Wales.

Britannia 3, 1972, 361; 19, 1988, 171, 416, bath; 20, 1989, 258, bath; 22, 1991, 222. Camden 1586, 'Britannia', edited by Stuart Piggott, 1951. Davies 1949, 226-38. *JRS* 58, 1968, 176. Nash-Williams 1969, 172. *RCAHM* Flintshire, Wales, 1912, 55-6. Scott 1993, 47, SMR 19, 19A-F, CL 8-14. Note: there are different spellings of this name, e.g. Frith, Ffrith, and Ffridd as given on the OS Roman Britain map 1991 4th ed. *TIRBS* 1987, 34, bath-house. (*Deceangli*).

Fifehead, Dorset.

PDNHAS 24, 1903, 172-7; 50, 1928, 92. *PSA* (ser.2) 8, 1881, 543-5; 9, 1883, 66-70. *RCHM* Dorset 3(1), 1970, 93-4, bath. Scott 1993, 52, SMR 2 018 013, DO 13. *TIRCGLL* 1983, 50, villa, occupied 3rd and 4th c. (*Durotiges*).

Fillingham, Lincolnshire.

Archaeological Notes 1959-60. *Lincolnshire Magazine* 3, 1936-8, 91-2. Scott 1993, 120, LI 58, bath-house. Whitwell 1982, 231.

Finchingfield, Essex.

Coverton J G, 1933. Coverton J G, 1937. Rivet 1969, 144. Rodwell in Todd M (ed.), 1978, 31, No.34. Scott 1993, 62, SMR 1493, ES 27. *TEAS* 20, 1933, 248-53; 21, 1937, 219-29. *VCH* Essex 3, 1963, 129-30. *TIRCGLL* 1983, 50, corridor villa, bath. (*Trinovantes*).

Findon, Muntham Court, West Sussex.

ANL 5, 1954-55, 204-5; 6, 1955-60, 101-2. *Antiquaries J.* 8, 1928, 449-60. Black 1987, 154. *Britannia* 2, 1971, 286 well; 11, 1980, 173. Fox & Wolseley 1928, 286, well, 79m deep. Scott 1993, 186, SMR 4315,

NAR TQ 10 NW 39, WS 42. *Sussex Notes & Queries* 15(7), 1961, 250. *SxAC* 101, 1963, 20-22; 110, 1972, 126. *TIRCGLL* 1983, 50, shrine, with a well, with ritual filling; occupation from late Pre-Roman period to 4th c. (*Regni*).

Fingringhoe, Essex.

Britannia 1, 1970, 181-2; 2, 1971, 180 n.57, 192-3; 8, 1977, 87; 20, 1989, 11 Claudian military supply-base. *Essex Naturalist* 1, ?, 181. Hawkes & Hull 1947, 19. *VCH Essex* 3, 1963, 130-2, two wells, i) 1.97m diam., and 9.73m deep; ii) 1.1m diam., of unknown depth. *TIRCGLL* 1983, 51, fort and naval base of Aulus Plautius, AD 43. (*Trinovantes*).

Fishbourne, Chichester, West Sussex.

Black 1987, 84-6. *Britannia* 1, 1970, 181f Claudian depot, 311 glass flask; 2, 1971, 168, 174, 180f, 183, 186, 189, 192f building materials; 3, 1972, 270-5 coins; 4, 1973, 162-5, 227; 7, 1976, 164; 8, 1977, 90-1 military buildings; 10, 1979, 103, 146 garden, 160-1; 12, 1981, 364; 14, 1983, 333; 15, 1984, 328 Fig 29; 16, 1985, 189; 17, 1986, 424-4; 18, 1987, 353 site crossed with drains; 19, 1988, 406 amphora stamps from F/B; 20, 1989, 11, 320-2; 21, 1990, 360 mosaics; 22, 1991, 290 tiles; 25, 1994, 289, aqueduct, 5 complete ceramic pipes connected with water supply of palace; the ditch carrying the pipes was timber-lined. Cunliffe 1971a. Margery 1971, 117-21. Site dates from c. AD 75. Drains: (xvii, 423f) c. 70m east of palace, drainage ditches N of road, a complex of drains at right angles (SU 841 048) related to palace, many timber-lined. Scott 1993, 184 (under Chichester), WS 25. *TIRCGLL* 1983, 51, villa and 'palace', military base c. AD 43 to 4th c.; palace built AD 75; burnt c. AD 280. (*Regni*).

Flamsteed, Kent.

KAR 16, 1969, 19-20, 'Flamsteed's Well, Greenwich'. The well shaft is c. 30m (100ft) deep and between 2.1m and 2.4m in diameter, cut through about 18m of upper strata and continuing for more than 10m into chalk.

Fletton, Huntingdonshire.

Peterborough Museum Record Nos. 1520, 1627. *RCHM* 1926, 95-7, No. 31, item 1, 'The area between the railway-line and Stranground Lode S of the Nene, was occupied early in the Roman period, particularly at a spot 1/2 mile S of St Margaret's Church...A little south was a

circular, steined stone-lined well, 20ft deep and 3.5ft in external diam...'. VCH Huntingdonshire 1, 1926, 249. Whitwell 1982, 233, well.

Folkstone, East Cliffe, Kent.

Antiq. J. 5, 1925, 65-7. *Arch. Cant.* 10, 1876, 41 (TR 22, 37); 37, 1925, 209; 38, 1926, 45-50, pl. xxi opp. p.45. *Britannia* 6, 1975, 202; 13, 1982, 211; 20, 1989, 193-200, 325; 21, 1990, 364; 22, 1991, 291. Bromehead 1942, 186 earthenware pipes, occupation: c. 1st c. to c. AD 350; bath-house, drains, waterpipes, 4 complete sections of earthenware (*tibulus lingulatus*) water- or drain-pipes found in room 27', (see Winbolt for details of piping. He suggests that the water pipe may have been used as a water supply at one time). Borough of Folkstone, 'Guide'. *JRS* 14, 1924, 242, 246. Rivet 1969, 57-64. Scott 1993, 105, KE 36. VCH Kent, 3, 1932, 114-5, pls.xxi-xxii. Winbolt 1925, 109. *TIRCGLL* 1987, 51, corridor villa, bath. (*Cantiaci*).

Fordcroft, Orpington, Bromley, South London.

Arch. Cant. 83, 1968, 127; 84, 1969, 39-77; 86, 1971, 239; 88, 1973, 223; 89, 1974, 220, villa - winged corridor type. *Britannia* 4, 1973, 306-7, bath-house; 5, 1974, 446; 6, 1975, 270; 9, 197, 471; 10, 1979, 336.

Foscott, Buckinghamshire.

Gentleman's Magazine, 1838, pt.1, 302; 1841, pt.1, 81; 1843, pt.1, 303. *RCHM Buckinghamshire* 2, 1913, 115, No.134, item 1, lead pipes, baths, tank. *Records of Buckinghamshire* 5, 1885, pt.1, 355. Scott 1993, 27: SMR 0773, BU 30, baths & tank.

Foxcote, Buckinghamshire.

RCHME Buckinghamshire 2, 1913, 115. VCH Buckinghamshire 2, 1908, 7. *TIRBS* 1987, 35, villa with bath and lead pipes; coins of early 4th c. (*Catuvellauni*).

Frampton, Dorset.

Antiq. J. 57, 1977, 312-3. *Britannia* 2, 1971, 186, 189; 9, 1978, 309; 11, 1980, 298; 22, 1991, 156; 23, 1992, 123-4. *RCHM Dorset* 1, 1952, 150. *PDNHAS* 78, 156, 81-3. *TIRCGLL* 1983, 52, villa. (*Durotriges*).

Frilford, Berkshire.

Arch. J., 42, 1809, 417-85; 45, 1880, 405-10; 54, 1897, 340-54 Fig. opp. 342, well, and pond with drain. *Britannia* 7, 1976, 175, 178, 190, temples; 11, 1980, 396, bath-house; 13, 1982, 305-9, 368; 18, 1987, 47. VCH Berkshire, 1, 1906, 207-8, Fig. TIRCGLL 1983, 52, villa with detached bath-house; coins of 4th c. (Atrebates/Dobunni).

Friskney, Lincolnshire.

Whitwell 1982, 234, TF 45 NEC. VCH Lincolnshire 1906.

Procester Court, Gloucestershire.

Britannia 2, 1971, 275 villa; 3, 1972, 339; 7, 1976, 357; 8, 1977, 413; 9, 1978, 455; 10, 1979, 319; 11, 1980, 384; 12, 1981, 355; 14, 1983, 316-7; 15, 1984, 314; 16, 1985, 300; 17, 1986, 412; 18, 1987, 339-40 + Fig 18: shows two wells; 19, 1988, 469; 21, 1990, 248-9; 22, 1991, 275; 25, 1994, 285. *Current Arch.* 21, 1976, 285. *Glevensis* 11, 1977, 24; 14, 1980, 24-5 + Fig; 18, 1984, 53: report a '...square 1.5m timber-lined tank with a stone slab floor and a drain emptying to the south as did others...These drains ran into a ditch (No.35), which had at least two distinct alignments, dated to 1st- 3rd centuries'. Gracie 1970, 15-86. *JRS* 50, 1960, 230; 52, 1962, 182; 53, 1963, 143; 54, 1964, 183; 55, 1965, 216; 56, 1966, 212. McWhirr 1981, 83-7. Scott 1993, 72, SMR 5198, GS 50 bath-suite, not earlier than c.AD 275. *TBGAS* 77, 1959, 23-30; 89, 1970, 15-86. *RCHM* 1976, 56-8, Figs. at pp. 57 & 58. TIRCGLL 1983, 52-3, villa with baths. Occupied c. AD 275 to early 5th c. (Dobunni).

Puntington, West Sussex.

Bradley R, 'Chichester Museum Record Map'. Scott 1993, 187, SMR 0541, WS 49, NAR SU80 NW 30, water pipe and tile fragments.

Gadebridge Park, Hemel Hempstead, Hertfordshire.

Archaeologia 34, 1852, 315, 394-7; 35 1853, 56. *Britannia* 5, 1974, 464. *Herts. Arch. Rev.*, 1971, 71, bathing pool added by AD 325. At Boxmoor Railway, TL 04 05, a well, SMR 517. *HMSO Excavation Reports* 1968. *JRS* 55, 1965, 211-2, Fig.17, original construction c. AD 120, extensive additions include a reconstructed bath in 4th c. and a swimming pool; 56, 1966, 208 Fig.13; 57, 1967, 187-8; 58, 1968, 194; 59, 1969, 221. Neal 1974, 'Winged-corridor villa (AD 140-60) with out-buildings, stockade, bath-house and enclosure ditches. Earliest timber buildings date to c. AD 70; occupation may have extended into 5th c. (SMR 186 & SMR 0088)'. Scott 1993, 93, SMR 186, HT 31, SMR

517, HT 33, SMR 0088, HT 35. MOW Excavations 1967, 15. PSA 1849, 53. VCH Hertfordshire., 4, 1914, 155.

Garden Hill, Hartfield, East Sussex.

Black 1987, 203, Fig.8. *Britannia* 4, 1973, 323; 5, 1974, 458; 8, 1977, 339-50, 'The Iron Age Hill Fort and Romano-British Iron-working Settlement at Garden Hill, Sussex: Interim Report 1968-76', Fig.5 & pls.xix & xx, bath, drains, lead-pipe from bath; five periods, 3rd period 1st c., and 5th period end 2nd c. or early 3rd c. ore brought in for smelting; 9, 1978, 467, 481; 10, 1979, 333-4; 11, 1980, 398-400, Fig.23.

Garton Slack, East Riding, Yorkshire.

Britannia 3, 1972, 310; 4, 1973, 28, well. *Current Arch.* 51, v(4) 1975, 104-116, article by T C M Brewster, shows picture of the well, excavated to 21m depth, likely deeper, half of which was cut originally through chalk. A 2nd well, 150m N-W of the 1st well had been abandoned at a depth of 5.5m after loose gravel sides had fallen in (iv, 281).

Gatcombe, near Long Ashton, Avon.

Brannigan 1975, 175-81, Fig.1; 1977, 246-7, Fig.5 at p.25, pl.15A. Occupation mid 3rd to later 4th c. Gardiner 1976, 168, 172. Greene 1986, 92-5. Scott 1993, 16, SMR 627, AV 53. Possible aqueduct.

Gayton, Northamptonshire.

Archaeologia 30, 1844, 125-31. *Britannia* 22, 1991, 252. *J. Northants Nat. Hist. Soc. & Field Club* 34, 1962, 45. *RCHME County of Northants*, S-W, 4, 1982, 58-60, No.25, item 2, Fig.58, villa, well. Scott 1993, 143, SMR 574, NH 45. VCH Northamptonshire 1, 1902, 217. *TIRBS* 1987, 35, much pottery, tiles and coins mostly of 4th c. (*Catuvellauni*).

Gayton Thorpe, Norfolk.

Archaeologia 23, 1928-9, 166-209. *Britannia* 1, 1971, 186-93; 6, 1975, 200-1; 7, 1976, 234; 15, 1984, 344; 17, 1986, 447; 18, 1987, 47. *EAA* 5, 1977, 235-6. Gregory 1982, 362-364. Scott 1993, 132, SMR 3743, NF 67. *TIRBS* 1987, 36, two conjoined winged-corridor houses, one with bath-suite, ...Detached building, possibly another bath-block nearby; finds date from late 2nd to 4th c. Occupation c. 2nd c. to c. 4th c. (*Iceni*).

Gelligaer, Glamorgan, Wales.

Black 1993, 249-54, bath. Ward 1903. Jarrett 1964, 66-9. Ward 1909, 25-69; 1911, 65-91.

Gestingthorpe, Essex.

Draper 1985, villa, bath. Rodwell in Todd (ed.), 1978, No.31. Scott 1993, 62, SMR 9953, ES 31. VCH Essex 3, 1963, 133-4. TIRBS 1987, 36. (*Trinovantes*).

Glenlochar, Dumfries, Scotland.

Britannia 2, 1971, 145 fort; 3, 1972, 11; 5, 1974, 154 Antonine II occupation; 26, 1995, 45. Hanson 1970, 366, comments, 'In 1952 part of a water channel, or perhaps the channel for a water pipeline, was found during excavations at the Roman fort'; at p.218, a covered water channel or pipeline found in the *via decumana*, and a stone-built well. Frere & St Joseph 1983, 27-8, plan 126-9. JRS 41, 1951, 60; 43, 1953, 107-9, plan; 55, 1965, 79-80. Stephens 1985b, 224, comments: 'A tank and "a covered water-channel or a pipeline" have been found (Richmond & St Joseph 1951-52, 10). The channel was probably the duct of a pipeline of unknown date', 224 item 21. TDGNHAS 30, 1953, 10-1. TIRBS 1987, 36, Rav. Cos. (*Lucotion*, var *Lucocion*). Late Flavian and Antonine fort (3.36ha) on River Dee. Large annexe (12.7ha).

Gloucester, Gloucestershire.

Antiq. J. 52, 1972, 24-69; 54, 1974, 8-52. Branigan & Fowler 1976, 21-58. *Britannia* 1, 1970, 57, Ant. Itin. 485.4 (*Clevio*); 2, 1971, 275; 3, 1972, 339-40; 4, 1973, 169, 202-3, 309; 6, 1975, 88-90, 192; 7, 1976, 354; 8, 1977, 413-4; 9, 1978, 455-6; 10, 1979, 177, 319-21; 11, 1980, 346-402, aqueduct; 12, 1981, 20; 13, 1982, 413; 14, 1983, 316; 15, 1984, 314, 333; 16, 1985, 202-3, 300; 17, 1986, 414, 429; 18, 1987, 339; 19, 1988, 469; 20, 1989, 310; 21, 1990, 345-6; 22, 1991, 275-6; 23, 1992, 295. Fullbrook-Leggatt 1952, 16-7. Fullbrook-Leggatt, 1968, 11. *Glenvenis* 23, 1989, 3-15. Hanson 1970, 367, item 44, comments, 'The remains of a water distribution system inside the colonia, in the form of a number of wooden pipelines, has been uncovered during excavations. The source of the aqueduct supplying the distribution system was probably springs near Matson on Robinswood Hill about two miles to the south of the colonia'. JRS 29, 1939, 217; 32, 1942, 39-52; 47, 1957, 233 item 31; 51, 1961, 196 item 32; 52, 1962, 197 item 40; 57, 1967, 195. McWhirr 1981, 21-58. Stephens 1985b, item 8, comments, 'The colonia was supplied by an aqueduct (Hurst 1974, 31; Hassall & Rhodes 1974, 26-7). This may have

functioned in the 2nd c. (Grew 1980, 385) but could be earlier. a 9m-wide tank has been located in the fortress (Wilson 1967, 195); this seems large for a rainwater tank and could easily have been the terminal reservoir of an aqueduct'. *TBGAS* 67, 1946-8, 347-58, Fig 2, pls.I, II, III, well; 87, 1969, 113ff; 93, 1974, 31, aqueduct, well. Wachter 1995, 150-66. Webster 1981, 43-4. *TIRCGLL* 1983, 54, *RIB* 119-24.

Goadby Marwood, Leicestershire.

Liddle 1982, 35. *TLAS* 32, 1956, 17. *VCH Leicestershire* 1, 1907, 212. Whitwell 1982, 81-2, 86, 237. *TIRBS* 1987, 36, minor settlement (c. 12ha); stone buildings, wells. (*Corieltavi*).

Godmanchester(1), Granary Close, Cambridgeshire.

AEx 1975. Black 1995, 41-2, 43, 72, 79, 91, 118, 151 Fig.20, 190-1. *Britannia* 1, 1970, 287; 4, 1973, 325-8; 7, 1976, 333-4, well; 10, 1979, 300; 12, 1981, 340. Green 1975, 199, 203. Scott 1993, 38, *SMR* 01536, CA 84. Smith 1987, 182-6. Swan 1984, fiche 370, (TL 2590 7210) Cow Lane Quarry, well 1.5m diam. Occupation later 1st c. to early 2nd c. to late 4th c. *Mansio* destroyed c. AD 300, probably during a 'massacre'. Since a *mansio*, it must have had a bath and probably a running water supply; well, 1.5m diam. *TIRBS* 1987, 36, Claudian and Neronian fort on Ermine Street. Development in Flavian period and 2nd c. Hadrianic *mansio*; fire in late 3rd c. (*Catuvellauni*).

Godmanchester(2), Rectory Farm, Cambridgeshire.

Britannia 7, 1976, 334; 22, 1991, 256. *JRS* 45, 1955, 89; 48, 1958, ?; 56, 1966, ?; 58, 1968, ?. *PCAS* 61, 1968, 19-43. Scott 1993, 37, *SMR* 02546, CA 80, occupation c. 2nd c. to 4th c; bath.

Gorhambury, Hertfordshire.

AEx 1972, 54-5; 1975, 61. *Britannia* 2, 1971, 111, 181 no.60; 3, 1972, 121; 4, 1973, 299; 5, 1974, 437; 6, 1975, 181-258, 339-40; 8, 1977, 401; 9, 1978, 445; 10, 1979, 305-6; 11, 1980, 373-4 Figs.11, 12; 12, 1981, 165, 345; 13, 1982, 369; 14, 1983, 307, 413; 25, 1994, 104. *CBA Newsletter* 1, 1983, 20. *Current Arch.* 87, 8(4), 1983, 115-121. *JRS*, 51, 1961, 180-2. Neal 1980. Neal, et al, 1990. Scott 1993, 95, *SMR* 504, HT 52, bath-house. Todd 1978, 33-58. *TSAHAAS* 1961, 21-30. *TIRCGLL* 1983, 54, winged-corridor villa with bath; from late Iron Age,

succeeded by timber house, burnt in 1st c.; early 2nd c. masonry house, later extended and altered in 2nd c. and 4th c. (*Catuvellauni*).

Goring, West Sussex.

Black 1987, 155, No. 132. Rudling 1983, 45-7. *Britannia* 14, 1983, 333; 15, 1984, 328-9; 19, 1988, 481, pl.xxixB. *SxAS* 54, 1988, 10, bath, well, drains.

Grafton Estate, Cheshire.

Britannia 1, 1970, 42, 69, Ant. Itin. 469.3 (*Bovio*); 12, 1981, 333; 14, 1983, 299; 15, 1984, 255-7. Scott 1993, 46, SMR 1768, CH 2, bath-suite, aqueduct. *VCH Cheshire* 1, 1987, 236. Waddelove 1984, 255-7, do not give an actual positional location, but concludes that *Bovium* must have been a Roman tile and pottery factory. From the information I conclude that the site must have been at approximately SJ 445 514 near the Carden Brook as he suggests. For it to have been at Holt would have required a crossing of the major River Dee to get to *Deva* (*Chesters*) from Holt.

Grandford, Cambridgeshire.

Britannia 12, 1981, 79-133, drain; 16, 1985, 190. Phillips 1970, 197. Potter, 1981, 79, 81, 85-93, 126ff, a large Roman village, probably originally a Roman fort, Figs.4-6, pl.v. *TIRBS* 1987, 37, rural settlement (c.12ha); possible 1st c. fort. (*Iceni*).

Great & Little Kimble, Buckinghamshire.

Allcroft 1908, 476. Allen 1958, 220. *Arch. J.* 124, 1967, 151. Head 1955, 160. *Records of Buckinghamshire* 1, 1848-55, 39, 140; 2, 1857, 48; 14, 1946, 316. *RCHM* 1, 1912, 165. Scott 1993, 27, SMR 0925 & 0901, BU 32 & BU 33; bath. Thopson 1957.

Great Bulmore, Monmouthshire.

Britannia 8, 1977, 360, 429; 11, 1980, 404-5; 15, 1984, 271 bath, drain; 16, 1985, 260-3; 19, 1988, 181; 20, 1989, 263; 25, 1994, 252 west of building 5, ran a stone-lined culvert drain channelling water from a spring 50m further south. Occupation c. 1st c. to end 3rd c.

Great Casterton(1), Rutland, Leicestershire.

AASR 9, ? , 160. *Britannia* 1, 1970, 116, 119-24, 184, 197; 3, 1972, 220, 121; 5, 1974, 11, 27; 10, 1979, 19, 25, 28, 31, 48-9; 12, 1981, 165; 24, 1993, 290; 25, 1994, 270. Coder 1961, 49-50. *EMAB* 1958, 11.

JRS 40, 1950, 102; 41, 1951, 127-30, plan, section; 42, 1952, 96; 43, 1953, 115-7; 44, 1954, 92-3; 47, 1957, 212-3; 48, 1958, 137; 48, 1958, 137; 51, 1961, 175; 53, 1963, 134-5; 56, 1966, 204-5; 57, 1967, 183-4. Scott 1993, 112, LE 38. Stukeley 1724, 24. *The Rutland Magazine* 1, 59. VCH Leicestershire 1, 1907, 88-99. Whitwell 1982, 239-40. Wright 1684, (reprinted 1974), 35. TIRBS 1987, 37, a Claudian fort (2.43ha) with vicus, on Ermine Street; reduced in size c. AD 70 (2.1ha); abandoned c. AD 80. Pre-Flavian settlement developing in 2nd c. to 9.3ha; wall later and towers in 4th c. Late 1st c. bath probably indicate a *mansio*. (Corieltavi).

Great Casterton(2), Leicestershire.

Corder (ed.), interim reports, 1st, 1951, 2nd, 1954, 3rd, 1961. St Joseph 1961b, 13-17. Todd 1973, 78, 89, 92, 94. Whitwell 1982, 102, bath. TIRBS 1987, 37, villa, coins from Marcus Aurelius to Theodosius; final destruction by fire. (Corieltavi).

Great Chesterford(1), Essex.

Arch. J. 7, 1850, 139-41; 13, 1856, 1-13; 14, 1857, 85-7. *Britannia* 1 1970, 120-1, 126, 183; 3, 1972, 290-3; 4, 1973, 331; 5, 464 graffiti; 7, 180, temple; 10, 309-11; 12, 348-50, Fig 12; 23, 1992, 290. Collins 1978, Arch. Gr. Bull. 2. Crossan et al, 1990, 11-8. *Essex Arch. & Hist. Soc.* 19, 1988, 264-5, item 19 (TL 515 436); 21, 1990, 11-18, (TL 5029 4267). PCAS 75, 1988, 3-41. Rodwell 1972, 290-3. VCH Essex 3, 1963, 72-88, Fig 22, p.77, 2 wells. TIRBS 1987, 37, suspected Neronian vexillation fortress (14.15ha); pre-Roman shafts; civil settlement walled in early 4th c. Roman-Celtic temple at TL 5143 4360. (Trinovantes).

Great Chesterford(2), Essex.

JBAA 4, 1849, 356-78. Scott 1993, 61, SMR 4915, ES 15, comments, 'A Roman villa excavated close to a Roman "station"...'. Coins of 1st to 4th centuries, double-corridor villa, ?bath.

Great Chesters, Hadrian's Wall, Northumberland.

Arch. Ael.(2) 24, 1903, 19-64; Arch. Ael.(3) 5, 1909, 158-67 baths; Arch. Ael.(4) 2, 1926, 197-202. *Britannia* 2, 1971, 268; 3, 1972, 193-6, 205, destruction of fort; 4, 1973, 200, 3rd c. tombstone of a soldier; 12, 1981, 268; 15, 1984, 234, 345, inscr.; 18, 1987, 318 at NZ 717 688, 'excavation across the course of the aqueduct in advance of surface drainage showed it to consist of an unlined channel, 560mm

wide and 280mm deep, with spoil forming a retaining bank on the down hill side'; 21, 1990, 285-9. Birley 1961, 188-92. Bruce 1855, 225ff. Hanson 1970, 367, comments: 'A six mile long water course, consisting of an open leat, is known from Great Chesters and brought water to the fort from a source on the Caw Burn only 2.25 miles away from Aesica in a direct line'. JRS 30, 1940, 161-4; 35, 1945, 80-1 aqueduct, plan. Mackay 1990, 285-9. Stephens 1985b, 226, item 30, comments: 'The fort was supplied by a 9.65km long leat fed from Haltwhistle Burn/Caw Burn 4.4 km to the N-E (Bruce, 1851, 257-62, Fig 99; Taylor & Cillingwood 1945, 80). This will have fed an extramural distribution tank from which the extramural bath-house, and presumably the fort itself, were supplied. The leat is undated'. TIRBS 1987, 37, fort (1.38ha) on Hadrian's Wall, built after AD 128, RIB 1736; overlies MC43. Civil settlement, baths, aqueduct, tank. (*Brigantes*).

Great Dunmow, Essex

AEx 1972, 49. *Britannia* 2, 1971, 272; 3, 1972, 333, 356; 4, 1973, 304, 'A 3rd c. well c. 7m deep had a timber lining made of oak planks 50 x 300 mm dovetailed at the corners; 17, 1986, 442; 25, 1994, 280. EAA 41, 1988, 'Excavations at Great Dunmow, Essex', a well, Period III, phase 2: 2nd c., c. 6.9m deep, cut through brickearth and iron-bound sand and bottoming on gravel (Fig.4, S11). Construction shaft was c. 1.25m sq., into, which was inserted a caisson 0.76m sq., made of oak planks 300mm x 50mm dovetailed at the corners. It was originally lined with flint and green clay, which collapsed inwards as the wood started to rot', (p.11). Rivet 1964, 147. Rodwell & Rowley 1975, 85-101. VCH Essex 3, 1963, 125. Wickenden 1988, 11. TIRCGLL 1983, 55, major settlement. (*Trinovantes*).

Great Linford, Stantonbury, Buckinghamshire.

Britannia 7, 1976, 337-8; 12, 1981, 344-5. CBA Gr.9 Newsletter, 6, 1976, 41ff; 10, 1980; 12, 1982, 78-81. Mynard 1987, 97-104. Scott 1993, 27, SMR 3306, BU 34; bath.

Great Staughton, Cambridgeshire.

JRS 49, 1959, 118; 50, 1960, 224-5, Fig.26. Scott 1993, 38, CA 90. Occupation from c. 2nd c. to 4th c. Whitwell 1982, 241, bath. TIRBS 1987, 38, corridor house, found 865 coins of AD 306-62; about 60m S-W of this site another corridor house of 2nd to 3rd c. (*Catuvellauni*).

Great Tew Beaconsfield Farm, Oxfordshire.

Scott 1993, 159, SMR 2336, OX 27. *Oxoniensia* 31, 1966, 153. *VCH Oxfordshire* 1, 1939, 310-11. *TIRCGLL* 1983, 55, courtyard villa, with bath. (*Dobunni*).

Great Totham, Slough House Farm, Essex.

Britannia 21, 1990, 342, Roman well, timber-lined; 22, 1991, 262, probably Saxon period (?), Howell's Farm, TL 857 098, Iron Age settlement. *CBA Gr.7 Bulletin* 10, 1989, 8-9; 11, 1990, 17-8, plan.

Great Witcombe, Gloucestershire.

Antiq. J. 19, 1939, 194. *Antiquity* 9, 1935, 339-41. *Archaeologia* 19, 1821, 178-83. *Britannia* 1, 1970, 294-5, Fig 9; 4, 1973, 335; 7, 1976, 152, 161-66. *JRS* 51, 1961, 186; 53, 1963, 141; 54, 1964, 54-65; 56, 1966, 212. *JBAA* 1, 1846, 56. McWhirr 1981, 92-3. *RCHM* 1976, 60-1. Scott 1993, 73, SMR 423, GS 53. A latrine drained through the main drainage system, probably a sewer. *TBGAS* 30, 1907, 246; 57, 1935, 275; 73, 1954, 5-69. Lyson's plan of the villa is in the Library of the Society of Antiquaries (Red Portfolio). Witts, 1883, 66-7, No.22. *TIRCGLL* 1983, 55, courtyard villa, late 1st c. to 5th c.; baths. (*Dobunni*).

Greetwell Fields, near Lincoln, Lincolnshire.

AASR 21, 1891, 48-52. *Arch. J.* 48, 1891, 187; 49, 1892, 258-62. *Britannia* 7, 1946, 387. Rivet (ed.), 1969, 145, 152. Scott 1973, Vol 1, 155-7, bath (155), 4 wells, Fig.63, Vol 2; Coppack G, 1971, letter to P R Scott. Scott 1993, 121, SK99 71, LI 68. Whitwell 1982, 242. *TIRBS* 1987, 38. (*Corieltavi*).

Greta Bridge, North Yorkshire.

Britannia 3, 1972, 42, work on fort c. AD 205-7; 5, 1974, 413-5, vicus, ?mansio; 6, 1975, 235. Hartley 1971, 58. *TIRBS* 1987, 38, Fort (1.48ha), late Flavian or Trajanic foundation, early 3rd c., reconstruction. Extensive civil settlement (vicus), ?mansio, i.e. possible bath. (*Brigantes*).

Grimstead, Wiltshire.

Scott 1993, 202, SMR NW 301, WZ 90. Sumner 1924. *VCH Wiltshire* 1, 1957, 75. Occupation, from pottery, c. 3rd c. to 4th c.

Grimston, Norfolk.

Britannia 18, 1987, 330. Gregory 1982, 362-4. *Norfolk Archaeology* 16, 1907, 219-27. Scott 1993, 133, SMR 3575, NF 81. *TIRBS* 1987, 39, large villa; plan and date uncertain; baths. (*Iceni*).

Grinley on the Hill, Nottinghamshire.

EMAB 1963, 15; 1964, 25. Whitwell 1982, 243, SK 79 SW 5; well.

Hacconby, Lincolnshire.

LAASRP 8(n.s.) 1959-60, 44, 62. Phillips 1970, 91, 256-7; Two aqueducts used in salt industry, channels/leats for drainage, running towards the Car Dyke in the South Lincolnshire Wash of the Fens. Scott 1993, 121, TF 07 24, NAR TF 02 SE 1. Simmons 1975, 33-6. Stukeley 1724, 8. Trollope 1872, 37. Whitwell 1982, 244, TF 12 NW 8 & TF 12 SW F. *TIRBS* 1987, 39. (*Corieltavi*).

Haceby, Lincolnshire.

Antiquity 3, 1929, 486. *Archaeologia* 22, 1829, 26-32; 23, 1828?, 385-7. Scott 1993, 124, SMR 7712/7789, LI 116. *Gentleman's Magazine* 1, 1818, 634. Greenfield 1971, 29-57. Hindley 1961, LAASRP 9(1), 16. *JRAFCC* 9(2), 1929, 140-3. *JRS* 19, 1929, 193. Scott 1973, Vol.1, 158, Vol.2, Fig.65, 2 baths, coins dated from AD 96-AD 364. Stukeley 1719, *Philosophical Transactions* 35, 428-32. Whitwell 1982, 280. Wooler 1917, 190. *TIRBS* 1987, 39, villa, no dating evidence. (*Corieltavi*).

Hacheston, Suffolk.

Britannia 1, 1970, 20, 29; 2, 1971, 271 settlement; 3, 1972, 361; 5, 1974, 439, 468; 6, 1975, 261-2, 288: well, lined with oak boards, dated to c. early 1st c. to mid 2nd c., 5.2m deep, and measured 0.83m by 0.76m between the boards; 8, 1976, 403. 20, 1989, 301. Rodwell & Rowley 1975, 85-101. *TIRBS* 1987, 39, minor settlement, iron working; well; occupation c. 1st c. to late 3rd or early 4th c. from coin evidence. (*Trinovantes*).

Haddon, Cambridgeshire.

Britannia 23, 1992, 286; 24, 1993, 297; 25, 1994, 274, bath. Condron 1996, 418. Cambridgeshire SMR 9748, well, AD 50-410? Scott 1993, 38, CA 95.

Hadstock, Essex.

Rodwell 1978, 32. Scott 1993, 63, SMR 4747, ES 35; bath. *VCH Essex* 1963, 135-6.

Halton Chesters, Hadrian's Wall, Northumberland.

AA(4) 38, 1960, 153-60. AA(5) 3, 1975, 212-4. *Britannia* 3, 1972, 193-5, 201, 204; 4, 1973, 200-1, 276; 5, 1974, 461-2; 15, 1984, 77ff. Bruce 1966, 69-70. Jarrett 1959, 177-90, describes the Flavian bath, which was replaced by an Hadrianic bath, and a stone-built drain set in clay. *JRS* 51, 1961, 164, describes the buildings over several periods. MacLauchlan 1857, 22. Northumberland County History 10, 1914, 468-73. OS Historical Map and Guide: Hadrian's Wall, 1989, shows aqueduct and mentions a bath. Simpson and Richmond 1937, 151-71. *TIRBS* 1987, 40, *RIB* 1423-36; fort (1.74ha, enlarged in 3rd c. to 1.94ha) on Hadrian's Wall; fort built by Platorius Nepos (*RIB* 1427); burnt down late 2nd c., and rebuilt in early 3rd c., but partly derelict by early 4th c. (*Brigantes*).

Hales, Tyrley, Staffordshire.

Britannia 2, 1971, 259, bath-house; 5, 1974, 426, 2 wells, drains. *N. Staffordshire J. Field Studies* 9, 1968, 104-17. Scott 1993, 173, *SMR* 165, ST 7. *VCH Staffordshire* 1, 1908, 189. *WMANS.* 12, 1969, 26. *TIRBS* 1987, 40, corridor villa, late 1st c.; bath-house built 2nd c.; occupied to mid 4th c. (*Cornovii*).

Halstock, Common Lane, Dorset.

Branigan 1976, 36, 68, 80, 101. *Britannia* 4, 1973, 316; 5, 1974, 455; 6, 1975, 277; 7, 1976, 362; 8, 1977, 416; 9, 1978, 462, 2 bath-houses; 10, 1979, 327, slabbed-drain; 11, 1980, 390, stone-lined drain and a covered drain; 12, 1981, 259; 14, 1983, 327, aqueduct and stone-lined tank; 15, 1984, 320; 16, 1985, 306 spring; 17, 1976, 417. *Current Arch.* 64, 1978, 162. *PDNHAS* 77, 1985; and vols. 88 & 89; 91-107. *RCHM Dorset* 1, 1952, 121. Scott 1993, 52, *SMR* 1, DO 16. *TIRCGLL* 1983, 56. (*Durotriges*).

Hambleton, Buckinghamshire.

Archaeologia 71, 1921, 141-98, bath. *Arch. J.* 124, 1968, 152, 158. *Britannia* 14, 1983, 256-9. Scott 1993, 28, *SMR* 0868, BU 37.

Hamilton, Leicestershire.

Clarke 1956, (ed.). Condron 1996, 379. Leicestershire *SMR* 132; 430, 1951; 231, 1956. Liddle 1982, *Archaeology Report* 4, 40, Leicester Museums. *TLAAS* 28, 1956, 94-5. (possible bath-house).

Hampstead Norrey's, Berkshire.

VCH Berkshire 1, 1906, 209-10, well-house. JBAA 16, 1860, 229-30; 17, 1861, 336; 19, 1863, 60-3, well house; 36, 1880, 27-8.

Hanham Abbots, Avon.

Scott 1993, 15, SMR 1411, AV 42. Scarth 1864, 125; well.

Hardham, West Sussex.

Britannia 1, 1970, 122 bath-house. Coles & Simpson (eds.), 1968, 265. Cunliffe 1973, 69-70. SxAC 16, 1864, 52-64; 68, 1927, 89-132. TIRCGLL 1983, 57, minor settlement, earthen rampart enclosing 1.6ha; six ritual shafts; occupied 1st and 2nd c. (Regni).

Hardingstone, Northamptonshire.

Britannia 5, 1974, 265, 270-2, 276, 280. Dryden 1885, well, found 1884, near a 1st c. pottery settlement, probably dating 3rd to 4th c. JRS 58, 1968, 192. Northampton Archit. Soc. 18, 1885, 61. Swan 1984, fiche 523-4. Woods 1969, Northampton County Council.

Hardknott, Cumbria.

Collingwood 1928, 314-52. Garlick 1985, (1973). Hanson 1970, 367-8, comments, 'A lead pipeline, bringing water to the fort from a spring rising just to the south of the Parade Ground, which lay to the N-E of the fort and nearly 30.4m (100ft) above it, was found in the 19th c.', (item 48). At item 49, 'The bath-house lay just to the east of the fort near to a stream known as the Camp Sike. Excavations...revealed traces of a dam across the stream close to the bath-house and this may well have been constructed to feed a channel or pipeline to supply the building with water. Hutchinson 1794, 578. Stephens 1985b, item 42, 227, comments, 'The extramural bath-house was probably supplied by a short (c. 40m) leat fed from an adjacent hill, 'Camp Sike' (Collingwood 1928, 351). The fort itself was apparently supplied by a lead pipeline aqueduct (Hutchinson 1794, 578). Both aqueducts must be 2nd c.' TCWAAS (new ser.), 28, 1928, 134ff, 351-2.

Harlow, Essex.

Bartlett 1991, 22, 154-5, Roman settlement. Britannia 2, 1971, 272-3, a building with hypocaust and mosaic floor, possible bath-house?; 4, 1973, 304, 325; 5, 1974, 442; 8, 1977, 407, well, timber-lined; 20, 1989, 303; 22, 1991, 263; 23, 1992, 291; 24, 1993, 302. Essex Arch. &

Hist. Scott 1993, 63, SMR 3753 (TL 46 07), ES 37, Latton Common; SMR 3600, ES39. 23, 1992, 106.

Harpole, Nottinghamshire.

BNFAS 2, 1967, 11, (SP 69 62). *JBAA* 2, 1847, 364; 5, 1850, 375; 6, 1851, 126. *JRS* 57, 1967, 186. *JNNHS* 11, 1901-2, 7-8. Scott 1993, 144, SMR 375, NH 61, SMR 422, NH 62, bath. *VCH* Nottinghamshire 1, 1902, 197. Whitwell 1982, 246.

Harpsden, Oxfordshire.

Scott 1993, 159, SMR 2190, OX 29. *VCH* Oxfordshire 1, 1939, 323-4. *TIRCGLL* 1983, 57, aisled villa with bath. (*Catuvellauni*).

Hartfield, Garden Hill, East Sussex.

Britannia 4, 1973, 321, 333, bath-house; 5, 1974, 458; 15, 1984, 330; 16, 1985, 327. Money 1973, *Current Arch.* 41, 185-8. Money 1980. Scott 1993, 59, NAR TQ 43 SW8, EA 14. *SxAC* 108, 1970, 39-49; 111, 1973, 27-43.

Hartlip, Dare Field, Kent.

Black 1987, No. 37, Hartlip, Appendix Ten, 'The Bath-building at Hartlip', 124-5, 246, Fig.49. *JBAA* 1, 1845, 314; 4, 1848, 398; 5, 1849, 370. Scott 1993, 105, KE 41. Smith 1852, Vol.2, 1-24, pls I & II, & Figs., bath-building. *VCH* Kent 3, 1932, 117-8, pl.xxiii, xxiv(2). *TIRCGLL* 1983, 57, villa with large bath. (*Cantiaci*).

Havant(1) Near Langstone, Hampshire.

PHFC 10, 1930, 286-7, villa, bath. *JRS* 12, 1922, 273. Scott 1993, 84, NAR SU 70 NW 10, HA 44. *TIRCGLL* 1983, 58 corridor villa; coins of Vespasian (AD 69) to Constantine (AD 335) . (*Regni*).

Havant(2), Littlepark, Hampshire.

Black 1987, 158, item 173, ?bath. *Britannia* 8, 1977, 418; 25, 1994, 287. *JRS* 16, 1926, 232-3. Scott 1993, 84, NAR SU 60 NE 1. *TIRCGLL* 1983, 58, villa; earlier building c. AD 150-200; corridor house, c. AD 250-350. (*Regni*).

Hayes, Kent.

Black 1987, 145, No.38, Fig 29, p.252 bath-building constructed c AD 100 and apparently disused by c. AD 140. Philp 1973.

Hayton, North Humberside, Yorkshire.

Britannia 7, 1976, 315-6, Fig 11; 9, 1978, 57-114; 10, 1979, 49; 17, 1979, 84. Johnson 1978, 57-114, a 'Timberlined drain acting as an eavesdrop gulley...a large pit within a building; this was probably a watertank' (p.69).

Heath and Reach, near Leighton Buzzard, Bedfordshire.

Beds. Arch. J. 6, 1971, 71-2, well, stone-lined, 3.65m (12ft) deep, 1.06m (3.5ft) diam., dated to not later than 1st half of 2nd c. Scott 1993, 20, SMR 1170, BD 12.

Hemsworth, Dorset.

Britannia 2, 1971, 180, 187, 193. *PDNHAF* 30, 1909, 1-12 bath. OS Map of Roman Britain, 4th ed., 1991. *TIRCGLL* 1983, 58, courtyard villa with bath, occupied during first three quarters of the 4th c.; coins of Constantine I to Gratian. (*Durotriges*).

Heybridge, Essex.

Britannia 26, 1995, 360 item 9, (a) 'a possible public space around a large well... 4 timber-lined wells have been excavated with good preservation of wood', (b) near Langford, at TL 845 082, 'a simple well nearby a burial mound'. *TEAH* 17, 1986, 7-68; 19, 1988, 243-8, Figs 7 & 9, item 267, well, 2.5m deep with large present opening of 11m due to erosion of the sides; high water table and sandy soil. Wickenden 1986, 7-68.

Hibaldstow, Staniwells, Humberside, Lincolnshire.

Arch. J. 91, 1934, 169. *Britannia* 7, 1976, 324-5, settlement; 8, 1977, 389; 9, 1978, 433; 11, 1980, 366; 20, 1989, 278-80. *Current Arch.* 77, 1981, 168-71, well. Smith 1987, 189-98, Figs.11-4, pls.8-14; idem. 1977, *LHA* 12, 1977, 74; idem. 13, 1978, 78. Scott 1993, 98, SMR 2354, HU 6. Whitwell 1970, 67-8. *TIRBS* 1987, 42, minor settlement, pre-Roman occupation; civilian occupation from 3rd to 4th c. (*Corieltavi*).

High Cross, Leicestershire.

Britannia 1, 1970, 42, 49, 51 Ant. Itin. 470.4, 477.3(*venonis*), possible early fort, 184; 2, 1971, 258. 10, 1979, 296. Liddle 1982, 29. *VCH Leicestershire* 1, 1907, 213. *VCH Warwickshire* 1, 1904, 232-3. *TIRBS* 1987, 42, minor settlement, with well, at crossing of

Watling Street and Fosse Way; Roman fort near Wigston Parva, SP 464 894; coins dating from 1st to 4th c. (*Corieltavi*).

High Ham, Shropshire.

JRS 36, 1946, 142; 37, 173; 39, 109; 44, 99-100. PSANHS 92, 1946, 25-28. Radford & Dewar 1954. *Somerset and Dorset Notes and Queries* 25, 1950, 1-6, 61-4, 141-3; 27, 1961, 58-61. Pottery indicates occupation c. AD 200 to c AD 367. Bath and well. Scott 1993, 168, SMR 53980, SO 30.

High Legh, Cheshire.

Britannia 1, 1970, 282; 4, 1973, 284; 19, 1988; 445 drain; 21, 1990, 331.

High Rochester, Northumberland.

AA(4) 13, 1930, 171-84. *Britannia* 1, 1970, 40-1, 67 Ant. Itin. 463.3 (*Bremenio*), 150-1; 2, 1971, 127-8; 3, 1972, 9; 14, 1983, 143 fort, 337; 20, 1989, 178; 21, 1990, 210-11; 22, 1991, 304. Bruce 1855, 2nd ed.), 301 'recorded seeing the remains of an aqueduct of channelled stones entering the fort by the South-Gateway'. Hanson 1970, 368, comments, 'Bruce recorded seeing the remains of an aqueduct of channelled stones entering the fort by the S. gateway'. NCH 15, 1940, 66-75. Richmond 1940, 94. TIRBS 1987, 42, Flavian fort (2ha) to c. AD 120; rebuilt in stone c. AD 140; occupied to mid 4th c.

Higham Ferrers, Northamptonshire.

BNFAS 2, 1967, 19. *Britannia* 22, 1991, 252, settlement. *Northants. Arch.* 13, 1978, 79. Northants SMR 3212. RCHM County of Northants., N-E, 1, 1975, 54-6. Whellan 1874, 917. Bath.

Hinton Charterhouse, Fiford Plantation, Avon.

Scott 1993, 16, SMR 1635, AV 44, bath-house. VCH Somerset 1, 1906, 363.

Holcombe, Uplyme, Devon.

Antiq. J. 53, 1973, 16-41. *Archaeologia* 45, 1877, 462-5. *Arch. J.* 11, 1854, 49-51. *Britannia* 1, 1970, 297, bath; 2, 1971, 278-9; 3, 1972, 344; 10, 1979, 175-7. PDAS 32, 1974, 59-161. PSA 2, 1852, 265. Scott 1993, 50, NAR SY 39, DE 19, house from c. AD 70 to c. AD 200, then villa to 5th c.

Holditch, Farm Street, Newcastle, Stradfordshire.

JRS 48, 1958, 137 *vicus*; 49, 1959, 112 well 6.08m (20ft) deep; 50, 1960, 223; 51, 1961, 174, 197; 52, 1962, 195-6. *NSJFS* 1, 1961, 26-50; 2, 1962, 60-71. *TIRBS* 1987, 43, roadside settlement; occupation c. AD70-160; 3rd c. settlement on higher ground to the West. (*Cornovii*).

Holme House, Manfield, Piercebridge, Co. Durham, N. Yorkshire.

Britannia 1, 1970, 279-80, Fig.6, bath, dates from c. AD 140s, probably dismantled end 2nd c., drain from the bath indicates that these were no longer in use at the end of the 2nd c.; 2, 1971, 251-2, Fig.5; 3, 1972, 309; 4, 1973, 280, stone bridge; 5, 1974, 255, villa. Clack 1982, 381-4. *JRS* 41, 1951, 52. *MOW* 'Excavations', 1969, 51-2; 1970, 58. Scott 1993, 149, NAR NZ 21 NW 28, DU 2, under Cliffe, near Piercebridge. Tyler 1980, 60. *YAJ* 44, 1972, 220.

Holt, Cheshire.

Britannia 1, 1970, 42, 43 n.29 Ant. Itin. 469.3 (*Bovio*) (see my note for Grafton Estate); 2, 1971, 127-9, 130 n. 54, 182, 303; 3, 1972, 362; 12, 1981, 395; 15, 1984, 255-60. Davies 1949, 143-55. Hanson 1970, 368, item 51, comments that 'at this military supply depot a water pipeline made of earthenware pipes, and leading to the latrines, ...The source of such a pipeline is uncertain but the Devon Brook to the west of the site seems a possibility...'. Nash-Williams 1969, 42-4. *RCHM* Flintshire 1914, 72-4. Scott 1993, 47, SMR 1177c, CL 7, bath-house. Waddelove, 1988, 257. *Y Cymmrodor* 41, 1930, 14-5. *CSIR* I.5, 1986, Nos. 55, 98. *TIRBS* 1987, 43, *RIB* 439-443; pottery and tile works on the river Dee, supplying the legion at Chester; bath-block and many other buildings covering c. 8ha. (*Cornovii*).

Horncastle, Lincolnshire.

Arch. J. 90, 1935, 129-30, 169-79; 103, 1947, 21-3; 112, 1958, 38-9. *Britannia*, 10, 1979, 293; 17, 1986, 389; 25, 1994, 269. *EMAB* 5, 1962, 15; 9, 1966, 15, well. Todd 1973, 42-4. Whitwell 1970, 72-4; *idem.* 1982, 76-7. *TIRBS* 1987, 43, small walled town (c.2.5ha), on the pre-Roman road called High Street; walls and towers c. late 3rd c. *Corieltavi*).

Horningsea, Cambridgeshire.

Britannia 12, 1981, 340. Fox 1923, 210-11. Hughes 1904, 237-40, well. *PCAS* 10(iv) 1904 (1898-1903), 237-40. 17, 1912, 14-69. Phillips

1970, 200. RCHM County of Cambridge 2, 1972, 71-2, 'A mound and a well were dug into', but not clear to me if it was Roman. Swan 1984, fiche 236, well at TL 4983 6348. VCH Cambridgeshire 7, 1978, 71-3. Walker 1912, 16, describes the well mentioned by Hughes. TIRBS 1987, 143, pottery works near Eye Hall; active mainly in 2nd c. (*Corieltavi*).

Housesteads, Hadrian's Wall, Northumberland.

Arch. Ael.(1) 1, 1822, 263-320; Arch.Ael.(3) 25, 1904, 193-300, at 207, 211, 248-51, 253-4, 255-63; Arch. Ael.(4) 9, 1932, 226-37; 10, 1933, 85-96; 11, 1934, 185-205; 12, 1935, 243-4; 38, 1960, 61-71; 39, 1961, 279-99; 40, 1962, 83-96, 105-15, 117-33, 277-80; 41, 1963, 37-44; 49, 1971, 95-99; Arch. Ael.(5) 3, 1975, 17-42; 4, 1976, 17-30; 7, 1979, 127-43. Birley 1961, 181. Britannia 1, 1970, 153, 276,; 2, 1971, 127, 130 n.54, 153, 276; 3, 1972, 193-6, 202, 306-8, 360; 5, 1974, 410; 6, 1975, 232; 7, 1976, 155, 161, 165, 309, 390; 8, 1977, 263-4, 372-3, 431-2; 9, 1978, 420-1; 11, 1980, 18, 359; 12, 1981, 268,; 307-8; 13, 1982, 342-3 bath-house; 14, 1983, 269-70, 348-9; 16, 1985, 270; 18, 1977, 369; 19, 1988, 434 vicus; 23, 1992, 111-2, 315, latrine and fountain. Bosanquet 1904, 207, 248-9, 253, 255. Bruce 1863, 214ff. Bruce 1875, 170, 234. Hanson 1970, 249-55 mentions 5 tanks. Manning 1976, 40.151, Fig 24.151. Stephens 1985(b), comments, 'The extramural bath-house seems to have been supplied by a short line of channelled stones, 226. It is highly probable that the fort was also supplied by an aqueduct, although not from the adjacent Knag Burn (contra Birley 1961, 181). In the Hadrianic period the latrine in the S-E angle was flushed with water conveyed by four 'conduits', or stone channels, from the N and N-E (Simpson 1976, 136-7). One of these may have supported the wooden pipeline whose existence is established by Bosanquet's discovery of an iron pipe collar (Manning 1976, 40.151, Fig.24.151). The pipeline suggests strongly that the fort was supplied by an aqueduct. This could only have been a pipeline aqueduct and Collingwood (1933, 122) surmised that the fountain depicting the three nymphs (Lap. Sept. 170, 234) stood at its terminal point'. 2 Roman external wells at NY 7897 6869 and NY 7918 6894. A third well of later construction is at NY 7909 6857 near and outside the South gate. TIRBS 1987, 43-4, RIB 1594; fort (2.06ha) on Hadrian's Wall, earlier than the Narrow Wall but overlying the demolished foundations of the Broad Wall and Turret 36B; civil settlement and Mitraeum; occupied 2nd -4th c. (*Brigantes*).

Hovingham Park, North Yorkshire.

Clark 1935, 88-92. Drake 1736, 361, 582, 587. Elgee 1933, 168-9. Ramm 1978, 87, 89, 90, 106. Scott 1993, 150, SMR 00314, NK 14. Scott 1973, Vol I, 45-6. Stukeley 1885, Vol III, 354-6, Roman bath. Tyler 1980, 62. TIRBS 1987, 44, occupation 1st to late 4th c. (Parisi).

Hucclecote, Gloucestershire.

Britannia 21, 1990, 347. JRS 24, 1934, 212, 'an apsidal room with a drain and part of a bath-building'; 48, 1958, 153 no.23; 49, 1959, 127. TBGAS 55, 1933, 323-76; 79, 1961, 159-73; 80, 1962, 42-9. Liversidge p.146, and Smit p.79 in Rivet 1969. McWhirr 1981, 99-100. Scott 1993, 73, SMR 468, GS 59, comments, 'A wall plaster seems to depict a graffito sketch of a timbered building on stone footings, possibly a villa, and is a valuable insight into the construction of Roman rural buildings...'. TIRCGLL 1983, 59-60, corridor villa, with bath; built c. AD 150 and occupied into 5th c.

Hunsbury, Wootton Hill Farm, Northamptonshire.

Britannia 3, 1972, 228-9, 231, Iron Age; 5, 1974, 268, 434; 11, 1980, 372, bath-suite, 14m by 7m, c. 4th c.; 12, 1981, 342, describes main building and n.172 mentions name change from Wootton Hill Farm to Hunsbury Villa; 13, 1982, 366; 16, 1985, 182; 20, 1989, 200. CBA Gr. 9 Newsletter 4, 1974, 22; 9, 1979, 'A review of Archaeology in Bedfordshire, Northamptonshire and Oxfordshire', 10 & 22. *Northants. Arch. Soc. Newsletter* Oct.1979-May 1980, 3. *Northants. Arch.* 9, 1974, 86-101; 22, 1988-9, Jackson, 1988, 3-21. Northamptonshire SMR 1671. Swan 1984, fiche 527. Occupation, dated from pottery, c. 2nd c. to 4th c.; boundary ditches and a pit from 1st c. AD. *RCHME Northamptonshire* 5, 1985, pl.3, 424-6, with plan and microfiche. Scott 1993, 148-9, SMR 2103, NH 123. TIRBS 1987, 44, villa with bath-suite in left wing. (Catuvellauni).

Huntingdon, Cambridgeshire.

Britannia 6, 1975, 251 settlement; 12, 1981, 273-5, lead tank, ?aqueduct. CBA Gr.7, Bulletin 14, 1967, 3. *Medieval Arch.* 12 1968, 166. *VCH Cambridgeshire* 7, 1978. Scott 1993, 39, SMR 02545a, CA 101. Todd 1978, 115. TIRBS 1987, 44, two small houses later combined to form large winged villa. (Catuvellauni).

Huntsham, Herefordshire.

Antiq. J. 18, 1938 376, pl.80. *Britannia* 2, 1971, 261. *JRS* 51, 1961, 171; 52, 1962, 167, Fig.15, 169, '...., two small *opus signimum* tanks partly built into the walls of the larger tank sunk into the floor of the east aisle. The last remained in use after the barn was destroyed, in or before the 4th century....'; 55, 1965, 208, Fig.13; 56, 1966, 205, Fig.11, 206. *TWNFC* 37, 1961, 179-91. *WMANS* 12, 1969, 26. *TIRCGLL* 1983, 60, villa in loop of the river Wye; occupied c. AD 200 to late 4th c. (*Dobunni*).

Hurcot, Hurcot Farm, Somerset.

VCH Somerset 1, 1906, 322-3, 'a clear spring of water rises at a short distance from the ruins. Traces of hypocausts, baths and mosaic pavements were discovered'. (Uncertainty about location).

Ickham, Kent.

Britannia 6, 1975, 283: wells, 2 water-mills; 10, 1979, 350-3; 11, 1980, 413: inscribed lead seal; 12, 1981, 387; 20, 1989, 178, 188. *Collectanea Historica*, 1981, 32. *KAR* 68, 1982, 169.

Ickleton, Cambridgeshire

Arch. J. 6, 1849, 14--26. *Britannia*, 1971, 187, 192. Fox 1923, 183-4. *JBAA* 4, 1849, 356-68. Scott 1993, 39, SMR 04168/04153, CA 102, bath. *VCH Cambridgeshire* 7, 1978, 46. *TIRBS* 1987, 44, corridor villa; coin of Hadrian found and coins of 4th c. (*Catuvellauni*)..

Icklingham, Suffolk

Britannia 1, 1970, 19-20, 26-8, 30-1; 3, 1972, 330; 5, 1974, 439; 6, 1975, 262; 8, 1977, 444-5; 9, 1978, 448, well; 12, 1981, 271-5; 15, 1984, 307; 19, 1988, 456; 20, 1989, 235; 21, 1990, 341; 25, 1994, 279 settlement. *EAA* 3, 1977, 63-125. *NA* 28, 1945, 213. *VCH Suffolk* 1, 1911, 293 309-10. Swan, 1984. *TIRBS* 1987, 44, TL 783 719; mid-late 3rd c. (*Inceni*).

Iford, Wiltshire.

Scarth 1864, 120, claims it was 'a perfect Roman bath', but was covered up after it was investigated. *VCH Somerset* 1, 1906, 300. *TIRCGLL* 1983, villa with baths; coins of late 3rd and early 4th c. (*Belgae*).

Ilchester, Somerset.

Arch. J. 107, 1950, 94-5. *Britannia* 7, 1976, 357; 19, 1988, 471; 20, 1989, 313, '(ii) At Dolphin Lane, ...late 1st c. wheel-well and side drains noted'. Leach 1982. Leach 1985. Leach 1992, *Sheffield Excavation Reports* 2, 5, 7 Fig.3, 21, 129. *PNRB* 1979, 392. *SANH* 135, 1991, 11-84, Figs.1 & 2. Wachter, 1995, 21, 32, 324, 331. *TIRCGLL* 1983, 60, *Lindinis* : Rav. Cos. 106.11; *RIB* 1672, 1673; town occupied c. AD 60 to early 5th c.; a 2nd c. earthen rampart was succeeded by a 4th c. wall enclosing 13ha. (*Durotriges*).

Inchtuthill, Tayside, Scotland.

Britannia, 1970, 197, 201; 2, 1971, 123 n.7; 3, 1972, 4, 5, 7, 12-3, 226, 233-4, 241; 5, 1974, 13, 20-1, 27, 33-5; 10, 1979, 21, 27, 51; 12, 1981, 18, 25, 32, 287; 14, 1983, 284; 15, 1984, 55-7; 18, 1987, 27; 19, 1988, 170-1; 21, 1990, 310; 25, 1994, 103, 159. Hanson, 1970, 200. *JRS* 41, 1951, 63 pl. viii; 43, 1953 to 48, 1958, 91; 49, 1959, 104; 50, 1960, 213; 56, 1966, 198. Pitts & St Joseph 1985, discusses the water pipes and trenches which could have been for distribution of water once the aqueduct supplying water to the fortress was completed, and the future bath-house inside the fort. Before these could be constructed the fort was demolished c.AD 85. *PSAS* 36, 1902, 211, 229, 240. Stephens 1985b, 222: 'The discovery of ceramic water pipes and pipe trenches establishes that the fortress was to have been supplied by aqueduct (Taylor & Richmond 1959, 104; 1960, 213). The aqueduct seems not to have functioned (*JRS* 1966, 198), probably because of the short period of occupation'. It was not completed, if indeed it was started. *TIRBS* 1987, 45. Flavian legionary fortress (Plan iv), probably of *Legio XX V V* (21.74ha). Two successive construction-camps (19.9 and 14.1ha). Constructed c. AD 83, and evacuated c. AD 87.

Inveresk, Lothian, Midlothian, Scotland.

Britannia 3, 1972, 8, 20, 29-30, 42-4, 304, vicus at NT 345 720 examined; 8, 1977, 365 7; 9, 1978, 416-8 Fig.7; 13, 1982, 339-40; 16, 1985, 265. *DAES* 1977, 22; 1990, 29-30. Hanson 1970, 368, comments: 'In 1956 the remains of a stone-lined channel which had carried a water pipeline (probably of wood) to the Antonine bath-house at this fort was discovered'. *JRS* 36, 1946, 109; 37, 1947, 165; 38, 1948, 81-2 bath-house; 56, 1966, 199; 57, 1967, 176. Stephens 1985b, 224, item 15, comments: 'One of the extramural bath-houses was fed by a "water-pipe channel"' (*JRS* 1966, 199; 1967, 176). The channel was presumably the support of a wooden pipeline dating from one of the Antonine

phases'. CSIR I.4, 1985, Nos. 59-60. The bath-house is some distance away from the fort, probably in the *vicus*. TIRBS 1987, 45 at NT 344 721. RIB 2132-3. Fort (c. 2.84ha) occupied twice in the Antonine period; external bath-house and extensive civil settlement.

Irchester, Northamptonshire.

Arch. J. 36, 1879, 99-100; 124, 1967, 65-99, 100-28. BAJ 7, 1972, 14. BNFAS 5, 1971, 19; 6, 1971, 14 Irchester (1), occupation AD 68 to 4thc., modification to fort. Britannia 1, 1970, 114, 116, 118, 123, 127, small town (settlement); 13, 1982, 366, extramural settlement; 16, 1985, 200, water supply, 289; 23, 1992, 285; 25, 1994, 273. Burnham & Wachter, 1990, 147. JRS 16, 1926, 223, excavations by W W Robb on ramparts and extramural area, 3 wells; 43, 1953, 92. Nat. Hist. of Northants 1712, 517, J Morton reports that walls was still standing in his time, but now completely destroyed by cultivation. RCHM County of Northants, Central 2, 1979, 90-99, Fig.85-93, The Roman town, Figs.11, 89, 91, pls.3, 4, 32. Swan, 1984, fiche 533. RIB I, 1965, 75-6.

Islip, Northamptonshire.

Britannia 5, 1974, 257, villa examined from air. Northants. Archaeology 13, 1978, 179. PAS 9, 1882, 90-91, 'Possibly from the same site a "Roman well"...lined with white tiles', (limestone slabs). RCHM County of Northampton, N-E Arch. Sites 1, 1975, 57a.

Ivy Chimneys, Essex.

Britannia 11, 1980, 377-9, plan Fig.14, bath-house; 12, 1981, 350, 379; 13, 1982, 412; 15, 1984, 307-8, reservoir c. 50m x 25m x 2.5m deep from 1st c., springs and well, possible aqueduct. Dating from c. AD 260 to AD 360-400. An area of springs north of the settlement; settlement dates from Iron Age period and Romano-British religious site.

Ixworth, Suffolk.

Britannia 1, 1970, 183; 2, 1971, 187, 189, 193; 17, 1986, 404 fort, settlement, *vicus*. Scott 1993, 174, SMR IXW 004, SU 14. VCH Suffolk 1911, (reprinted 1975), 311-2, bath. Occupation 2nd c. to 4th c., from pottery.

Jordon Hill, Dorset.

Coles & Simpson 1968, 266. *RCHM Dorset* 2(3), 1970, 616. Ross 1968. Webster 1996. *TIRCGLL* 1983, 61; Romano-Celtic temple, active late 4th and early 5th c. Ritual shaft/well. (*Durotriges*).

Kelvedon, Essex.

Britannia 1, 1970, 52, 70, Ant. Itin. 480.5 (*Canonio*); 4, 1973, 265; 5, 1974, 442-3; 9, 1978, 451; 10, 1979, 311; 16, 1985, 197-208, item 31, 199. *Current Arch.* 48, v(1), 1975, 25-30, fort and later *vicus* settlement with *mansio* and presumably a bath. *CBA Res. Rep.* 63, Chelmsford Arch. Trust. *EAH* 10, 1978, 198. *JRS* 59, 1969, 223, 245. Rodwell 1988. Stephens 1985(a), item 31, 199, aqueduct. *VCH Essex* 3, 1963, 149. *TIRCGLL* 1983, 62; major settlement. (*Trinovantes*).

Kempsford, Gloucestershire.

Britannia 17, 1986, 414, 'a settlement of c 4ha... on island of flood plain of the river Coln. Two phases of ditches outlining rectangular paddocks c. 20m x 15m...dating to the late 1st c. and early 2nd c.; 2nd phase 2nd c. and early 3rd c. *Gloucestershire Countryside* 9, 1957, 154. *HBMC Unit's Newsletter* 13(3), 1985, 2-3. O'Neil 1961, 36. *RCHM* 1976, 68-9, 2 wells.

Kempston, Church End, Bedfordshire.

Britannia 24, 1993, 293 & 295: (ii) 'Evaluation revealed an area of timber structures, a well, and child burials...', dating from c. 4th to 7th c. (no previous work). Simco, 1984, 108. *VCH Bedfordshire* 2, 1908, 8. *TIRBS* 1987, 46, TL 005 503. (*Catuvellauni*).

Kenchester, Hertfordshire.

Branigan & Fowler 1976, 99-102. *Britannia* 1, 1970, 55, Ant. Itin. 484.7 (*Magnis*), 118-9, 189; 5, 1974, 346; 7, 1976, 182; 8, 1977, 288; 9, 1978, 438; 10, 1979, 298; 22, 1981, 31; 23, 1992, 283-4, villa. Jack 1916. Jack & Heyter 2, 1926. *RCHME Herefordshire* 2, 1932, 93-5. rere & St Joseph 1983, 169-70. *TWNFC* 38, 1964-6, 192-5. *VCH Herefordshire* 1, 1908, 175-83. *TIRBS* 1987, 46,; settlement (c. 9ha) with bath-house; other houses also with possible bath-houses; at junction with 4 Roman roads; Iron Age hill-fort nearby; possible Roman fort (Webster 1981, 73-4). Occupation from Iron Age period, kilns and iron workings and ditches; early Roman occupation to 4th c. Well c. 6m deep.

Keston, Warbank Site, Kent.

AEx. 1976, 91. *Archaeologia* 22, 1828, 336; 36, 1855, 120. *Arch. Cant.* 69, 1955, 96; 82, 1967, 184-91. *Athenaeum* Oct. 28, 1893. *Britannia* 2, 1971, 187; 5, 1974, 459; 8, 1977, 409; 9, 1978, 471-2; 12, 1981, 366; 16, 1985, 178, 315; 17, 1986, 426. Dunkin, 1815, 45-58. *JRS* 58, 1968, 205; 59, 1969, 232. *KAR* 11, 1968, 10-14; 21, 1970, 21-3. Philp, et al, 1991. Philp 1973, 94-8, bath-suite, drains, pipes, tanks. Scott, 1993, 79, GT 6. *VCH Kent* 3, 1932, 119. *TIRCGLL* 1983, 62, corridor villa with bath. (*Cantiaci*).

Kettering, Blanford Ave., Northamptonshire.

AASR 27, 1904, 382-7. *Antiq. J.* 20, 1940, 497-9. *BAR*, 24, 1976, 180. *BNFAS* 4, 1970, 9. Bridges 1791, II, 241. *Britannia* 1, 1970, 129; 3, 1972, 359; 5, 1974, 278, 434-5; 9, 1978, 51, 147, 206-13. *JBAA*. 32, 1926, 316-7 at SP 8695 8018, SP 8723 8009, SP 8715 8028, SP 876 798, SP 870 795, SP 875 796. *JRS* 29, 1939, 208. Northants *SMR* 3957. *Northamptonshire Arch.* 9, 1974, 90; 12, 1977, 212. *PSA*(2) 23, 1911, 493-501 (illustration); 24, 1911-2, 223-4. *RCHM County of Northants, Central*, 2, 1979, 101-5, No.38, Fig.96; 3 wells. Swan 1984, fiche 536, wells at SP 8718 8055. *VCH Northamptonshire* 1, 1902, 194. Whitwell 1982, 259. *TIRBS* 1987, 46, minor settlement. (*Catuvellauni* or *Corieltavi*).

Keynsham, Manor Woods, Somerset.

Archaeologia 75, 1926, 109-38, pls.16-18, plan of villa, bath. *Antiq. J.* 2, 1922, 371. *Britannia* 10, 1979, 175; 11, 1980, 293-6; 17, 1986, 415. Bulleid & Horne 1926, 109-38. Collingwood, 1926, 135. Fritter 1991, 166-7. *JRS* 11, 1921, 210-4; 14, 1924, 234. Scott 1993, 16, *SMR* 1214, AV 49, Chocolate Factory site/Somerdale ST 65 69. The villa is at ST 668 617 according to Boon, but Scott gives it at ST 64 69 at Durley Hill, the so called 'graveyard' site. She comments: '...bath-house excavated in 1922. One km from the Keynsham grave yard villa, thus too far away to be its bath-house as has been suggested'. *TIRCGLL* 1983, 62, large courtyard villa; coins of c.AD 265-375. (*Belgae*).

Kings Weston Park, Avon.

Boon 1949. *Britannia* 9, 1978, 351-8. Scott 1993, 14, *SMR* 744, AV 21. Smith D J 1978, 139. Smith J T 1978, 351-8. A bath c. AD 290, wooden water pipes with iron collars. *TBGAS* 69, 1950, 5ff.

Kingscote, The Chessals, Gloucestershire.

Britannia 1, 1970, 184, possible fort; 8, 1978, 456; 9, 1978, 456; 10, 1979, 322; 11, 1980, 385; 12, 1981, 165-75, wall paintings; 13, 1982, 378, 380, quarries and buildings; 21, 1990, 201. *Current Arch.* 69, 1979, 294. *Glenvensis* 10, 1976, 17f, plans. *Kingscote Arch. Ass.* 1981, 'The Chessals Excavations, Kingscote, 1975-80. McWhirr 1981, 73-80, 2 drains, one stone-lined, the other wood-lined. *RCHM County of Gloucestershire* 1, 1976, 70-3, plan. Scott 1993, 73, SMR 325, GS 61. (No water-related structures found).

Kinneil, Cumberland, Scotland.

Britannia 10, 1979, 275; 12, 1981, 143-61; 13, 1982, 338. *Glasgow Arch. J.* 2, 1971, 107. Keppie & Walker 1981, 150-4, Fig.6, 7, pl.ixb, stone-lined and stone-capped drain. Macdonald 1934, 191-2. *PSAS* 94, 1960-1, 322; 107, 1975-6, 77. Robertson 1990, (4th ed.), 6, 9, 27-31, 41, 111. *TIRBS* 1987, 47. Fortlet (0.5ha) of early phase of Antonine Wall. Also suspected secondary fort.

Kintbury, Berkshire.

BBAA 31, 1950, 2; 41, 1961, 1. Scott 1993, 23, SMR 1661, BK 25, small Roman bath-house.

Kirk Sink, Gasgrove, North Yorkshire.

Britannia 1, 1970, 280, bath; 5, 1974, 416-7; 6, 1975, 238, bath-house & earlier settlement; 7, 1976, 317-8. *Bradford Antiquary* (new ser.), 3, 1912, 353-68. *JRS* 59, 1969, 207. Scott 1993, 150, NK 10, bath, c. 2nd c., and occupation to 4th c. Tyler 1980, 52-3. *YAJ* 46, 1974, 144. *YAR* 1974, 3. *TIRBS* 1987, 47, villa, with detached bath-house, probably of 2nd c. (*Brigantes*).

Lake Farm, near Wimborne, Corfe Mullen, Dorset.

Britannia 1, 1970, 299, water tank; 2, 1971, 281; 5, 1974, 7, 455; 11, 1980, 391. *PDNAS* 89, 1967, 143, Field; 91, 1969, 188-9, Field, 'Phase I, a timber-lined tank, 20 ft (6.09m) square and 4 ft deep (1.2m) (c. 10 000 galls, 40,000litres)..., aligned with the aqueduct and causeway entering the camp from the south...Phase II, the 1st tank was reduced to a smaller volume, and tank 2 (8ft x 6ft) of similar construction and likewise aligned with the aqueduct...'. *JRS* lix 1969, 228, no. 54. Occupation appears to be from from mid AD 40s to 60s. Webster 1970, 179-97, esp. 187.

Lambourn, Maddie Farm, Berkshire.

Britannia 14, 1983, 331; 19, 1988, 401-4. Fulford 1989, 187. Gaffey & Tingle 1989. *PSA* 2, 1885, 410-11. Richards 1978. *TNDFC* 1, 1870-1, 207. Todd M, (ed.), 1989. (See E Scott's review of this book in *Antiquity*, 64, No.245, Dec. 1990, 'In search of Roman Britain: talking about their generation'. A very critical approach of some of the authors of articles in Todd's edited book). Scott 1993, 23, BK 27. (No water-related structures reported).

Lancaster, Lancastershire.

Arch. J. 127, 1970, 239-40. Bellis & Penny 1979-80, 4-31. *Britannia* 2, 1971, 254; 3, 1974, 312-3; 4, 1974, 206-9; 5, 1974, 418, 465; 6, 1975, 239; 7, 1976, 319; 9, 1978, 429, 473; 10, 1979, 290; 12, 1981, 331; 14, 1983, 270-1; 15, 1984, 284; 17, 1986, 436; 19, 1987, 443, plan, Fig.16. Hanson 1988, 179-83. *JRS* 49, 1959, 106-8, plan. *LAAA* 15, 1929, 33-40; 17, 1930, 57-72. Leather 1973. Leather G M, 1979. Shotter & White 1990, Occasional Paper 18. One bath north of fort and 2nd one east of fort. Well, timber-lined near east gate. *THSLC* 15, 1953, 1-23. *TIRBS* 1987, 48, *RIB* 600-8. Flavian fort 4th c. 'Wery Wall' late Roman construction. Civil settlement 1st to 4th c. (*Brigantes*).

Lanchester, Co. Durham.

Arch. J. 111, 1954, 220-1. *Britannia* 9, 1978, 475; 14, 1983, 151; 17, 1986, 442; 9, 1988, 492 inscription found in *vicus* near fort. *JRS* 28, 1938, 177-8 with pl.xvii (plan). Clack & Gosling 1976, 213-25 aqueducts. Steer 1938, 211-23, where the three aqueducts for the fort at *Longovivium* (Lanchester) are discussed in detail, which includes the two dams at the sources of the two longest aqueduct channels. All three channels were destroyed during open-cast coal mining during the 19th c. *TAASDN* 7 1936, 200-15; 9, 1939, 110-22 plan; 10, 1953, 394-5. *TIRBS* 1987, 48-9, *RIB* 1072-98. Large fort (2.52ha) established c. AD 140, held till late 2nd c., re-occupied under Gordian III AD 238-244; extensive civilian settlement (*vicus*). (*Brigantes*).

Landwade, Exning Parish, Suffolk.

JRS 49, 1959, 123, bath-building.

Langton, Near Malton, North Yorkshire.

AA(4) 38, 1960, 1-38; 39, 1961, 371-3; 41, 1963, 19-35, 211-3. *Britannia* 4, 1973, 9; 6, 1975, 119; 12, 1981, 268; 20, 1989, 178, 187.

Corder & Kirk 1932. *JRS* 16, 1926, 221; 21, 1931, 222; 22, 1932, 255-8. Ramm 1978, 38, 71-4, 80-7. Scott 1993, 151, SMR 03000.071/03000.75, NK 18. *TERAS* 10, 1902, 71. Tyler 1980, 45, 65-6. Webster 1969, 246-8. *YAJ* 44, 1972, 32-7. *TIRBS* 1987, 49, corridor villa, with small bath-house and well; defensive ditch established 1st or 2nd c.; expansion from 3rd into 4th c. (*Parisi*).

Latimer Buckinghamshire.

Britannia 1, 1970, 315; 2, 110, 112, 114, 116; 6, 1975, 197 plan. Branigan 1971, 169. *Medieval Arch.* 11, 1967, 263; 12, 1968, 1-11, Fig.11, showing Roman bath. *Recs. of Bucks.* 19, 1973, 340-3. Scott 1993, 26, SMR 400, BU 21. *TIRCGLL* 1983, 63, villa, timber building c. AD 80 lasting to c. AD 120; replaced by stone house and bath added; complex lasted several reconstructions until c. AD 400, then occupied through 5th c. into medieval period and into modern times. (*Catuvellauni*).

Lea Cross, Salop, Shropshire.

Britannia 2, 1971, 260, villa, 'Three periods of construction...The first building possibly a bath-house, was already ruinous when the 2nd building was erected on the same foundations.'. Dates from c. 1st to 2nd centuries. *Gentleman's Mag.* Nov. 1793. Rickman, 1838, pl.iv. Scott 1993, 164, SMR 1057, SH 8. *SNL* 39, 1970, 49; 40, 1971, 7-10, plan. *TCSVFC* 4, 1905, 36. *Trans. Shropshire Arch. Soc.* 56, 1957-60, 26-7. *VCH Shropshire* 1, 1908, 258, Fig.34. *WMANS* 12, 1969, 26-7; 13, 1970, 36-7. *TIRBS* 1987, 49, villa of 3 periods with bath-house; pottery of mid 2nd c., and corn-drier of 3rd c. (*Cornovii*).

Leaden Well, Bourton Bridge, Bourton on the Water, Gloucestershire.

Britannia 1, 1970, 126, n.78. Donovan H E 1934, 99-128. *RCHM Gloucestershire* 1976. *TBGAS* 55, 1933, 377, pl.1, well, dry stone walling, 2.58m deep, 0.67m diam.; 56, 1934, 99; 57, 1935, 234-59, plan facing p.240 shows water structures, period c. AD 120 to c. AD 370-400. Two cisterns or leaden tanks, c. AD 370-90.; drain and a sump next to the well.

Lease Rigg, Yorkshire.

Britannia 8, 1977, 381; 10, 1979, 287; 11, 1980, 363; 12, 1981, 328, 'A road-side ditch drained into the butt end of of the fort ditch...; a gully ran along the west side of the *via praetoria*, perhaps leading

to a stone drain immediately behind the north rampart'. Hayes & Rutter 1964, 69-75. Spratt (ed.), 1982, 210, plan. *TIRBS* 1987, 49, small fort (1.05ha); occupied c. AD 70-120. (*Brigantes*).

Lechlade, Gloucestershire.

Britannia 22, 1991, 276, villa. Defoe 1742, 244. Scott 1993, 74, SMR 2442, GS 65, bath, SMR 3191, GS 66, well, dating from c. 2nd c.

Leckhampton Hill, near Cheltenham, Gloucestershire.

Buckman & Newmarch 1850, authors refer to a "true Roman well" located in the centre of the hill fort, p.20. Champion 1971. *TBGAS* 90, 1971, 5-21. 96, 1978, 22-3, 'Reinterpretation of the dry-stone rampart..., suggests a single period of occupation during the earlier phases of the Iron Age'. Burrows, et. al., 1925. Chemkin, 1976 (1971).

Leicester, Leicestershire.

Bellairs 1899, 40-4, 2 Figures. *Britannia* 1, 1970, 38 n.17, 49, 51, Ant. Itin. 477.4 (*Ratas*), 479.3 (*Ratis*), 184, 286; 2, 1971, 155 n.44, 201-2; 3, 1972, 262-4; 4, 1973, 2; 5, 1974, 7 possible vexillation fortress; 6, 1975, 77-8, 246; 7, 1976, 171, 327-8, 387; 8, 1977, 392, wells; 9, 1978, 435, 479; 10, 1979, 160-2; 11, 1980, 18; 12, 1981, 336; 13, 1982, 415-6; 16, 1985, 204-5 water supply; 17, 1986, 390, 444-5; 20, 1989, 286, 339-40; 22, 1991, 245-6; 24, 1993, 290, 317-8; 25, 1994, 271. *JRS* 49, 1959, 113-4 market precinct. Kenyon 1948, bath-house. *PNRB* 443-4. *TLAHS* 44, 1968-9, 1-10. Wachter 1995, 343-62, Figs.154, 156, 158. *Ratae* was established as a *civitas* soon after AD 43, but the *Coritani* was unlikely to have enjoyed self-rule after the battles of AD 60. Wachter also discusses K M Kenyon's work on the Jewry Wall, and the so-called Raw Dykes aqueduct, but this is still not resolved. 2 wells, baths, watertank, drains, and sewer, and later forum, basilica and amphitheatre/theatre. *TIRBS* 1987, 49, *RIB* 244-5, 2244 (*A RATAE MP II*). Pre-Claudian native settlement on the river Soar. Possible Claudian vexillation fortress and/or pre- to early Flavian fort on Fosse Way. *Civitas* capital of *Corieltavi* from late Flavian period. Antonine baths; probable aqueduct (Raw Dykes, not yet resolved) from late 2nd c. Late 2nd c. market precinct, continued to present day. Roman occupation to 5th c. (*Corieltavi*).

Leicester(1), Norfolk Street Villa, Leicester. Leicestershire.

AEx 1975, 68. *Britannia* 7, 1976, 327-8; 8, 1977, 392; 11, 1980, 367 bath-suite; 12, 1981, 337-8, Fig.9. *Current Arch.* 81, 1981, 314.

EMAB 13, 1979-82, 8-9, 'Leicester: Norfolk Street Roman Villa', SK 575 043, 'villa situated c. 1/2 mile (0.81km) from the western boundary of *Ratae Coritanorum*'. *JRS* 29, 1939, 207-9, Fig 13. Scott 1993, 113, SMR SK 50 SE GC, LE 51. *TLAHS* 50, 1974-5, 58; 55, 1979-80, 83. *VCH* Leicestershire 1, 1907, 196. The watertank was timber-lined. Occupation c. mid 2nd c. to late 3rd or early 4th c.

Leicester(2), Leicestershire.

Britannia 24, 1993, 290, item vi, (SK 586 045), well; occupation 2nd to 3rd c. *EMAB* 11, 1977, 8-9, domestic bath-building.

Leintwardine, Hertfordshire.

AEx 1971, 18, summary report. Black, 1995, 26-7, 30, 83, 93. *Britannia* 1, 1970, 55 *Ant. Itin.* 484.8 (*Bravonio*); 3, 1972, 66, 69, 189, 317; 12, 1981, 339; 13, 1982, 360-1; 23, 1992, 284; 24, 1993, 292 fort at SO 415 740; 25, 1994, 271. Nash-Williams 1969, 94-5. *TWNFC* 39, 1969, 258-83 early excavations; 40, 1972, 318-20; 41, 1975, 297-300. Stanford 1969. Occupation c. AD 70 to 4th c. *TIRBS* 1987, 50, 1st c vicus; large 2nd c. fort or stores-base (4.55ha), with bath-house. (*Cornovii*).

Leyton, Essex.

London Arch. 7(15), 1995, 397-401. *RCHM* County of Essex, Cental and S-W, 1921, item 60, 166, Roman Period, 'one or more buildings were found in 1718....Two wells were also found,...'.

Limestone Corner, Hadrian's Wall, Northamptonshire.

No water-related structure recorded.

Lincoln, Lincolnshire.

Archaeologia 104, 1973, 129-207 gates. *Arch. J.* 103, 1946, 26-56 *colonia*; 111, 1954, 10-28 aqueduct; 111, 1954, 106-28; 117, 1960, 40-70. *Ant. J.* 55, 1975, 227-66 defences of lower city; 59, 1979, 50-91 lower city; 61, 1981, 83-114 extramural. *Britannia* 1, 1970, 38, 47, 49, 51 *Ant. Itin.* 475.3, 476.7, 477.9, 478.10 (*Lindo*), 184, 260; 2, 1971, 257-8, tank, *colonia*; 5, 1974, 422 water-pipe; 6, 1975, 275, bath-building and *castellum aquae*; 7, 1976, 325; 8, 1977, 390-1, bath; 9, 1978, 483-4, the southernmost pier of the aqueduct; 10, 1979, 294-5; 16, 1985, 197ff, water supply; 24, 1993, 288 refers to the southernmost pier of the raised portion of the aqueduct. Baker 1938. Colyer 1975. Donel & Hockley 1993, *Lincoln Arch. Unit* 5th Annual

Report. The aqueduct of encased earthenware pipes in Roman concrete of which many lengths have been recovered. It is c. 2.8km (1.75 miles) long; also drains, sewer, bath, tank and well have been located. Hanson 1970, 43-55, 369. She makes a very positive statement, unfounded, that the aqueduct at its source some 2 km (1.25 miles) from the town is 21.3m (70ft) below the highest point and that water was pumped to the delivery point. *EMAB* 11, 1977, 30 drain or gully leading to a stone-lined well at SK 9777 7211; 12, 1978, 25, East Bight, distribution tank. *JRS* 39, 1949, 57-78 fortress; 46, 1956, 22-36 gates and fountain. Jones 1985, in Grew & Hobley, 86-93. *PNRB*, 1979, 393. Thompson 1954, 106-28. Wacher 1995, 132-50. Wacher (Proc. ICE, 1981, 298-300), proposes a much longer aqueduct with a source in the hills to the N-E of Lincoln. So far no trace has been found of any evidence to support this proposal. There is some evidence of pier supports for a raised pipe in the vicinity of the Roaring Meg area. The Roman earthenware aqueduct's source has not been resolved yet (1996). Wilford, Lincoln Arch. Unit, 1982, unpublished summary and commentary on the background knowledge relating to the aqueduct. *TIRBS* 1987, 50-1, *RIB* 246-73, 2240-1. Fortress dates from c. AD 60 and legionary defences faced in stone during early 2nd c. Colonia founded c. AD 90. Further changes to colonia during 3rd and 4th centuries. Monumental gates constructed early 3rd c. including sewers, aqueduct, *castellum aquae*, 2 baths, 2 wells, and fountain. (*Corieltavi*).

Linley, Linley Hall at More, Salop, Shropshire.

Britannia 13, 1982, 358, aqueduct; 15, 1984, 291. *VCH Shropshire* 1, 1908, 257-8. Webster 1975, 100-2. Wright 1872, 24-9. *TIRBS* 1987, 51, lead industry; foundations covering c. 5ha. (*Cornovii*).

Linton, Cambridgeshire.

Archaeologia 32, ?, 352. *Arch. J.* 7, 1850, 389; 8, 1851, 27-55; 10, 1853, 64, 227; 14, 1857, 14, 63. *Britannia* 22, 1991, 257 ns. 162 & 163. *Gentleman's Magazine* 2, 1859, 418. *PSA* 1, 171. *PCAS* 3, 1905, 23; 49, 1951, 13-4. *RCHM Essex* 1, 1916, 143. Scott 1993, 39-40, *SMR* 09841, CA 107, bath-suite. *VCH Essex* 3, 1963, 135-6. *TEAS* 1, 91, 147, 193; 2, 62.

Litlington, Cambridgeshire.

Archaeologia 26, 1836, 376. *Arch. J.* 25, 1868, 32. *Gentleman's Mag.* 1, 1829, 546. Babbington, 1883, 37, 60-2. Fox 1923, 184-5. *JBAA*(3) 22, 1958, 20-1, pl.iv. *PGAS* 19, 1915, 4. Scott 1993, 40, *SMR* 03186,

CA 109, bath. VCH Cambridgeshire 7, 1978, 46. TIRBS 1987, 51. Courtyard villa, said to have at least 30 rooms; bath-suite. (Catuvellauni).

Little Dunmow, Essex.

Rodwell, 1978, 31, No.31. Scott 1993, 62, SMR 1247, ES 26. VCH Essex 3, 1963, 126. Wooden water-pipe, iron collars located, possible aqueduct.

Little Ponton/Stroxton, Lincolnshire.

LHA 6, 1971, 8. Scott 1993, 123, LI 102. Whitwell 1982, 266, SK 93 SW 10, well.

Little Waltham, Essex.

Smith 1987, 154, well. CBA Res. Rept. 26, 1978, 40-43. Drury 1978.

Littlechester, Derbyshire.

Antiq. J. 51, 1971, 36-9. Brassington 1993, 24, who refers to R G Collingwood's (2 wells) comment on the Roman well. Britannia 1, 1970, 283; 4, 1973, 285, 330; 5, 1974, 324, 420 vicus; 11, 1980, 365; 12, 1981, 335, 2 wells; 15, 1984, 342; 18, 1987, 321; 19, 1988, 445-6; 20, 1989, 283-6. DAJ (JDANHS) 86, 1966, 104; 89, 1969, 107-14. EMAB 1960, 2. JDANHS 7, 1985, 70-91. JRS 58, 1968, 3; 59, 1969, 213 + Fig 35 & pl. 13.2. Watkin 1985, 70-91. comments '...which seems further confirmed by Mr Brasher informing me that he came upon what he considered a Roman well beneath the bank', to a depth of 3.6m (12ft). Whitwell 1982, 221, well at SK 362 377.

Littlecote Park, Ramsbury, Wiltshire.

Britannia 10, 1979, 329-30, Fig.17; 11, 1980, 391f; 12, 1981, 1-5 mosaic, 360f, Fig 16; 13, 1982, 387f, Fig.24; 14, 1983, 328f, Fig.29, plan of buildings c. AD 350-70; 15, 1984, 322f, Fig.26 shows development of villa; 16, 1985, 308; 19, 1988, 407-10, Fig.27; 20, 1989, 317f; 21, 1990, 353-4; 23, 1992, 301, Fig.23 shows the final boundaries after excavation project completed. Hoare 1819, 117-21. Lysons 1813-9, Vol.4, pls.9 & 10. Scott 1993, 206, SMR SE 300, WZ 142, as Ramsbury, 3 phases of bath building. It would seem that only one was functional at any given time, dating from c. AD 240 to c.4th c. VCH Wiltshire 1, 1957, 98. Walters & Phillips (1) 1978 (Littlecote 1979); (2) 1978 & 1980 (Littlecote 1981). 3 bath-houses, dating from mid to late 1st c. to 4th c. indicating 8 periods of

reconstruction and modifying of buildings. Well, flint-lined, late 3rd c.; 3 wells: well, unlined c. AD 260; well, c. AD 400, not completed. 3 tanks, timber-lined in the S-E corner with outlet through the wall. *TIRCGLL* 1983, 65. Villa. (Atrebates).

Littleton, Somerset.

VCH Somerset 1, 1906, 323-4: 2 villas, at villa No.2, item 37, 'a bath found'. *TIRCGLL* 1983, 65. Courtyard villa with bath. Site occupied in 1st c.; villa built early 4th c. (*Durotriges*).

Llanddewi Brefi, Dyfed, Wales.

Archaeologia 93, 1949, 6, 17, 25. *Arch. Camb.* 5th ser., 5, 1888, 304-10. *Arch. in Wales* 10, 1970, 15; 11, 1971, 16. Scott 1993, 57, SMR 5999, DY 7, bath-house.

Llanddowror, Cwmbrwyn, Dyfed, Wales.

Antiq. J. 17, 1937, 138. *Arch. Camb.* (6th ser.), 7, 1907, 175-212, 226-30. Nash-Williams 1954, 83-7. *RCAHM Carmarthenshire* 1917, 58-60. Scott 1993, 57, SMR 3900, DY 8, baths. *TCASFC* 1, 1905, 84, 97, 98.

Llandough, South Glamorgan, Wales.

Arch. in Wales, 1979, 28-9, 31. *Britannia* 11, 1980, 349-50, Fig.3. *Cambria* 9(1), 1982, 17-9. *Glamorgan-Gwent Arch. Trust Ltd*, Annual Rep. 1978-9, 29-38. *Annual Report* no.12, 29-38. Robinson 1980, 27-32. Robinson 1988, 123-77. Scott 1993, 67, GL 4. Bath-suite, water wooden pipeline, drain, 2 cisterns.

Llanio, Cardiganshire.

Arch. J. 121, 1965, 29. *Arch. of Wales CBA* Gr.2, 1970, 10; 1971; 1972, 23; 1973, 38-9. *Britannia* 1, 1970, 192, 269; 2, 1971, 243 bath, fort, vicus; 3, 1972, 300 baths; 4, 1973, 271 *praetorium*; 5, 1974, 400. Davies & Kirby 1994, 302-6. Occupation of fort from c. AD 75 to after AD 120. *JRS* 67, 1977, 154-5. Bath, drain, spring. Nash-Williams 1969, 129. *CSIR* I.5, 1986, No. 56. *TIRBS* 1987, 51, *RIB* 407-11; fort (c. 1.8ha), Flavian-Hadrianic; vicus, bath. (*Ordovices*).

Llanfrynach, Maes Derwen, Powys, Wales.

Archaeologia 7, 1785, 205-10. *Bulletin of Celtic Studies* 13(2), 1949, 105-8. Jones 1930, Part 4, 38, pl. 15. Scott 1993, 163, SMR 610, PO1, NAR SO 02 NE 2, bath.

Llantwit, Glamorgan, Wales.

Arch. Camb. 5, 1888, 413-7; 102, 1953, 89-163. *Britannia* 5, 1974, 225-50, 238 Fig.1, bath. *Cambria* 9(1), 1982, 17. *Cardiff Naturalists Soc.* 20, 1808, 50ff. Hogg 1974, 225-50. Morris 1979. Scott 1993, 67, GL 5. *TIRCGLL* 1983, 65-6. Courtyard villa, founded mid 2nd c.; abandoned late 4th c. (*Silures*).

Locking, Avon, Wales.

JRS 48, 1958, 146. *PSANHS* 95, 1950, 173. Scott 1993, 16, SMR 206, AV 52, bath block. *TIRCGLL* 1983, 66, villa; occupation from pottery, 3rd to late 4th c. (*Belgae*).

Loddington, Northamptonshire.

RCHM County of Nothants, Central 2, 1979, 105-7, No.39, item 3, well. George 1904, 17.

Loddon, Norfolk.

Scott 1993, 135, SMR 17982, NF 132, bath-house.

London

Britannia 1, 1970, 42, 44, 49, 51-3, 65, Ant. Itin. 471-480, passim, (*Londinio*, *Lundinio*), 292, baths; 6, 1975, 268, timber water pipe, baths; 7, 1976, 350, wood-lined drain, timber water pipe, baths; 13, 1982, 373-4; 16, 1985, 202, water supply; 18, 1987, 335; 19, 1988, 461, Fig.21, amphitheatre; 21, 1990, 342-4. *Current Arch.* 49, v(2) 1975, 39-49, 'Seal House', report by J Scholfield. Grimes 1968. (Note: The literature on Roman London (*Londinium*) is extensive and only some that refers to water related structures will be cited). Maloney 1990, Vol.1, *CBA Reports* No.69. Maloney & de Moulins 1993, Vol.3, *CBA Reports* No.88. Marsden 1980. Merrifield 1965; idem. 1969. Milne 1985. Morris 1982 (as revised by Sarah Macready). (see p.104 for status of *Londinium*). Perring, Roskams & Allen 1991, Vol.2, *CBA Report* No.70. *JRS* 55, 1965, 215. '*Municipium civium Romanorum*', a special status accorded to London in the Empire. 3 public baths: 1) Huggin Hill; 2) Cheapside; 3) Billingsgate, and an apparently private bath; many wells, drains and springs. Wachter, 1995, 88-111. Wilmott 1982, *TLMAS* 33, 1982, 1-31. Wilmott mentions 55 Roman wells and gives a detailed description of the development of the timber lining of the wells; Wilmott 1984, *TLMAS* 35, 5-10. Wilmott adds three more wells to his list of 55. Many excavation reports have been reported in in

London Archaeology and *TLMAS* during the last four decades. During the last decade extensive excavations at the Guildhall Yard has revealed the amphitheatre of Roman London and its elaborate drainage works to drain water which was a problem as a result of the high water table in the area. Three systems of drainage works has been discovered. This work has still to be written up. Wilmott 1982a, *TLMAS*, 33, 1-31; *idem*, 1982b *London Archaeologist* Vol.4(9), 234-42, 4 baths; *idem*, 1991, *LMAS* Special Paper 13. *TIRCGLL* 1983, 66, *RIB* 1-40. Town established c. AD 50, destroyed by Boudica AD 60; gradually rebuilt over the next two decades. Residence of the procurator of Roman Britain probably before AD 60. Walls built c. AD 200, enclosing 132ha, and a riverside wall added c. 4th c. A bridge over the Thames linked London to the suburb at Southwark. (*Londinienses*). London.

Long Melford, Suffolk.

JRS 49, 1959, 124, bath. Smedley 1958-60, 274. Smith 1987, 154-5.

Long Wittenham, Oxfordshire.

Archaeologia 38, 1862, 327-52; 39, 1863, 135-43. *Berks. Buck. and Oxon. Arch. J.* 1(4) 1896, 120-1; 4(4), 1899, 124; 8(1) 1902, 30-1, H J Hewitt reports on his excavations on the site and the discovery of 7 wells with Roman pottery and other small finds. *Britannia* 1, 1970, 302; 8, 1977, 421. Scott 1993, 160, *SMR* 3172, OX 37, 'several wells'. *PSA* 18, 1899-1901, 10-16. *VCH Berkshire* 1, 1906, 220-1.

Longstock, Stockbridge, Hampshire.

JRS 12, 1922, 270-3, bath-house. *PHFC* 9, 1920-4, 288-90, 388, 398. Scott 1993, 85, *NAR* SU 33 NW 4, HA 58.

Longthorpe, Cambridgeshire.

Dannell & Wild 1987, *Britannia* Monograph No.8. *Durobrivae* Vols.1-8, 1973-80: 1, 1973, 1-10, Fig.1, map of archaeological sites in the Nene valley. Frere & St Joseph, *Britannia* 5, 1974, 1-129. Occupation c. 3000 BC through to Iron Age and Roman periods. Well, drain, tank. *TIRBS* 1987, 52, Claudio-Neronian vexillation fortress (10.9ha) on bank of river Nene; later reduced in size to 4.4ha. (*Catuvellauni*).

Loughor, West Glamorgan, Wales.

Arch. Camb. 122, 1974, 99-146. *Britannia* 1, 1970, 55-7, 272, fort; 2, 1971, 245-6; 3, 1972, 300-2; 14, 1983, 282, bath-house; 15, 1984, 268-

9; 19, 1988, 421; 23, 1992, 258. *TIRCGLL* 1983, 67, fort and minor settlement; pottery of AD 75-130. (*Silures*).

Low Borrowbridge, Cumberland ?

Britannia 1, 1970, 53-4 Ant. Itin. as 'Alone'; 4, 1973, 260 n.45 as 'Alione' in Not. Dig.; 8, 1977, 377 bath; 23, 1992, 272, 312. *JRS* 42, 1952, 91; 49, 1959, 135. *RCHME* Westmorland 1936, 99-100. *TCWAAS*(2) 47, 1947, 1-19; 51, 1951, 40-66. *TIRBS* 1987, 53, RIB 756. Fort in Lune gorge (1.13ha). Possible small Flavian post. Fort with stonewall built c.AD 120; rebuilt in early 3rd c. Occupation to end 4th c. Extramural bath-house. (*Brigantes*).

Low Ham, Somerset.

Britannia 7, 1976, 358-9, villa; 9, 1978, 308-9. *PSANHS* 92, 1946, 25-8. *SDNQ* 25, 1947-50, 1-6, 61-4, 141-3. *TIRCGLL* 1983, 67, timber house of 2nd c., succeeded by stone built villa enlarged late 3rd c., and again c. AD 330; abandoned c. AD 367. Baths. (*Durotriges*).

Lower Slaughter, Gloucestershire.

RCHM 1976, 78-8-, Fig. opp. p.79, 11 wells. Scott 1993, 74, SMR 345, GS 71.

Lufton, Brympton, Somerset.

Pevsner 1958, 225. *PSANHS* 92, 1946, 41-3; 97, 1952, 91-112; 116, 1972, 59-77. Scott 1993, 166, SMR 53634, SO 5. *TIRCGLL* 1983, 67, coridor villa; elaborate octogonal baths. (*Durotriges*).

Lullingstone, Eynsford, Kent.

Arch. Cant. 63, 1950, 9, no.60; 65, 1952, 26-78; 66, 1953, 23f, no.41; 67, 1954, 15-36; 70, 1956, 249-50; 72, 1958, xlvii-1. *Britannia* 1, 1970, 312; 2, 1971, 169, 176 no.41, 181 no.60, 187, 190, 192-3; 3, 1972, 251f, 270-2, 274-5; 4, 1973, 227; 6, 1975, 196-7; 7, 1976, 171, 175, 186, 189; 9, 1979, 309-13; 17, 1986, 426. Meates 1955(1963). Meates 1979, Vol.1, 'The Site'. Meates discusses the problem of water supply, suggesting that from the well-head outside the bath building a line of wooden pipes delivered water from the well as it was drawn from the well by slaves or others. However the problem is not resolved. Well was 1.83m in diam. and c. 6m deep. Above the chalk it was lined with interlocking oak planks in a 1.22m square framework. It was lined with flint rock to the depth of the chalk..'. Scott 1993, 104, 'The "Deep Room" constructed c. AD 80-90; Belgic occupation until

early 5th c. when it was destroyed by fire'. *TIRCGLL* 1983, 67, unique type villa. (*Cantiaci*).

Lunt, Warwickshire.

Applebaum 1967, 21-34. *Britannia* 10, 1979, 21-3, 34, 40-1; 12, 1981, 339; 14, 1983, 295; 16, 1985, 286-7; 21, 1990, 294. Hobley 1973, 2nd Interim Report, *TBWAS* 85, 1971-73, 7-92, pls.1-14. Hobley 1975, *TBWAS* 87, 1-56. 6 wells, some lined and others unlined; drains and 15 watertanks. *TIRBS* 1987, 4. Large fort of unknown size, reduced in size (1.21ha) c. AD 64-80; in late 3rd c., civilian occupation. The fort had a 'gyrus' for training horses. 2 wells within the *retentura*, Fig.11, p.39 of *TBWAS* 85, which also shows all the water structures. (*Corieltavi*).

Lydney, Lydney Park, Gloucestershire.

Britannia 1, 1970, 138, 148; 4, 1973, 151, 207; 6, 1975, 184-5; 7, 1976, 187, 200; 8, 1977, 199; 12, 1981, 357; 13, 1982, 380; 16, 1985, 248-9; 19, 1988, 469; 20, 1989, 310. Hanson 1970, 370, comments 'A line of a wooden pipeline supplying baths at Lydney has been excavated'. McWhirr 1981, 152-5. *The Soc. of Antiquaries of London* 9, 1932, 132-7. Scott 1993, 74, GS 72. Ross, 1967, 22, 176, 339. Wheeler 1932, 52-55. *TIRCGLL* 1983, 68, *RIB* 305-8. Temple, with priests accommodation, a guesthouse and baths. Aqueduct wooden pipeline, bath, tank, drain, latrine, temple, guesthouse. (*Dobunni*).

Lyminge, Church, Kent.

Scott 1993, 106, KE 54, bath-house. *VCH Kent* 3, 1932, 123.

Lympne, Kent.

Britannia 1, 1970, 45-6, 65, Ant. Itin. 473.7, 473.10, (*ad portum Lemanis*); Rav Cos. 106.35 (*Lemanis*), 241-2; 2, 1971, 172, 188; 8, 1977, 235, 238, 246, 425; 11, 1980, 227-88; 16, 1985, 209-36. Collingwood & Richmond 1969, 51. Cunliffe 1980, 227-88. Hutchinson, Poole, Lambert & Bromhead 1985, 209-36. *VCH Kent* 3, 1932, 55-9. *SxAC* 107, 1969, 102-25. Johnston 1977, 29-30. Johnson 1979, 53-6. *TIRCGLL* 1983, 68; fort at the mouth of the East Rother (*LEMANA FLUMEN*, Rav. Cos. 108.39); 2nd c. port and probable naval base of the *Classis Britannica* (*RIB* 66); 3rd c. fort of the 'Litus Saxonicum'; walls and bastions; baths. (*Cantiaci*).

Lynch Farm, Cambridgeshire.

Durobrivae 1, 1973, 20-21, (Wild J P); 28-30, (Manning W); 2, 1974, 23 (Challands A). *Britannia* 4, 1973, 291-3; 5, 1974, 433; 6, 1975, 252. *Northants Arch.* 8, 1973, 9-12, 2 stone-lined wells; Lynch Farm is low-lying, with lots of flooding seen by numerous enclosures and drainage ditches. Quite an elaborate farmstead of the 3rd-4th c, with a smithy and a fishtank.

Lyne, Peebles, Borders, Scotland.

Britannia 3, 1972, 9, 14, 44-5; 5, 1974, 153. Hanson 1970, 370, comments 'An aqueduct-fed supply system, its source being to the N-W of the site, has been identified at this fort. Originally interpreted as sewers and cesspits the stone-built channels and tanks can be recognised from the excavation report'. Christison, *PSAS* 35, 1900-1, 154-86, 179-81, Figs.8 & 15, 3 cisterns, 2 drains. Hanson & Maxwell 1983, 148. *JRS* 41, 1951, 57; 45, 1955, 85; 51, 1961, 121; 55, 1965, 79; 63, 1973, 216-7. *PNRB* 1979, 300-1. Richmond 1941, *PSAS* 75, 39-43, stone-lined aqueduct channel; 95, 1964, Steer & Feacham 1959-63', 208-18, plan. *RCAHMS Peeblesshire* 1, 1967, 173-5, plan. Stephens 1985(b), 224, comments that the aqueduct was a stone-lined channel, and the cisterns were stone-lined. *TIRBS* 1987, 53, Antonine II(?) fort (2.66ha); two annexes. Antonine I (?) fortlet (0.11ha) 150m to North.

Maidenhead, Berkshire.

BBOAJ 30, 1926, 76. *Maidenhead & Taplow FC* 8th Annual Report, 1890-1, 50-2. Scott 1993, 23, *SMR* 169, BK 28, bath.

Maidstone, Kent.

AEx 1972, 58. *Arch. Cant.* 10, 163-72. *Britannia* 2, 1971, 172-4; 3, 1972, 357; 4, 1973, 323 villa. *JBAA* 2, 1847, 86-8. Scott 1993, 106, KE 56-KE 61, at TQ 75 56 KE 56, villa at 'The Mount', found in 1843, and again excavated 1970; at TQ 74 56 KE 59, extensive villa found c. 1835. Smith 1876. *VCH Kent* 3, 1932, 98-103, Figs.19 & 20. Possibly 2 baths. *TIRCGLL* 1983, 68, major settlement. (*Cantiaci*).

Malton, North Riding, North Yorkshire.

AEx. 1970. *Antiquity* 2, 1928, 69-82. *Britannia* 1, 1970, 40-1, Ant. Itin. 466.2 (*Derventione*), 313-4; 2, 1971, 252-3, vexillation fortress, vicus and minor settlement, 291, 302-3; 3, 1972, 361; 4, 1973, 188; 5, 1974, 7; 6, 1975, 84; 7, 1976, 139-40; 8, 1977, 288; 9, 1978, 382; 10, 1979, 10, 35; 17, 1986, 449; 19, 1988, 504; 20, 1989,

178. Hanson 1970, 370, item 59B, comments, 'A wooden pipeline, probably of mid to late 2nd c. date, was found running down the centre of the main street in the civilian settlement at Malton. It supplied water to the shops and houses on either side of the road'. Mitchelson 1963-66, YAJ 41, 209-61 at, 212-3, Figs.5 & 6, gives details of the well, 5.47m deep, and 1.8m in diameter at the top, narrowing down to 0.6m diam. at c. 3m depth. Robertson 1978. Stephens 1985b, 227, item 45, comments, 'The road running to the S-E gate of the fort was flanked by a wooden pipeline from about the second quarter of the 2nd c. (Mitchelson 1964, 213, pl.iv). The excavator believed that this pipeline supplied two small buildings in the "hop area" of the vicus. Since the road is military, the chances are that this pipeline supplied official structures, so that the buildings may have been military *fabricae*. The pipeline could not have conveyed water from the nearby Lady spring. It presumably conveyed water either from the fort, or from an external source from which the fort was also supplied. Another pipeline will have supplied the recently located extramural bath-house (*Britannia* 2, 1971, 252; Wright & Hassall 1971, 291.9). Periods cover Trajanic, Severan, Constantian and Theodesian dates'. Wenham 1974. CSIR I.3, 1983, Nos.18, 37, 100, 116. TIRBS 1987, 54, RIB 711-9. Possible early Flavian vexillation fortress (c. 8.9ha). Large Agricolaan fort (3.4ha), evacuated c. 120-158. Reconstruction early 3rd c.; held till late 4th c. Extensive civil settlement. (*Parisi*).

Mancetter(1), Warwickshire.

Britannia 1, 1970, 42 Ant. Itin. 470.3 (*Manduesedo*); 2, 1971, 263; 3, 1972, 319; 8, 1977, 379-80, fort; 9, 1978, 440; 12, 1981, 339, 3 ditches dating to c. AD 45-65; 13, 1982, 361, dated to c. AD 40-60, and occupied to 4th c.; 15, 1984, 295-7, vexillation fortress; 16, 1985, 286-7; 22, 1991, 250. TBAS 77, 1959, 5-17. TBWAS 74, 1958, 30-52; 91, 1981, 1-24. Oswald & Gathercole 1958, TBWAS 74, 30-52. Smith 1987, 224-6. Swan 1984, fiche 651 (*Mancetter(2)*). TIRBS 1987, 54. (*Corieltavi*).

Mancetter(2), Warwickshire.

AEx 1971. *Britannia* 2, 1971, 263; 3, 1972, 309, 319, 3 wells and water channels; 9, 1978, 440-1. Swan 1984, fiche 650, 651, well, water channel, cistern-sump, 654, wells 2 and 3 after mid 3rd c. JRS 55, 1965, 208; 59, 1969, 217. LAHS 1970-2, 72. WMANS 14, 1971, 15-6; 20, 1977, 70-1.

Manchester

Britannia 1, 1970, 42-4, 53, Ant. Itin. 468.7 (*Mamucio*), 482.2 (*Mamcunio*, var. *Mancunio*); 4, 1973, 283, vicus; 7, 1976, 319, fort; 10, 1979, 291; 11, 1980, 364; 17, 1986, 385; 19, 1988, 444. Bruton 1909a. *Greater Manchester Arch. J.* 1, 1985, 13-18, Figs.8 & 9, ?aqueduct, ?well. Vicus at SJ 833 977.

Mansfield Wood House, Northfield, Nottinghamshire.

Archaeologia 8, 1787; 363-76. *Antiq. J.* 18, 1938, 176-8. *Arch. J.* 43, 1886, 28ff. *JRS* 29, 1939, 206. *PPS* 5, 1939, 187, 192. Scott 1993, 155, SMR 04001, NT 22, 2 baths, one in villa, other in aisled farmhouse. Scott 1973, Vols.1 & 2, 179-82, period of occupation c.AD 80-c.AD 450-475, spring, leadpipes, baths, separate latrine. Todd 1973, 89. *TTS* 53, 1949, 1-14. *VCH Nottinghamshire* 1, 1910, 28. Whitwell 1982, 270.

Market Overton, Leicestershire.

JRS 47-8, 1957-8, 90, 137, 212; 50, 1960, 224; 51, 1961, 175, plan; 52, 1962, 172, 192; 55, 1965, 207. *MJTL* 1966, 84, 93-4, 146, St Joseph VE95, VJ75. Scott 1993, 113, SMR SK 81 NE AB, LE 60, SK 89 16; SMR SK81 NE BQ, LE 61, SK 88 16. *VCH Leicestershire* 1, 1908, 89, 90-3. Whitwell 1982, 271, SK 91 NW 3. Well.

Marshfield, Avon.

Arch. Rev. 4, 1969, 41. *Britannia* 14, 1983, 317; 16, 1985, 302; 17, 1986, 415; 18, 1987, 343; 19, 1988, 471. Blockley 1985, BAR 141, watertank, drain, foot-bath, lead-pipe. Blockley & Day 1982. *RCHM* 1976, 80. Scott 1993, 17, at ST 79 76, Ironmongers Piece, AV 56; at ST 78 73, The Hams, SMR 2051, AV 57, drain made of limestone slabs. Occupation mid 1st c.

Marsworth, Buckinghamshire.

Records of Buckinghamshire 18, 1970, 440. Scott 1993, 29, SMR 1520, BU 57, SMR 1269, BU 58. Well.

Maryport, Cumbria.

Archaeologia 10, 1787, 140. Birley, 1961, 129-31, 220, no.41. *Britannia* 2, 1971, 128-9; 3, 1972, 355; 4, 1973, 112, 260; 22, 1991, 295-6. Bruce, 1978, 273-8. Collingwood ?, 'The Roman Fort and Settlement at Maryport'. Jarrett 1976. Stephens 1985(b), 226, item

34, comments, 'A sculptured panel of Venus at the Bath (Bruce, *Lapidarium Septentrionale* 901) may have come from a fountain or cistern (Richmond & Gillam 1950, 167). This might well be indicative of an aqueduct supply in view of the analogous panel from High Rochester and the fountain at Housesteads'. *TCWAAS*(2) 23, 1923, 142-53; 26, 1926, 415-22; 36, 1936, 85-99, bath-house and well, within fort; 39, 1939, 19-30; 54, 1954, 268-71; 58, 1958, 63-7; 65, 1965, 118; 70, 1970, 42. *TIRBS* 1987, 55, *RIB* 808-79. Hadrianic fort (2.58ha), to late 4th c. (*Brigantes*).

Melandra Castle, Derbyshire.

Britannia 1, 1970, 283-4, *vicus* and *mansio*; 5, 1974, 420, bath-house; 6, 1975, 244; 7, 1976, 323; 8, 1977, 387f; 9, 1978, 432; 10, 1979, 293; 12, 1981, 335; 14, 1983, 299; 16, 1985, 282-4, Fig.18, 'an extramural bath-house which stood on a narrow artificial terrace...'; 22, 1991, 245, 'a stone-lined drain was uncovered...'; 24, 1993, 288, drain. Bruton 1909b. Conway 1906. *DAJ* 69, 1949, 1-40; 83, 1963, 1-9; 91, 1971, 58-118. *VCH* Derbyshire 1, 1905, 216-21. *TIRBS* 1987, 55, *RIB* 279-80. Fort (1.16ha) c. AD 80-140; stonewall added perhaps c. AD 160; casual use in 3rd and 4th c. Civil settlement. (*Brigantes*).

Methwold, Norfolk.

Phillips, 1970, 250. *VCH* Norfolk 1, 1901, 297-8, bath. *TIRBS* 1987, 56. (*Iceni*).

Middleham, North Yorkshire

JRS 31, 1941, 131; 47, 1957, 208. Scott 1993, 151, NK 22. Tyler 1980, 70. *YAJ* 7, 1882, 459-64, bath; 35, 1943, 226.

Mildenhall, Wiltshire.

Annable 1976, 126-7, well, c. AD 50-60. *Britannia* 1, 1970, 58, Ant. Itin. 486.5 (*Cunetione*), 118, 121, 126; 4, 1973, 169; 5, 1974, 341; 6, 1975, 43-5, well. Burnham & Wachter, 1990, 148-52, Figs.42, 43. Frere & St Joseph 1983, pl.101, *CUAC BTT*, 007, 009, 0013, 0014. *WANHM* 57, 1963, 30-8, 'Excavations and Fieldwork in Wiltshire, 1960', bath-house; 70-1, 1975-6, 126-7. Smith 1987, 258. *VCH* Wiltshire 1, 1957, 88-9. *TIRCGLL* 1983, 71. (*Atrebates*).

More, near Linley, Shropshire.

Gentleman's Mag. 2, 1856, 500. *HBMC* 1983, Nat. No. 13158. *Illustrated London News Supplement*, Oct., 4, 1856, 352-3. Scott 1993,

164, SMR 1226, SH 6. TCSVFC 15, 1957-60, 81. VCH Shropshire 1, 1908, 257. Webster 1975, 100-2 (1975), 114-5 (1991). Wright 1872, 257-8. Aqueduct, well, drain.

Moresby, West Cumberland.

Birley 1961, 224-6. *Britannia* 4, 1973, 335, fort relocated; 5, 1974, 286-7; 8, 1977, 179; 10, 1979, 283-4; 15, 1984, 234, 470, inscription. Bruce 1861, 139, 'There is a well in the south brow of the camp, called Holy-well, which it is said never runs dry'. Bruce, 1978, 224-6. JRS 53, 1963, 160, No.5, inscription. TCWAAS(2), 48, 1948, 42-72; 49, 1949, 218-9; 51, 1951, 176-7. TIRBS 1987, 57, RIB 797-805; fort (1.46ha) on Cumberland coast, late Hadrianic to 4th c. civil settlement. *Not. Dig.* xl, 50, (*Cabrosenti*, var. *Gubrosenti*); *Rav. Cos.* 107.3 (*Cabrocentio*). (*Brigantes*).

Morton Bourne, Lincolnshire.

LAASRP 8 (ns.) 1950-60, 62. Whitwell 1982, 276, TF 12 SW B, aqueduct leat.

Mountsorrel, The Hill, Leicestershire.

Arch. Alian. ?, ?, 172-99, at 189-9, bucket. LAS 2, 1870, 106; 5, 1882, 345. PCAS 8, 1892-3, 'On an Ancient well at Mountsorell, 133-41. Scott 1993, 114, SMR SK 51 SE G, LE 64, well. VCH Leicestershire 1, 1907, 172, pl., well, rectangular 2.13m by 1.22m, 18m deep, and bucket, 215. Whitwell 1982, 277, SK 51 SE 1. TIRBS 1987, 57. (*Corieltavi*).

Mucking, Thurrock, Kent.

Britannia 3, 1972, 334-5; 4, 1973, 305; 5, 1974, 442; 6, 1975, 264-5; 7, 1976, 344; 8, 1977, 451; 12, 1982, 372. *Current Arch.* 50, v(3), 1975, 73-80; several wells.

Mumrills, Antonine Wall, Stirlingshire, Scotland.

DAES 1982, 5-6. Hanson 1970, 370, item 60, comments, 'Badly sited, from the point of view of water supply, on a dry plateau the water for the garrison of this fort must have come from the only nearby source, the Westquarter Burn. The water could either have been pumped up from a point below the fort or, more likely, have been piped into the fort by means of an inverted siphon from the higher reaches of the Burn about 0.8km (0.5 mile) to the west'. Macdonald 1934, 194-214. Macdonald & Curle 1929, 396--575. PSAS 1928-9, 396-575; 94, 1960-1,

86-132. *RCHAMS* Stirlingshire 1, 1963, 96-9. Robertson 1990, 6, 20, 47-51. *CSIR* I.4, 1985, Nos. 69-71. *TIRBS* 1987, 57, *RIB* 2140-2. Large fort (2.88ha).

Munthem Court, West Sussex.

ANL 5, 1954-5, 204-5; 6, 1955-60, 101-2. *Britannia* 11, 1980, 173, settlement from Iron Age to Roman, 192f Romano-British ritual site with well; occupied to 4th c. *TIRCGLL* 1983, 73, shrine. (*Regni*).

Nantwich, Cheshire.

McNeil & Roberts, 1987, *Britannia* 18, 1987, 287-8, Fig.5, tank.

Nazeingbury, Nazeing, Essex.

Britannia 7, 1976, 344-5, 3 wells, one c. 1.5m square and 2m deep, with wattle lining; 8, 1977, 407. Occupation later 1st c. to after 2nd c.AD, when it ceased, and reoccurs in 7th to 11th centuries.

Neath, Glamorgan, Wales.

Britannia 1970 55-6 Ant. Itin. 484.2 (*Nido*), 192 fort; 8, 1977, 287-8; 15, 1984, 269; 16, 1985, 256; 20, 1989, 263; 21, 1990, 306. Nash-Williams 1969, 98-101. Webster, 1981, 57. *TIRCGLL* 1987, 74, fort founded c.AD 75, and abandoned c. AD 130. (*Silures*). (no water-related structures).

Neatham Hampshire.

Black 1995, 118, *mansio*. *Britannia* 1, 1970, 60-1 Ant. Itin.; 2, 1971, 283; 3, 1972, 348; 4, 1973, 317, pl.xxxv; 6, 1975, 213-6, 278, water tanks, 286; 11, 1980, 393, bath; 12, 1981, 384-5; 20, 1989, 178, 186. Millett 1975a. Millett 1975b, *Current Arch.* 52, v(5), 135, comments, 'may have had a military origin,...but after the conquest it formed the nucleus of the settlement'. Occupation from 1st to 4th c. or mid 5th c.AD as indicated by pottery. Bath-house, well, drains, watertanks timber-lined. *TIRCGLL* 1983, 74, minor settlement, established 1st c and active to the 4th c. (*Belgae/Regni*).

Nether Wild Farm, Aldenham, Hertfordshire.

Britannia 1, 1970, 289. *JRS* 53, 1963, 136 (spelt *Netherwylde*), Colney Str. 2 baths.

Netheravon, Wiltshire.

Scott 1993, 205, SMR NW 301, WZ 128. WAM 45, 1930-2, 490-1; 47, 1935-7, 538. Bath.

Netherby, Cumbria.

Birley, 1961, 229-30. Breeze & Dobson 1976, *passim*. *Britannia* 1, 1970, 42 Ant. Itin. 467.1, 144, 155; 17, 1986, 441. Bruce, 1978, (13th ed.), 311-4. Stephens 1985(b), 225, item 23, comments, 'The extramural bath-house was supplied by an undated ceramic pipeline fed from a spring c. 35m from the building (Bruce 1867, 439; Birley 1953, 15)'. TCWAAS(2) 52, 1953, 197, 200; 60, 1960 203; 62, 1962, 250; 69, 1969, 16; 83, 1983, 41-7. TIRBS 1987, 58, fort and extensive civil settlement. (*Brigantes*).

Nettleton, Wiltshire.

Britannia 6, 1975, 45; 20, 1989, 187, 190, 205. JRS 52, 1962, 191. Smith 1987, 292-3. VCH Wiltshire 1, 1957, 91. Wedlake 1982, aqueduct leat. TIRCGLL 1983, 74, possible fort, succeeded by shrines. (*Belgae/Dobunni*).

Newcastle, Hadrian's Wall, Northumberlandshire.

Britannia 5, 1974, 410; 9, 1978, 419; 10, 1979, 279-80 fort; 11, 1980, 358, 410; 12, 1981, 307, 309-10; 15, 1984, 279; 17, 1986, 329, 376-8; 18, 1987, 315; 19, 1988, 433. *Northumberland County History*, 13, 1930, 501-7. Birley 1961, 161-3. CSIR I.1, 1977, *passim*. TIRBS 1987, 58, fort and civil settlement. ?aqueduct. (*Brigantes*).

Newhaven, East Sussex.

Black, 1987, 155, Figs.17, 18, bath-building; 'half-box' tile suggests date before c.AD 75-80; stamped tile of c.AD 90-110; tile fragments relates to abandonment of site c.AD 200, and presumably bath-building demolished at this time. Bell 1976, 250-1. *Britannia* 2, 1971, 187, 190; 4, 1973, 458; 6, 1975, 282. Scott 1993, 59, EA 16; EA 17. Spurrell 1852, 262-6. VCH Sussex 3, 1935, 61.

Newnham, Bedford, Bedfordshire.

Britannia 4, 1973, 296, well, stone-lined; 5, 1974, 435; 6, 1975, 256; 7, 1976, 335. Simco 1984, 26-8. Occupation from the Iron Age to Saxon times. Roman occupation c. 2nd to 4th c. TIRBS 1987, 58. (*Catuvellauni*).

Newport, Isle of Wight.

Antiq. J. 9, 1929, 141-51, 345-71. Basford 1980, 123. *Britannia* 2, 1971, 173-93; 12, 1981, 303-4; 22, 1991, 303; 25, 1994, 30. Scott 1993, 102, SMR 855, IW 11. Suetonius, c.AD 120, *The Island of Vectis, very near Britannia*. Tomlin 1987. *TIRCGLL* 1983, 75, winged corridor villa, with 2 baths, of 2nd c. (*Belgae*).

Newstead, Borders Region, Scotland.

Britannia 4, 1973, 150-1; 21, 1990, 313, Fig 7; 24, 1993, 283-3, '...a steep-sided flat-bottomed drain'. Clarke J, 1933. Clarke S, 1995. Clarke S, 1996. Curle 1911, 99-102, bath, drains, and 107 pits/wells. Hanson 1970, 371, comments, 'A line of earthenware pipes carrying water to the external bath-house and nearby latrine from the direction of the fort was uncovered at Newstead. The source of water for the pipeline is unknown, nor was any trace of a water supply found during excavations within the fort'. *PSAS* 84, 1949-50, 1-38. *RCAHM Roxburghshire* 2, 1956, 313 Fig 424 & 316 Fig 426. Jones, Clark, Clarke & Rush, *The Newstead Research Project*, Interim Reports 1989 and 1990, and Preliminary Reports for 1991, 1992 and 1993. Stephens 1985, 224, item 17, comments, 'The extramural bath-house was supplied by two ceramic pipelines, one of which appears to run towards the latrine (Curle 1911, 99, 102). These must have been fed by an aqueduct. The fact that the block served only the auxiliary troops of the garrison (Richmond 1949-50, 23), implies wider distribution to the legionary bath-house, and perhaps also to the fort. The system seems to date from Phase III (Antonine I)'. *CSIR I.4*, 1985, Nos. 45-56, 66. *TIRBS* 1987, 58, *RIB* 2120-30. Large Flavian I (4.2'9ha) and II (5.78ha), Antonine I & II (5.95ha) forts; annexe and *mansio*. Occupation continued after retreat from Scotland (c. AD 163) to c. AD 180(?). (*Selgovae*).

Norden, Dorset.

Britannia 1, 1970, 299; 4, 1973, 316, two inscribed altars in association with a well with steps. *TIRCGLL* 1983, 75, shrine, well; coins attesting to occupation from 1st to 4thc. (*Durotriges*).

Norfolk Street, Leicestershire.

Britannia 7, 1976, 327-8; 11, 1980, 367, bath-suite in N-Wing, drain; 12, 1981, 337, Fig.9, water tank. Condron 1996, 374, Leicestershire SMR 278.1851, 16.1879, 11.1912, 287.1975, 907.1978, 526.1980. Liddle 1982, 38-9. *VCH Leicestershire* 1, 1907, 196.

North Leigh, Near East End Farm, Oxfordshire.

AEx 1975, 15; *Antiquity* ?, 1962, 219. *Britannia* 4, 1973, 297; 5, 1974, 436; 7, 1976, 337 bath; 8, 1977, 400; 9, 1978, 444; 11, 1980, 372-3. CBA Gr.9, Newsletter 3, 1973, 16; 4, 1974, 9. Hakewill 1826. Hands 1968. *JRS* 34, 1944, 81; 52, 1962, 175; 54, 1964, 166; 55, 1965, 210. *Medieval. Arch.* 11, 1967, 268; 14, 1970, 162. *Oxoniensia* 8, 1943, 197-8; 23, 1958, 133-4; 24, 1959, 13-21; 33, 1968, 138; 35, 1970, 107. Scott 1993, 160-1, SMR 1314, OX 41, 2 or 3 baths and 2 or 3 wells. VCH Oxfordshire 1, 1939, 316-8, 319, 341, 3 baths; 1976, 20. Wilson & Sherlock 1980, HMSO. *TIRCGLL* 1983, 75, large courtyard villa; occupied from 1st to 5th c. (*Dobunni*).

North Mundham, West Sussex.

Scott 1993, 188, SMR 0735, WS 62, NAR SU 80 SE 34, Chichester Museum Accesories Register no. 4304, bath.

North Stainley, Ripon, North Yorkshire.

Archaeologia 32, 1846?, 133. *Arch. J.* 32, 1875, 134-54. *SxAC* 81, 1940, 62, '...where the 1st period baths, excavated in 1866-74, include a *frigidarium* drained in one corner...'. *JRS* 11, 1921, 83; 18, 1928, 197; 19, 1929, 190. Scott 1993, 151, NK 26. Tyler 1980, 33. *YAJ* 38, 1955, 257-9.

North Wraxall, Truckle Hill, Wiltshire.

Britannia 4, 1973, 334. Scarth 1864, 121-2, bath, well. Scott 1993, 205, SMR NW 304, WZ 130, bath. VCH Wiltshire 1, 1957, 92. *TIRCGLL* 1983, 75, villa with baths and well within courtyard; well is 20.7m deep, circular and lined with masonry and 1.1m in diameter trimmed to diameter of 1.21m. Coins from Trajan period to Gratian, but mostly from early 4th c. (*Belgae*).

Northallerton, North Yorkshire.

Bromehead 1942, 142-51, 183-96, at 144, well.

Northampton, Northamptonshire.

Dryden 1885, 53-61. Swan 1984, fiche 538, well.

Northchurch, Hertfordshire.

Antiq. J. 2, 1922, 379-80. *Berkhamsted Parochial Review* 1971, 94 no.9. *Britannia* 5, 1974, 438, 464. BDAS 1978. *Herts. Arch.* 4, 1974-6, 1-135; 8, 1973, 148-9. *JRS* 19, 1929, 196; 28, 1938, 185. Scott 1993,

94, SMR 1859, HT 38, Northchurch Common, Berkhamsted site, bath-suite; another villa SMR 1861, HT 39; a hypocaust, SMR 1334, HT 41, Dudswell Rise; earthworks of Roman building, SMR 1337, HT 42 at TL 00 09, Berkhamsted Golf Course site. *TIRCGLL* 1983, 26, corridor villa of Antonine period with later development. (*Catuvellauni*). Occupation c. AD 70, abandoned c. AD 170 and reoccupied AD 339.

Northfleet, Kent.

Black 1987, 147, no.60. *Britannia* 2, 1971, 190; 4, 1973 130 n.8, 137,8; 9, 1978, 472; 10, 1979, 336-7; 12, 1981, 368, bath; 13, 1982, 395. *VCH Kent* 3, 1932, 'County Houses' reports by M V Taylor. Ansell R J, News from Thameside Archaeology Group, *KAR*, 69, 1982, 201-2; 50, 1977, 240ff; 56, 1979, 140. Scott 1993, 105, KE 39. Occupation late 1st/early 2nd c.; altered during Antonine period; probably continuous occupation to Valens' period, from coin. *TIRCGLL* 1983, 75. (*Cantiaci*).

Northmoor, Oxfordshire.

Arch. News, 17, 4, Dec. 1989, 4. Benson & Miles 1974, map 22. *Britannia* 15, 1984, 300-1; 17, 1986, 399, wells; 21, 1990, 334. *Oxford Arch. Unit's Newsletter*, 10, 1983, notes 2-4; 16, 1990, ?.

Norton, Northamptonshire.

BNFAS 7, 1972, 27-9. *Britannia* 3, 1972, 325; 4, 1973, 296. *CBA Gr. 9 Newsletter* 2, 1972, 9. *DOE Arch. Exs.* 1971(1972), 21-2. *RCHM County of Northants, North West*, 3, 1981, 149-158, item 4, No.46, Figs.114-120. Well, stone-lined.

Norton Disney, Potter Hill, Lincolnshire.

Antiq. J. 17, 1937, 138-78. *Arch. J.* 91, 1935, 112-76; 120, 1964, 12, Fig.1. *LHA* 7, 1972, 10. Scott 1993, 124, SMR 7144, LI 123. Whitwell 1982, 284. *TIRBS* 1987, 59-60, winged corridor villa with bath-suite linking villa with barn; occupation 1st to 4th c. (*Corieltavi*).

Norton St. Phillip, Farleigh, Hungerford, Shropshire.

British Museum Skinner Manuscript 1820, 33656, 151, 236. Scott 1993, 169, SMR 23890, SO 42. *VCH Somerset* 1, 1906, 300, 362. Occupation c. 3rd & 4th c., bath.

Nunney, Whatley, Coombe/Chessils Field, Somerset.

Gentleman's Mag. 1, 1838, 435; 2, 1839, ii, 77. *JRS* 49, 1959, 129: '...in the 1st half of the 4th c....rooms including a bath-building added...'. *PSANHS* 114, 1970 37-47. Scott 1993, 170, SMR 23900, SO 45. *Somerset Proc.* 1, 1851, 38; 21, 1875, 67; 35, 1889, 50. *VCH Somerset* 1, 1906, 317. *TIRCGLL* 1983, 75, courtyard villa with bath-suite; probably built c.AD 300 and abandoned c.AD 370. (*Belgae*).

Nursling, Hampshire.

Britannia 26, 1995, 368: 'excavation of 2.7ha site revealed part of a substantial Roman settlement consisting of enclosures, buildings, pits and wells. Probably part of a large settlement first identified in the 19th c. Site dates from mid-1st c. to mid-2nd c., yielding Gallic and Spanish imported pottery'. *Hampshire Field Club and Archaeology Soc.* 50, 1995, 35-41. Composite distribution centre. *VCH Hampshire* 1, 1900, 311. *TIRCGLL* 1983, 75, settlement, coins from AD 70 to AD 380, mostly after AD 250; wells.

Oakham, Leicestershire.

Britannia 18, 1987, 322, 2 wells; 19, 1988, 447-8, '2 wells, one is c. 1.5m in diameter and c.2.5m deep with footholds in the sides'.

Oakley, Scole, Suffolk.

Britannia 25, 1994, 278, possibly 7 wells reported; 26, 1995, 357-8, item 9, Scole-Sturton By-Pass, 'Pre-Roman phase and two Roman phases: 4 wells, the two earlier had wicker linings, and the two later ones, one square, planked shaft; the other one had pieces of an oak cask dating from the 1st c. to later 2nd c. A causeway set on close-spaced piles (many of them appeared to be young spring-cut oak) crossed a channel of pre-Roman date, probably a meander of the river, dating from radio-carbon, giving dates calculated to AD 454-633 and AD 429-653'. *CBA Gr.7 Bulletin* 1960, 9, 'a flint-lined well'.

Oakridge, Basingstoke, Hampshire.

Proc. Hants. FC Arch. Soc. 48, 1992, 55-94. Continuous occupation from early to middle Iron Age (6th-4th c. to 3rd-1st c. BC) settlement (period 1), to an expansion of the site in late 1st c. BC to early AD 1st c. i.e. late early Roman times (period 2), to later Roman occupation (period 3), late 2nd c. to late 3rd c. or early 4th c. AD. A large deep well has been reported, see Figs.7 & 7a, opp. pp. 72-77. Deep well, 26.7m (87ft 6in) at a constant diam. of 1.22m (4ft), to 21.95m (72ft) when it widened slightly to a width of 1.52m (5ft).

Water was reached at 22.48m (73.75ft), but dropped to about 23.27m (73.3ft).

Odell, Bedfordshire.

BAJ 7, 1972, 1-16. *Britannia* 6, 1975, 256; 7, 1976, 336; 8, 1977, 400; 9, 1978, 442, Fig.11, 'Farming based on a single family unit engaged in mixed economy'. 2 stone-lined wells in area B, and a wicker-lined well in area A. Tanks, for watering of animals. Occupation from 1st c. to late 4th c. Bedfordshire SMR 2669.

Odiham, Hampshire.

Britannia 2, 1971, 282-3; 19, 1988, 476. *JRS* 21, 1931, 242-3. *Proc. Hants. FC* 10, 1926-30, 225ff. Scott 1993, 86, NAR SU 75 SW 9, HA 68. *TIRCGLL* 1983, 76, villa with bath-house; active 4th c. (*Atrebates*).

Old Durham, County Durham.

AA(4) 22, 1944, 1-21; 29, 1951, 203-12; 31, 1953, 116-26. *Britannia* 16, 1985, 276. Richmond, Romans & Wright 1944, 1-21. Scott 1993, 56, DU 1, bath. Scott, 1973.

Old Kilpatrick, Antonine Wall, Strathclyde, Glasgow.

Hanson, 1970, 402, well, and refers to buckets and water raising equipment found in well. Miller, 1928, 23, well.

Old Penrith, Cumbria.

Britannia 1, 1970, 42 Ant. Itin. 467.3 (*Voreda*); 4, 1973, 200; 9, 1978, 424-5, 474 vicus. Higham & Jones 1985, 9-128. *JRS* 41, 1951, 54. *TCWAAS(2)* 13, 1913, 177-98; 34, 1934, 217-8; 36, 1936, 132-41; 47, 1947, 166-82, plan; 50, 1950, 202-5; 82, 1982, 51-71. *TIRBS* 1987, 61, *RIB* 914-42, 2287 (milestone); fort (c.1.53ha), late Flavian(?) or Trajanic, perhaps unoccupied c.AD 120-58, after which held till late 4th c. Large vicus and civil settlement, occupied into 4thc. (*Brigantes*).

Old South Eau, Cambridgeshire.

Whitwell 1982, 284, RAF 1069/UK 1049, 4437, TF 284 099 - TF 292 094, aqueduct leat.

Orpington, Fordcroft, Bromley, Greater London.

Arch. Cant. 40, 1928, 46; 71, 1957, xlvi, 240; 72, 1958, 210; 73, 1959, 1; 76, 1961; lii; 88, 1973, 223 bath; 89, 1974, 220. *Britannia*

5, 1974, 446; 6, 1975, 270; 20, 1989, 326, villa. KAR 8, 1967, 9; 78, 1984, 196; 94, 1988, 75-8. CBA Calendar Summaries 1973, 9. Scott 1993, 79, GT 9, bath-suite. TIRCGLL 1983, 76, corridor villa with baths. (*Cantiaci*).

Orton Longueville, Peterborough, Cambridgeshire.

Whitwell 1982, 285 bath. *Britannia* 3, 1972, 322; 6, 1975, 252; 7, 1976, 334; 8, 1977, 398-9; 22, 1991, 257; 24, 1993, 298. Cambridgeshire SMR 1808. JRS 50, 1960, 224-5; 58, 1968, 189-90. Morris 1979, 137-8. PCAS 54, 1961, 50-67. RCHM Huntingdonshire 1926, 195, SMR 01615. RCHM Peterborough New Town, 1969, 29-30. Scott 1993, 40, CA 115-CA 119. MacKreth in Todd (ed.), 1978, 209-23. TIRBS 1987, 80, item 3(c), villa; occupation from late 3rd to mid 4th c. Later occupied by Saxons. (*Catuvellauni*).

Otford, Kent.

Arch. Cant. 39, 1921?, 153ff; 42, 1930, 157-71; 43, 1931, 157; 47, 1935, 236-7; 61, 1948, 182; 68, 1954, 44-5; 70, 1956, 172-7; 81, 1961, lxi. *Britannia* 2, 1971, 169, 187; 3, 1972, 121; 6, 1975, 118; 9, 1978, 309; 14, 1983, 335. JRS 16, 1926, 238, 244; 17, 1927, 209; 18, 1928, 208. KAR 6, 1966, 8-13; 13, 1968, 4-5. Report of the Excavs. Comm. of the Sevenoaks Soc., Ashford, 1928-9. Rivet, 1969, 91, 145. Scott 1993, 107, KE 73 - KE 75. VCH Kent 3, 1932, 122. TIRCGLL 1983, 77. (*Cantiaci*).

Oxford, Churchill Hospital, New Headington, Oxfordshire.

Britannia 3, 1972, 327-8, well; 5, 1974, 436. CBA Gr.9 Newsletter no.2, 1972, 33-4. *Current Arch.* 3, 1971-2, 211, Fig. of site shows well and drain, water tank clay-lined. *Oxoniensia* 17/18, 1952/3, 224-6; 20, 1955, 90; 37, 1972, ?. Swan 1984, fiche 589. VCH Oxfordshire 1, 1939, 301-3. TIRCGLL 1983, 77, minor settlement; occupation pre-Roman, Romano-British and post-Roman. (*Catuvellauni*).

Oxford(2), St. Luke Road, South Cowley, Oxfordshire.

Atkinson 1941, 9-21. *Oxoniensia* 6, 1941, 9-21; 38, 1973, 215-7, Fig.1. Young C J, 1977, BAR 43, 245-6, well for water supply.

Pagans Hill, Chew Stoke, Somersetshire.

Britannia 7, 1976, 175, 178, 180; 15, 1984, 336; 20, 1989, 201-17. PSANHS 96, 1951, 112-42, p.134 no.60; 101, 1956-7, 15-57, a temple

well, stone-lined, cut in rock, 5.17m (17ft) deep. Rahtz & Watts 1989, Arch. J. 146, 330-71, Figs.1, 2 & 7. Thomas 1981, Fig.48(map). TIRCGLL 1983, 77, Romano-Celtic temple and well. Built late 3rd c and in use until early 5th c. (Belgae).

Pamphill, King Down/Bradford Down, Dorset.

Arch. Rev. 3, 1968, 14; 4, 1969, 36-7; 7, 1972, 28. Branigan 1976, 36. Britannia 4, 1973, 315. Field 1982, PDNHAS 104, 71-92, bath at p.82. PDNHAS 76, 1954, 98; 90, 1968, 171; 91, 1969, 189; 92, 1970, 151; 94, 1972, 76; 104, 1982, 71-92. Scott 1993, 53, SMR 3 016 070B, DO 23.

Paulton, Somerset, Avon.

VCH Somerset 1, 1906, 315-6, item 22, Fig.75, bath.

Pen Llystyn, Gwynedd, Wales.

Arch. J. 125, 1968, 124-6. Britannia 3, 1972, 13 n.56, 66, 69-70, 73-5, 79, 85-7; 5, 1974, 13, 20-2, 27; 10, 1979, 21-2, 27-8, 41, 52-3, 272; 12, 1981, 21, 23-4, 27. Hanson 1970, 371, item 62, comments, 'The wooden pipeline bringing water into the fort from an unidentified source to the N-W of the site has been recently discovered'. Hogg, 1968, 101-92, Figs.19-24 and pl.xii.. At pp.124-6 he describes the water supply to the fort. Stephens 1985, 228, item 51, comments, 'A roughly square channel identified as a water pipe entered the fort through the N-E gate (Hogg 1968, 124-26, pl..XII.B). At fairly regular intervals of about 7.6m, the pipe trench was found to increase from 0.6m to 0.9m in width for a length of about 1.2m; "these sections were solidly packed with clay and presumably correspond to the junctions between pipes". This would denote pipes an unprecedented c. 8.2m long. Although rectangular pipes are known at London (Wheeler 1930, Pl. XII), it is difficult to believe that pipes of this length would have been provided. It is much more probable that this was a simple wooden channel fashioned from planks, rather than a wooden pipeline. The fort is late-Vespasianic but the channel must be later than its foundation since the channel's trench was cut after the 'via decumana' had been metalled (Hogg 1968, 125). Thus the channel probably dates from the reign of Titus (AD 79-81), or the first years of Domitian'. Wilson 1980, 34-6, 50, Fig.40. TIRBS 1987, 62, Flavian fort (1.8ha) and later a fortlet (0.5ha). (Ordovices).

Pen-Y-Darren, Mid Glamorgan, Wales.

Nash-Williams 1969, 106-8. *RCAHM* (Wales) Glamorgan 1(ii), 1976, 84-6, bath. Wilson 1980, 92. *TIRCGLL* 1983, 79, fort occupied AD 74 to c. AD 120. (*Silures*).

Pennal, Merionethshire, Gwynedd, Wales.

Britannia 6, 1975, 222 n.3; 7, 1976, 296, bath-house; 10, 1979, 272; 15, 1984, 266. *JRS* 67, 1977, 15. Nash-Williams 1969, 104-5, 130-1. Sommer 1984, pl.24. Bath-house, of 'reihentyp' (terraced) plan, slate-lined cistern. *TIRBS* 1987, 62, fort (1.71ha) and civil settlement. (*Ordovices*).

Pentre Ffwrndan Farm, Flint, Flinshire, Wales.

Britannia 8, 1977, 358; 9, 1978, 406, 482-3; 10, 1979, 269; 13, 1982, 329; 18, 1987, 302-3; 19, 1988, 171, 416; 23, 1992, 256. O'Leary, Blockley & Musson 1989, *BAR* 207. *TIRBS* 1987, 63, villa c.AD 140, replaced a timber building of c.AD 120 with stone; a small bath-suite; nine lengths of lead waterpipes found. Villa mostly destroyed in 3rd c., after which it was used as a lead-processing workshop, before final abandonment. (*Deceangli*).

Peterborough(1), Fengate, Cats Water, Cambridgeshire.

Britannia 4, 1973, 294; 6, 1975, 253; 9, 1978, 441, 2 wells; 13, 1982, 364-5; 15, 1984, 299. *RCHME* 1969, Peterborough New Town, 7, 'Occupation dates from Iron Age (6th c. BC) and most intensive from 3rd c. to 4th c. BC to the first half of the 1st c. AD... briefly reoccupied in the latter part of the 2nd c. AD... The only internal features were two large pits or wells'.

Peterborough(2), Northamptonshire/ Cambridgeshire.

Hawkes 1943, *Arch. J.* 100, 188-223. *VCH* Northamptonshire 1, 1902, 216. Whitwell 1982, 289, well.

Piddington, Hackleton, Northamptonshire.

BNFAS 8, 1973, 14-5. *Britannia* 12, 1981, 342; 19, 1988, 452; 20, 1989, 290-2; 21, 1990, 342-4. *Current Arch.* 55, 1977, 245; 82, 1982, 348. Friendship-Taylor 1989: *Upper Nene Archeological Society*. Occupation c. 3rd c. *Northants. Arch.* 14, 1979, 106; 24, 1992, 99-101. *RCHME* Northamptonshire 2, 1979, 63, site 11. Scott 1993, 144, SMR 585/862?, NH 58. *VCH* Northamptonshire 1, 1902, 198. 8m diam. by 3.5m deep pit used as a storage water tank to provide water supply for

bath. A drain and timber water pipe-line found. *TIRBS* 1987, 63, corridor villa. (*Catuvellauni*).

Piercebridge, County Durham.

Black 1995, 118-9. *Britannia* 5, 1974, 461; 6, 1975, 234-5; 7, 1976, 313, 380-1; 8, 1977, 381 bath-building; 9, 1978, 474; 10, 1979, 285; 11, 1980 362, 405; 12, 1981, 327-8; 13, 1982, 345-6; 14, 1983, 292-3; 15, 1984, 119; 18, 1987, 46 *vicus*; 20, 1989, 227, 337; 22, 1991, 302. *Current Arch.* 55, 1976, 245. Sommer, 1984, pl. 25. *TAASDN* 7, 1936, 235-77; 9(1) 1939, 43-68 plan; 9(2), 1941, 127-38; 10, 1950, 285-309; 11, 1958, 165-75. Wooler 1917. *TIRBS* 1987, 63, *RIB* 1021-7, 2293; large fort (4.58ha) and mansio with bath-building (well preserved), established c. AD 300, but may have been earlier. (*Brigantes*).

Pitmeads, East of Dunge, Wiltshire.

Rainey 1973, 128. *VCH Wiltshire* 1, 1957, 110. *TIRCGLL* 1983, 79, villa, baths; coin of Claudius II. (*Belgae*).

Pitney, Shropshire.

Britannia 11, 1980, 296-7; 12, 1981, 163-4; 14, 1983, 13ff. *PSANHS* 11, 1863, 22-4. Scott 1993, 170, Pitney I: 45 30, SMR 54407, SO 46; Pitney II: ST 44 29, SMR 54410, SO 47. *VCH Somerset* 1, 1906, 326-8. *TIRCGLL* 1983, 79, courtyard villa with baths; flourished 3rd and 4th c. (*Durotriges*).

Pitsford, Northamptonshire.

RCHM County of Northants, S-W, 4, 1982, 204, item 10, well.

Plas Coch, Wrexham, Clwyd, Wales.

Britannia 26, 1995, 326, Fig.2, a civillian settlement, dependent on agriculture, with a well.

Plaxtol, Sedgebrook, Kent.

Britannia 2, 1971, 297-8; 18, 1987, 359; 19, 1988, 484, 501, n.65; 20, 1989 326. *Kent Arch. Newsletter*, 11, 1987, 1-3. Scott 107, KE76, bath-house. *VCH Kent* 3, 1932, 122-4, item 40, Fig.29. 163, pl.26, bath. Well, constructed with timberwork (p.123). *TIRCGLL* 1983, 80, villa; occupation c. 1st to 4th c. (*Cantiaci*).

Poole, Dorset.

Britannia 12, 1981, 383, well; 19, 1988, 475; 16, 1985, 308. *RCHM County of Dorset*, 2(3), 1970, 603-4, drains, ditches and salt-boiling.

Portchester, Hampshire.

AEx 1970, 1971, 283, n.189. *Antiq. J.* 43, 1963, 222-3. *Arch. Rev.* 1972, 46-7, n.149, 318. *Britannia* 1, 1970, 300-1; 2, 1971, 283, wells; 3, 1972, 270-5, 348; 4, 1974, 160-72, 227, 318. *Cunliffe* 1975, I, 1976, II.

Portishead, Avon.

Britannia 16, 1985, 303. *Scott* 1993, 17, SMR 429, 439, AV 65-67. Well.

Portland Island, Dorset.

Britannia 2, 1971, 180, Roman quarry. *Dorset Proc.* 84, 1962, 112. *JBAA* 28, 1872, 32-3, 161-80. *PPS* 24, 1958, 118. *RCHM County of Dorset*, 2(3), 1970, 604-5, '...a stone-lined well...'. 'Guide to Early Iron Age Antiquities', 1925, 150-1. (*Durotriges*)

Prestatyn, Glwyd, N Wales.

Arch. Cambr. 92, 1937, 214-20. *BBCS* 23, 1969 187-9. *Bockley* 1989, *BAR* 210. The settlement dates from c. AD 80-140. Bath, aqueduct, drain, well, watertanks. *Britannia* 5, 1974, 398 *vicus*; 8, 1977, 358-9; 12, 1981, 314-5; 16, 252-3, 324-5; 17, 1986, 364. *TIRBS* 1987, 63, *RIB* 444; two possible forts; small external 2nd c. bath-house; civil settlement; bronze workshop. (*Deceangli*).

Puckeridge, Hertfordshire.

Britannia 2, 1971, 270; 3, 1972, 329, wells; 4, 1973, 299; 8, 1977, 442; 17, 1986, 443.

Pulborough, West Sussex.

Britannia 1, 1970, 122; 2, 1971, 174, 193; 2, 1981, 271, 273-5; 20, 1989, 234. *Cunliffe*, 1973, 77-8. *Hull*, 1963, 46. *PSA* 2(8) 1899, 294-6; 2(23), 1909, 377-8. *SxAC* 11, 1859, 142; 75, 1934, 60, 62; 112, 1974, 101. *Scott* 1993, 188-9, SMR 2365, WS 66, at Homestreet Farm, TQ 06 18, a drain amongst foundations of Roman buildings; SMR 2367, WS 67, at Nutbourne, TQ 07 18, a hypocaust was found, indicating likely bath structure. *Sussex Arch. Soc. Res. Comm. Mins.* 93, & 95, 1970. *Sussex County Magazine* 8, 1934, 677-8. *VCH Sussex* 3, 1935, 63-4.

TIRCGLL 1983, 83, villa at Pulborough Farm; baths; coins of 1st c. (Regni).

Pumsaint, Carmarthenshire, Wales.

Britannia 1, 1970, 307; 4, 1973, 272, fort; 5, 1974, 398-9, vicus; 10, 1979, 273; 19, 1988, 420; 21, 1990, 304-6 Fig.2 shows well, stone-lined, 1m diameter and over 4.8m deep; 22, 1991, 203-7, 210. *Carmarthenshire Antiquary* 9, 1973, 3-27. *Carmarthenshire Antiquary* 10, 1974, 3-12. *Current Arch.* 119, 1990, 395-7. Jones & Little 1973. Jones & Little, 1974. *TIRBS* 1987, 63, Flavian fort (1.89ha), reduced in size to 0.9ha c. AD 120; abandoned c. AD 140-50. Bath-building on south bank of Cothi river. (Demetae).

Putley, Old Rectory, Hereford & Worcester.

Scott 1993, 90, SMR 3228, HE 17. *TWNFC* 1822, 258; 36, 1958, 84-7, 143-5. two open drains.

Quernmore, Lancashire.

Britannia 2, 1971, 254; 3, 1972, 313; 4, 1973, 283; 7, 1976, 403. Leather 1973. Swan 1984, fiche 423, a stone-lined culvert (?aqueduct) leading water from a stream 70m north for use in pottery kiln. *TIRBS* 1987, 63, settlement with several pottery kilns, occupied during 1st to 2nd c. (Brigantes).

Quinton, Northamptonshire.

BNFAS 5, 1971, 25; 7, 1974, 30-1. *Britannia* 3, 1972, 322, Fig 8; 4, 1975, 233 & 235?, Fig 9; 7, 1976, 334-5; 8, 1977, 399. *Northamptonshire Arch.* 9, 1974, 95; 12, 1977, 216, plan, well near building B. Scott 1993, 147, SMR 519B, NH 101. Whitwell 1982, 292.

Radfield, Kent.

Britannia 5, 1974, 459; KAR 14, 1968, 10, 'Romano-British site at Radfield', 2 wells.

Raeburnfoot, Dumfries & Galloway.

Britannia 3, 1972, 10; 5, 1974, 148-9, 153, fortlet; 15, 1984, 55. *JRS* 37, 1947, 166; 50, 1960, 214; 51, 1961, 161. *PSAS* 97, 1963-4, 189-9, plan. *RCAHMS Dumfriesshire* 1920, 68-70, plan. Stephens 1985(b) 224, item 20, comments, 'The main N-S road of the Antonine fort was bounded by a stone channel lacking a bottom (Barbour 1898, 23; Robertson 1962, 32), possibly the channel trench was for a wooden pipeline'. *TDGNHAS*

39, 1960-1, 24-49. *TIRBS* 1987, 64, Antonine fortlet (0.64ha), within larger enclosure (@.12ha).

Rainham, East London, Greater London, Essex.

Britannia 9, 1978, 451-2; 11, 1980, 379; 13, 1982, 374-5, Fig.8, two wells, one timbered- & one flint-lined; 22, 1991, 264.

Ravenglass, Cumbria.

Britannia 1, 1970, 53-4, 65, Ant, Itin. 481.1 (*Clanoventa*), Rav. Cos. 107.2 (*Cantiventi*); 8, 1977, 378; 16, 1985, 134-5; 19, 1988, 256; 20, 1989, 75-9. Mann 1989. *CW*(1) 3, 1876, 23-8; 4, 1883, 216-24; 9, 1888, 296-7; *TCWAAS*(2) 38, 1928, 353-66; 58, 1958, 14-30; 85, 1985, 81-5. Potter 1979, 1-138. *TIRBS* 1987, 64; *RIB* 795; Hadrianic fortlet (c. AD 120-130) and later fort (c. 1.46ha) built c. AD 130; burnt down c. AD 200 and rebuilt c. AD 200-10; rebuilt again c. AD 370 and occupied to c. AD 400. External bath-house. (*Brigantes*).

Rayne, Essex.

Britannia 19, 1988, 459. Smooty 1989, *TEAH* 20, 1-29. The site is c. 1km west of Rayne, Fig.1. Well, 1.42m deep, 1.56 m diam. at top, probably due to erosion of sides.

Reach, Cambridgeshire.

Antiquity, 45, 1971, 224-5. *Britannia* 5, 1974, 258, pl.xxvi. *JRS* 63, 1973, 245. *RCHM* County of Cambridgeshire 2, 1972, 88-9, Fig.80. Scott 1993, 41, SMR 06781, 06760a, CA 129 & 131. *VCH* Cambridgeshire 7, 1978, 45, pl.ivB. *TIRBS* 1987, 64, large villa, with bath-suite. (*Icení* ?).

Reculver, Herne Bay, Kent.

Arch. Cant. 83, 1969, 296. *BMQ* 24, 1969, 58-63. *Britannia* 1, 1970, 304, bath, drain; 2, 1971, 172-94; 4, 1973, 257, 261 n.47 *Not. Dig.* XXVIII, 8, (*Regulbi*); 6, 1975, 176; 7, 1976, 376-7; 10, 1979, 148; 17, 1986, 444. *JRS* 59, 1969, 233, 242. Johnson, 1979, 45-8. Johnston 1977, 15. *KAR* 17, 1969, 18-20. Philp 1970, (6th ed.). *TIRCGLL* 1983, 84; bath, well, drain. Pre-Roman occupation. Small Claudian fort of mid 1st c.; then fort of the '*Litus Saxonicum*', 3rd to 4th and 5th c., with vicus. (*Cantiaci*).

Redlands Farm, ?

Britannia 22, 1990, 252-4, 2 stone-lined wells.

Reigate, Surrey.

Arch. J. 6, 1849, 288. *Britannia* 25, 1994, 288. Hooper 1945, 16-7. Scott 1993, 177, SMR 1054, SY 38. Williams 1984, SyAC 75, 111-53. Well, drain.

Richborough, Kent.

Britannia 1, 1970, 42-3, 65, Ant. Itin. 463.4, 466.5, 472.6 (*ad portum Ritipus*), 240-8 date of fort; 2, 147 n.26 (*Classis Bratannica*), 197-8; 3, 1972, 69, 271-4; 4, 1973, 157-8, 172, 227; 5, 1974, 136, 193, 195, 393-5; 6, 1975, 175, 177, 185-6; 7, 1976, 162-3, 180, 200; 8, 1977, 238, 245, 287-8, 442-3; 10, 1979, 22, 43; 15, 1984, 180; 16, 1985, 178-9; 17, 1986, 427; 20, 73, 178. Bushe-Fox 1926, Vol.I, 19. Hanson 1970, 371, comments, 'No trace of an aqueduct channel has yet been found at this site, but the strongest evidence that one existed comes from a fountain or water basin, tile built and hexagonal in shape, and seemingly fed by a lead waterpipe, that was located in the N-W corner of the Saxon Shore fort'. Stephens 1985b, 228, comments: 'An hexagonal basin or cistern is known, made of tiles coated with pink *opus signinum*. It is normally attributed to the Saxon Shore fort (Bushe-Fox 1926, 19, pl. xxxiii; Cunliffe 1968, 248), and is not unlike the much larger but less ornamental fountain in the lower *colonia* at Lincoln (Thompson 1956, 32-6). In fact the 'basin' was probably the font of a late-Roman church (Brown 1971, 227-8)'. *SxAC* 107, 1969, 102-125. *TIRCGLL* 1983, 85, *RIB* 46-65; fort (0.2ha) and bridgehead of Claudius' invasion in AD 43. Later fort of the '*Litus Saxonicum*', built c. AD 275-85. (*Cantiaci*).

Ridgewell, Great Ashley Field, Essex.

Archaeologia 14, 1803, 62; 16, 1812, 364; 35, 1853, 62. Dunnett 1975, 98-9. *JBAA* 19, 1863, 27, 319. Rodwell 1978, 31, No. 38. Scott, 1993, 65, SMR 6975, ES 59. *VCH Essex* 3, 1963, 170-1, Fig.34. *TIRBS* 1987, 65; villa with bath; coins from Claudius to Arcadius. (*Trinovantes*).

Rippingale, Lincolnshire.

Whitwell 1982, 294, TF 12 NW 15, bath.

Rivenhall, Essex.

AEx 1972, 51. *Ant. J.* 52, 1973, 219-31. *Britannia* 1, 1970, 117, 126; 2, 1971, 174-93; 3, 1972, 335-6; 4, 1973, 115-27, 305; 5, 1974, 444;

7, 1976, 200; 8, 1977, 439; 13, 1982, 211. CBA Res. Rep. 55, 1986. Rodwell in Todd, M (ed.), 1978, 11-32. Scott 1993, 65, SMR 8059-91, ES 60. VCH Essex 3, 1963, 171-4. TIRCGLL 1983, 85 courtyard villa with bath. (*Trinovantes*).

Rochester, Kent.

Arch. Cant. 18, 1889, 193-5; 21, 1895, 1-16; 27, 1905, lxvii-lxx, 177-92; 28, 1909, lxxxviii- xcii; 29, 39, 1927, 159-64; 84, 1969, 110; 97, 1981, 95-108. Bath, well, drain. Arch J. 20, 1863, 390. Britannia 1, 1970, 42-44-6, Ant. Itin. 472.3 (*Durobrivis*), 473.3 (*Dubobrius*), 473.8 (*Durobrivis*), 73, 183 possible Claudian fort, 304; 2, 1971, xvi-xvii, 188; 6, 1975, 78, 90; 7, 1976, 377; 8, 1977, 425; 11, 1980, 17; 18, 1987, 359; 22, 1991, 292. JRS 14, 1924, 138. Cassius Dio 'Historiae Romanae', LX, 20, the decisive battle in AD 43, between the British forces and the Roman invading army under Aulus Plautius. Dudley & Webster 1965, 67-70. Fisher 1772, *History of Rochester*. Frere 1978, 80-1. VCH Kent 3, 1932, 81-2, Fig.14, 'Rochester (*Dvrobrivae*) is a Roman bridge-head settlement', p.81. Wachter 1966, 62, 105, 109. TIRCGLL 1983, 85, Pre-Roman oppidum with mint. Possible Roman fort followed by settlement. (*Cantiaci*).

Rock, Brightstone, Isle of Wight.

Britannia 7, 1976, 367-9, Fig.25, drain, spring 140m west of house. JBAA 12, 1856, 159f. TIRCGLL 1983, 85, villa; coins of 3rd and 4th c. (*Belgae*).

Rockbourne, West Park, Hampshire.

Britannia 2, 1971, 179, 181, 183, 187, 190, 193; 3, 1972, 348, Fig.18; 10, 1979, 148 vousoir tiles, 168, 174, 176; 11, 1980, 394, date mid 1st c. to c.AD 200, roof collapsed c.3rd c.; 14, 1983, 329f, bath-suite (east wing), c. end 3rd c., perhaps replacing earlier baths; 18, 1987, 348, 16 gold coins, termination c.AD 394, at SU 095 211; 21, 1990, 355, further 4 gold coins. JRS 33, 1943, 75; 35, 1945, 88; 53, 1963, 150, 164; 55, 1965, 217, 228; 56, 1966, 214, 219-20, 225. Hewitt, et. al., 1983, Arch. J. 140, 129-50, 2 baths, 2 wells; west well, c.4th c., first, 0.92m stone-lined, then timber-lined to depth 5.5m, water level at 2.75m; east well 2.3m deep, 0.92m diam., narrowing to 0.6m, and entirely of sandstone blocks, near a corndrier, 7 drains. Hewitt M A T, 1960, Interim Report; idem, 1962, 2nd Interim Report; idem, 3rd Interim Report, 1971; idem, Final Report, 1974. Scott, 1993, 86, NAR 11 NW 11, HA 79.

Rockingham, Northamptonshire.

Northants. Archaeology 9, 1974, 75-7. *RCHM* county of Northamptonshire, Central, 2, 1979, 126-30, No.49, item 3, Figs.113-116. A deep Roman well.

Rodersham, Kent.

Britannia 17, 1986, 427, bath-house, dated from pottery to 1st to 3rd c. Scott 1993, 108, KE 80.

Roecliffe, North Yorkshire.

Britannia 25, 1994, 265-6, fort previously unknown, 2.5 ha (6.2 acres). 3 wells.

Romford, Essex.

Black 1995, 120 site 43, 121 Fig.2 position 43, vicus or roadside settlement and mansio,?bath. *Britannia* 1, 1970, 52-3, 65, 73, Ant. Itin. 480.7 (*Durolito*) (Note: there seems to be some uncertainty about the location of Romford and Chigwell in the Antonine Itinerary, as both sites are given the same location); 6, 1975, 93, identification discounted; 20, 1989, 304. *TEAS* 7, 1900, 95. *VCH Essex* 3, 1963 175. *TIRCGLL* 1983, 86, `? *Durolitum*', (cf. Chigwell). (*Tinovantes*).

Rothley, Leicestershire.

Liddle 1982, 38-9, Fig 26. Scott 1993, 115, SMR SK 51 SE AR, LE 75. *TLAHS* 9, 1904-5, 157-8. *VCH Leicestershire* 1, 1907, 216-7. Whitwell 1982 109, well.

Rothwell Haigh, North Yorkshire.

Britannia 9, 1978, 429, well. *YAR* 1977, 3.

Rough Castle, Stirlingshire.

Britannia 3, 1972, 7, 18, 29, 45; 7, 1976, 301, military way; 14, 1983, 288, road. Burnham & Wachter 1990, 78. *DAES* 1975, 53. Frere & St Joseph 1983, 75-6. *JRS* 50, 1960, 85-6, 213; 52, 1962, 163, head quarters building. *PSAS* 39, 1905, 442-99; 67, 1933, 243-96; 110, 1978-80, 230-85. *RCAHMS Stirlingshire* 1, 1963, 100-2, plan. Robertson, 1990, 56-9 bath-house, well, located inside fort. Roy 1793, pl.xxxv. Wooler 1917, 190 bath. *CSIR I.4*, 1985, Nos. 73-5.

TIRBS 1987, 67, *RIB* 2144-5; small secondary fort (0.63ha) and possible earlier fortlet, NS 844 798.

Rousham, Oxfordshire.

Scott 1993, 161, SMR 1749, OX 47. *VCH* Oxfordshire 1, 1939, 266, 309. Bath.

Rowlands Castle, Hampshire.

Scott 1993, 87, NAR SU 70 NW 76, HA 80. *VCH* Hampshire 1, 1900, 310. Bath.

Rudston, Humberside, Yorkshire.

AEx 1972, 12. *Britannia* 2, 1971, 253; 3, 1972, 310-11; 4, 1973, 90, 281; 8, 1977, 446; 14, 1983, 13ff; 22, 1991, 157. *JRS* 53, 1963, 130-1; 54, 1964, 156; 55, 1965, 204. Richmond 1963. Scott 1993, 100, SMR 4139, HU 17 bath. Scott 1973, Vol.1, 70-95. Stead 1980. *Yorkshire Archaeology* 1973, 6. *YAJ* 31, 1934, 366-76; 32, 1936, 214-20; 33, 1938, 81-6, 222-4, 320-38. *TIRBS* 1987, 67, courtyard villa, constructed 4thc., with bath-suite, well. (*Parisi*).

Rushton, Eaton Villa, Cheshire.

Britannia 12, 1981, 333; 13, 1982, 353-4. *CAB* 8, 1982, 49-52; 9, 1983, 67-73. Scott 1993, 46, SMR 882, CH 3, bath, drainage, watertanks. *VCH* Cheshire 1, 1987, 210-1. Dated to c. AD 170-200 to late 3rd or early 4th c.

Ruthin, Clwyd, N. Wales.

Britannia 13, 1982, 329; 20, 1989, 258-9, 304, fort, timber-lined tank, timber-lined latrine; 21, 1990, 299-302, vicus, 304; 23, 1992, 256. Waddelove & Jones 1989, *Britannia* 20, 249-54. Flavio-Trajanic period.

Ryton on Dunsmore, Warwickshire.

Condron 1996, 318. Swan 1984, fiche 656, well.

Salford Priors, Warwickshire.

Britannia 23, 1992, 284 settlement; 24, 1993, 272-3; 25, 1994, 272 villa nearby; 26, 1995, 353 a five-roomed building with inserted bath-suite.

Sambourne, Warwickshire.

Scott 1993, 180, SMR 3748, bath, WA 18, 3rd to 4th c.

Sandringham, Norfolk.

Gregory 1982, 360. Scott 1993, 137, SMR 3254, bath, NF 164, 3rd to 4th c.

Sandwich, Kent.

Arch. Cant. 94, 1978, 191-4. *Britannia* 10, 1979, 337 villa; 11, 1980, 402; 12, 1981, 368; 19, 1988, 484 settlement; 22, 1991, 292; 24, 1993, 317. KAR 56, 1979, 133-4; 63, 1981, 56-60, Parfitt & Jones 1981, bath.

Sandy Lane, Wiltshire.

Britannia 1, 1970, 58, Ant. Itin. 486.4. VCH Wiltshire 1, 1957, 53-4, bath. TIRCGLL 1983, 92, minor settlement; coins of Victorinus. (*Belgae*).

Sapcote, Black Piece Field, Leicestershire.

Condron 1996, 319; Leicestershire SMR 408.1860; 520.1968. Liddle 1982, 38-40, bath-suite. Pickering 1935, 162-7. VCH Leicestershire 1, 1907, 207. TIRBS 1987, 68, villa. (*Corieltavi*).

Scampton, Lincolnshire.

Britannia 5, 1974, 424, 466. Iilingworth 1810, 6-13. Northants SMR 58. Scott 1973, vol 1, 151-4, Vol.2, Fig.60. Todd 1973, 81-3. Whitwell 1970, Vol.2, 56, 82-3, 144. Whitwell 1982, 105-6. TIRBS 1987, 68, courtyard villa, semi-detached bath-house, probably of 4th c. (*Corieltavi*).

Scawby, Sturton-by-Scawby, Humberside, Yorkshire.

Dudley 1931, 33. Loughlin & Miller 1979, 214. Scott 1993, bath, 100, SMR 2398, HU 18. Stead 1976, 257, 259. Trollope 1872, 57-8. White 1882, (4th ed.), 657. Whitwell 1982, 300. TIRBS 1987, 68, extensive settlement. (*Corieltavi*).

Scole, Norfolk.

Britannia 1, 1970, 47 suggested 'Villa Faustini' near Scole; 2, 1971, 187; 5, 1974, 439, 2 timber-lined wells, early 2nd to mid 4th c.; 6, 1975, 80, corrected to Stoke Ash; 7, 1976, 388; 9, 1978, 327; 17, 1986, 356-8; 18, 1987, 331; 19, 1988, 456; 25, 1994, 278, 'an area of the "small town" excavated', and a number of buildings found and 7

wells, of which 2 were timber-lined. *EAA* 5, 1977, 97-224, and a number of plans, especially 108, 111, 114, Figs.46-52, pls.xvi, xvii, show wells. *Popular Arch.* Jan. 1984, 31-3. *Proc. Suffolk Inst. Arch.* 22, 1936, 263-86; 23, 1937, 24-30. Scott 1993, 137, SMR 1007, NF 166. *TIRBS* 1987, 68, minor settlement; occupation from Flavian period to 4th c. (*Iceni*).

Scunthorpe, Dragonby, Lincolnshire.

Antiq. J. 1, 1970, 222-45. *Arch. Notes* 1966. *Britannia* 20, 1989, 176. *EMAB* 5, 1962, 14; 7, 1964, 13-4; 9, 1966, 17, 4 wells. Loughlin & Miller 1979, 210, 235-6. Whitwell 1982, 79-80, 301, Fig.14a, 4 wells shown. *TIRBS* 1987, 30, 68, Iron Age and Roman settlement; occupation likely from 1st c. to early 4th c. (*Corieltavi*).

Seabegs Wood, Cumberland, Scotland.

Britannia 4, 1973, 274; 5, 1974, 407, 2 culverts; 9, 1978, 415-6, plan; 12, 1981, 143-9, 'stone-capped culvert passed through the Antonine wall'; 13, 1982, 338; 14, 1983, 288, (NS 822 797). *DAES* 1972, 40-1; 1974, 51. *JRS* 59, 1969, 202-4. Hanson & Keppie 1979, 107-12. Magdonald 1934, 239-40. *PSAS* 105, 1972-4, 157. *RCAHMS Stirlingshire* 1, 1963, 102-3. Robertson 1990, 60-2. *TIRBS* 1987, 68-9, primary fortlet (0.68ha), and probably a secondary small fort (unlocated) on Antonine Wall.

Seaton, Honeyditches, Devon.

Arch. J. 49, 1892, 180. *Britannia* 1, 1970, 61 'Moridunum' disputed, 297; 10, 1979, 326; 19, 1988, 476; 25, 1994, 31. *JRS* 11, 1921, 211; 51, 1961, 188. Miles 1977, *Britannia* 8, 101-48. *PDAS* 39, 1981, 37-87; 45, 1987, 59-74. *TDA* 2, 1868, 379-80; 17, 1855, 277-80; 24, 1892, 76; 54, 1922, 66-8; 102, 1970, 247-8. *TIRCGLL* 1983, 93, villa with small bath-house. (*Durotriges*).

Selsey, West Sussex.

Britannia 1, 1970, 5, 18, 20, 30; 2, 1971, 174; 18, 1987; 353. Scott 1993, 189, NAR SZ 89 SE 9, WS 74, hypocaust for a ?bath.

Sewingshields, Haydon, Hadrian's Wall, Northumberland

Britannia 9, 1978, 420; 10, 1979, 280, Mile Castles 34 and 35 on Hadrian's Wall, 11, 1980, 358-9; 12, 1981, 269, 394; 17, 1986, 403; 19, 1988, 456; 21, 1990, 341; 23, 1992, 288. ?aqueduct.

Shakenoak, Oxfordshire.

Britannia 1, 1970, 288, 311; 2, 1971, 268, 301; 3, 1972, 121, 328; 4, 1973, 297-8, villa, bath-house; 5, 1974, 436; 6, 1975, 188; 7, 1976, 166; 9, 1978, 332; 10, 1979, 160-2. Brodribb, Hands & Walker, 1968-73, 4 vols. *TIRCGLL* 1983, 94, villa with bath, site A occupied AD 100-430 and site B from 1st to 5thc. (*Dobunni*).

Shawell/Churchover, Leicestershire.

Arch. J. 5, 1848, 328. *JRS* 43, 1953, 118, pl.23; 53, 1963, 134. *RSNHSR* 1939, No.73, 24-5; 1948, ?; 1949, 31. *PSA* (2nd ser.), 8, , 324. *TLAS* 1993. *VCH Warwickshire* 1, ?, 231. Whitwell 1982, 302-3, SP 57 NW 15. Bath, 2 wells.

Shepreth, Cambridgeshire.

Fox 1923, 185. *PCAS* 6, 1885, 60-1. Scott 1993, 42, SMR 03364, CA 139, bath-house and latrine. *VCH Cambridgeshire* 7, 1978, 45-6. *TIRBS* 1987, 69, villa with bath. (*Catuvellauni*).

Shepton Mallet, Fosse Lane, Somerset.

Britannia 5, 1974, 346; 22, 1991, 279-82, Fig.25; 24, 1993, 303. *PSANHS* 134, 1990, 47-56. Scott 1993, 170, SMR 25160, SO 52. *VCH Somerset* 1, 1906, 318, well, shown on plan, but not mentioned in text. *TIRCGLL* 1983, 94 settlement. (*Belgae*).

Shipton Gorge, Dorset.

PDNHAS 73, 1951, 101-2; 78, 1956, 87; 79, 1957, 114-5; 102, 1980, 104. Scott 1993, 54, SMR 1 102 014, DO 28, bath. Dated to 4th c.

Shireoaks, Nottinghamshire.

EMAB 1959, 13; 1961, 15; 1962, 22. Whitwell 1982, 304, well.

Shoreham, Old Shoreham, West Sussex.

Black 1987, 156. Scott 1993, 190, SMR 3718, WS 79. *SxAC* 116, 1978, 393-6. *SxASN* 5, 1972, 19-20. Well; occupation dated to 1st to 4th c.

Shortlanesend, Cornwall.

Britannia 11, 1980, 389, drain.

Siberton, Silberton in Wansford, Cambridgeshire.

Stukeley 1887, Vol.III, *The Surtees Society*, 54. ?Well and ?spring.

Siddington, Gloucestershire.

RCHM 1976, 101-3, Fig. p.102a, well, discovered accidentally in 1966; still unexcavated in 1976. From pottery it dates to late 1st to 4th c. Scott 1993, 75, SMR 2365, GS 88.

Sidlesham, West Sussex.

Black 1987, 156. Scott 1993, 190, SMR 0321, WS 80, NAR SZ 89 NE 1, & at SZ 85 96, WS 82, NAR SZ 89 NE 14 'Roman drain of sandstone slabs, and possible bath-house'. *SxAC* 93, 1955, 76; 111, 1973, 1-19. *Sussex Notes & Queries* 1954, 67. *TIRCGLL* 1983, 94, villa with bath; occupied c. 2nd c. to 4thc. (*Regni*).

Silchester, Hampshire.

Archaeologia 53, 1983, 6; 54(2), 1895, 19, 22, 28; 55(2) 1897, 409-30, pl. xxiii, shows 6 wells. Altogether 76 wells reported; two baths. *Britannia* 1, 1970, 49, 57-8, 60, Ant. Itin. 478.3 (*Calleva Atrebatum*), 484.10, 485.7, 485.8, 486.7; 486.8 (*Calleva*), 114, 122, 255; 2, 1971, 168-194, building materials; 3, 1972, 146, 211, 233, 357; 4, 1973, 38 n.28, 107-14; 5, 1974, 124, 283; 6, 1975, 78, 91-2, 201, 209-10; 7, 1976, 152, 162, 165, 171, 368-71; 8, 1977, 264, 329-30 332, 418-9; 9, 1978, 307-8, 338, 464-5; 10, 1979, 102, 169, 331; 11, 1980, 129, 394-5; 12, 1981, 362; 13, 1982, 302-4, Fig.24, drain, 389-91; 14, 1983, 100, 330-1; 15, 1984, 69, 241, 324-6; 16, 1985, 200-1, water supply, 311; 17, 1986, 346; 18, 1987, 348; 19, 1988, 477; 20, 1989, 187, 316; 21, 1990 272; 22, 1991, 21-2. Hanson 1970, 124-32, plan showing all 76 wells, and lists a number of springs within the town, and drains. Wachter, 1966, *passim*; *idem*. 1995, 271-91.

Sixpenny Handley, Woodcutts Common, Dorset.

Arch. J. 24, 1867, 168-9; 104, 1947, 42-8. *JRS* 54, 1964, 62. *PPS* 24, 1958, 101-19. Pitt-Rivers, Vol.I, 1887, 7-239, 2 deep wells. Pitt-Rivers 1887, Vol.1, 27-8, pls.i, ii, iv, v, 193, 198, (on Roman well shaft sinking). 2 wells, 1) evenly-cut well shaft c. 30.4m (100ft) deep, 1.2m (4 ft) diam., originally located as a depression of 11m (36ft diam., and about 1.25m (4ft) deep. The well had two rows of small cavities, called "put-logs" into which timber was inserted, probably for climbing down and up the shaft. The timber was so located that a bucket could still be lowered down the well. There seems to be some doubt whether there was water at the bottom, but this could be because of the draw-down from modern wells in the vicinity which are deeper than the Roman well. A Roman type wooden bucket was found at a depth of 56.5m (186ft) down the well, probably indicating that in

ancient times it must have yielded water. Pitt-Rivers states that he had a borehole sunk to a depth 'of 89m (294ft), without finding more than a slight soakage of water,...'. (198) It would appear both these two deep wells were major Roman failures, indicating also that they did not know how to locate water at depth, especially in the chalk. For both the wells water could have been present at the time but that the water table has been depressed during medieval and modern times; (2) small well, 41m (136ft) deep, 0.91m (3ft) in diam. cut smoothly, into chalk. No water was found (193). *RCHM* County of Dorset 2(2), 1975, 64-72, No.18, item 19, at p.69, 'In phase III,...This enclosure contained a well 1.23m (4ft) in diameter and 57m (188ft) deep,...'.

Slack, West Yorkshire.

Britannia 1, 1970, 44, 67 n.96, 151; 2, 1971, 132, 254; 7, 1976, 231, tile-stamps of *Legio VI Victrix*; 10, 1979, 30, 35, 43, 45, 60-1. *JRS* 53, 1963, 165; 59, 1969, 207 annexe. Wooler 1917, 190, bath. *YAJ* 26, 1920, 1-92. Well. *CSIR* I.3, 1983; No.20. *TIRBS* 1987, 70, *RIB* 623-6; fort (1.46ha), occupied c. AD 80- 140; civil settlement. (*Brigantes*).

Sleaford, Lincolnshire.

Britannia 17, 1986, 390. *EMAB* 1961, ?. *JRS* 51, 1961, 171; 52, 1962, 167; 54, 1964, 159. Scott 1993, 126, LI 148. Whitwell 1982, 305-6, well.

Snodland, Church Field, Kent.

Arch. Cant. 46, 1934, 202-4; 82, 1967, 192-217, tank. *Britannia* 14, 1983, 335; 17, 1986, 427; 20, 1989, 326. *Kent Arch. Newsletter* 9, 1985, 4. Scott 1993, 108, KE 87, bath. *VCH Kent* 3, 1932, 124, item 43. Occupation c. AD 87 to AD 375-83.

Somerford Keynes, Gloucestershire.

Britannia 16, 1985, 302f; 18, 1987, 341; 20, 1989, 310, Iron Age occupation; 22, 1991, 277, Cotswold Community School SU 033 963, 12.7ha site. *Oxford Arch. Unit Newsletter* 11, 1983, 1-2; 14, 1986, 2-3; 16, 1988, 2, Iron Age occupation. *TBGAS* 107, 1988, 257. Bath-building suggested from concentration of flue tiles.

South Shields, Northumberland.

Arch. Ael.(4) 1934, 83-102. *Britannia* 2, 1971, 127, 130, n.54, 295; 4, 1973, 206-9; 5, 1974, 165, 407 vicus; 7, 1976, 306; 8, 1977, 371; 11, 1980, 318-9, 355; 12, 1981, 321; 15, 1984, 277, 342; 16, 1985,

268, 325-6; 17, 1986, 374-6, 448-9; 18, 1987, 314-5, Fig.8; 1988, 431-3; 20, 1989, 272-3; 21, 1990, 315; 22, 1991, 232-3, Fig.6; 23, 1992, 112, 267-9; 24, 1993, 267-9, 284; 25, 1994, 264-5. Bidwell & Speak 1994, Vol.1. *Current Arch.* 133, 12(1), 1993, 23-7, 'Abeia Roman fort, South Shields'; 'a classical Roman house of the 4th c. with a bath-suite', color photo in a courtyard, p.25. *JRS* 50, 1960, 237; 52, 1962, 193. Dore & Gillam 1979. Hanson 1970, 372, *RIB* 1060, attests 3rd c. aqueduct to AD 222. Mickett 1983, 7-11, Tyne & Wear Museums. Richmond 1954, 11. *CSIR* I.1, 1977, *passim*. *TIRBS* 1987, 71, *RIB* 1052-1071. (*Brigantes*).

Southwark, Redcross Way, Greater London.

Britannia 1, 1970, 292; 4, 1973, 307; 5, 1974, 466; 6, 1975, 270-1, wells; 7, 1976, 352, 388; 8, 1977, 409-10; 9, 1978, 473-5; 10, 1979, 318, 354; 11, 1980, 344-5, 381-2; 12, 1981, 353-4, 443; 13, 1982, 376-7; 14, 1983, 313-4; 15, 1984, 310; 16, 1985, 298; 17, 1986, 409; 19, 1988, 464; 20, 1989, 205ff, 309; 22, 1991, 273; 23, 1992, 293-4, 309-10; 25, 1994, 283-4, 304; 26, 1995, 364 at TQ 3247 8011, 2 wells; at TQ 3249 8002 a well, timber-lined, c. 3rd c.; revetted channel, timber drain, another large conduit; at p.364 item 6, 'to the south, two successive timber, box-framed wells were constructed in a possible metallated yard dated to c. AD 160-200' and became disused in the 4th c. Now 38 wells discovered.

Southwark Street, Herefordshire.

Antiq. J. 18, 1938, 376, pl.80. Beard & Cowan 1988, 475-81 water-pipe with iron collars. Cowan 1992, 3-191. At p.101, mentions a wooden water-pipe with iron collars at the junctions, a probable indication that water was piped, possibly to the bath of the *mansio*. *London Archaeologist* 5(14), 1988, 475-81. Shepherd J D, ??, *TLMAS* 37, 1986, 125-44; 43, 1992, 3-191.

Southwell, Bishop's Place, Nottinghamshire.

Archaeologia 9, 1789, 199-200; 71, 1967, 13-7; 79, 1975, 14. *Britannia* 3, 1972, 265, 267-8, large villa, original bath replaced by larger one with elaborately decorated walls; 12, 1981, 172. *EMAB* 1959, 13-4. *JRS* 50, 1960, 233-4. *Rec. of Bucks.* 16, 1959, 234. Scott 1993, 156, *SMR* 03069, NT 36. Scott 1973, vol I, 173-6. *TTSN* 5, 1901, 58-9; 70, 1966, 13-54; 71, 1967, 13-7; 79, 1975, 14. *VCH Nottinghamshire* 2, 1910, 34, old bath-house replaced by larger one in second half of 2nd c., apparently demolished in 3rd c. Whitwell 1982, 101-2, 308-9.

TIRCGLL 1983, 71, courtyard vila with bath-suite; pottery of 2nd to 4th c. (Corieltavi).

South Witham, Lincolnshire.

Arch. J. 1934, 186, well. *Britannia* 2, 1971, 197. *JRS* 15, 1925 227-8. Scott 1993, 126, LI 153, NAR SK 91 NW 5. Whitwell 1982, 309, well.

Southwick, West Sussex.

Black 1987, 102-4. *Britannia* 2, 1971, 187. *JRS* 56, 1966, 214. *SxAC* 73, 1932, 13-32; 79-80, 1938-9, 118; 123, 1985, 73-84. Cunliffe 1973, 77-8. *Sussex Notes & Queries* 5, 1934-5, 90; 17, 1966, 280-1. Scott 1993, 191, SMR 4344, WS91. *VCH Sussex* 3, 1935, 25, 70. TIRCGLL 1983, 95-6, courtyard villa constructed before end of 1st c. AD, and occupied from to c. AD 350. 2 sets of baths. (Regni).

Sparsholt, Hampshire.

AEx 1972, 10. *Arch. Rev.* 1972, 35. *Britannia* 1, 1970, 301; 2, 1971, 170-193, building materials, 283, Iron Age & Roman occupation; 3, 1972, 348, Fig.15, bath; 4, 1973, 318-9, no.151; 5, 1974, 318; 12, 1981, 163; 22, 1991, 288. *Current Arch.* 12, 1969, 14-8. Johnston 1972b, (rev. ed.), comments that the water supply is problematical and that a damaged structure near the stoke-hole may have been a cistern. Scott 1993, 87, HA 93, NAR SU 43 SW 18.

Spilsby, Lincolnshire.

Arch. J. 91, 1934, 181, (?)Roman pipe line. Stukeley 76, 1883, Vol.2, *Itin. Cur.*, i, 27.

Spoonley Wood, Gloucestershire.

Archaeologia 52, 1889-90, 651-68. *Arch. J.* 47, 1890, 420-1. *Britannia* 14, 1983, 13ff. *JBAA* 38, 1882, 215-6. *JRS* 49, 1959, 127. McWhirr 1981, 94-6. *TBGAS* 14, 1889, 208; 32, 1909, 300; 33, 1910, 12; 71, 1953, 162-6. *RCHM Gloucestershire Cotswolds* 1976, 113-4. *Winchcombe and Sudeley Record*, 4, 1893, with illustrations. TIRCGLL 1983, 96, courtyard villa with bath; coins of 3rd and 4th c. (Dobunni).

Springhead, Southfleet, Kent.

Arch. Cant. 80, 1965, 107-17, Fig. facing p.108, baths. *Britannia* 1, 1970, 44 Ant. *Itin.* 472.2; 2, 1971, 170-92, building materials, 288;

3, 1972, 351; 4, 1973, 323; 6, 1975, 90; 7, 1976, 177, 183, 187; 8, 1977, 425, well, 2nd c.; 9, 1978, 472; 10, 1979, 338; 15, 1984, 343-4; 16, 1985, 184, 189; 20, 1989, 178; 21, 1989, 297. *JRS* 59, 1969, 232. Rodwell & Rowley 1975, 39. Ross, 1967, 20-33. *VCH Kent* 3, 1932, 90-3, pl.xiv. *TIRCGLL* 1983, 96, settlement; cult of springs with 7 Romano-Celtic temples. (*Cantiaci*).

St. Mary Cray, Kent.

Britannia 8, 1977, 425, 'a building of which 3 rooms examined, two of them containing baths'; 9, 1978, 472. *KAR* 47, 1977, 172.

St. Stephen, Park Street/Bricket Wood, Hertfordshire.

Arch. J. 102, 1945, 21-110, Excavation Report; 118, 1961, 100-35, Excav. rept. *Britannia* 1, 1970, 289-90; 2, 1971, 169-93, building materials; 3, 1972, 357; 6, 1975, 198; 8, 1977, 328. *Herts. Arch.* 2, 1970, 62-5. Scott, 1993, 95, SMR 1469, HT 54, SMR 4264, HT 56, SMR 4838, HT 57. *TEHAS* 1945-6, 50. *TSAHAAS* (n.s), 4, 1932, 212-4. *WSWHASB* 3, 1955, 2, Bricket Wood; 4, 1956, 2, Park Str.; 18, 1973, 12-3, well. *TIRCGLL* 1983, 78, 91, villa of timber house built c.AD 65 on site of native farmstead and enlarged in masonry c.AD 150, and again late 3rd c., and abandoned mid 4th c.; detached bath-house. (*Catuvellauni*).

Staden, Lincolnshire.

CBA Gr. 14, 3, 1988, 43-5, bath, occupation 1st to 4th c.

Staines, Surrey.

Britannia 1, 1970, 49, 64 Ant. Itin. 478.4 (*Pontibus*), 292; 3, 1972, 359; 6, 1975, 92; 7, 1976, 374; 8, 1977, 408-9 well; 10, 1979, 468; 11, 1980, 400; 13, 1982, 393; 15, 1984, 347; 18, 1987, 354; 21, 1990, 358. *Current Arch.* 52, 1975, 134-8. *London Archaeologist* 1, 1970, 161-2; 2(14), 1976, 362-5; 3(7), ?, 180-6. *TLMAS* 27, 1976, 71-134. Burnham & Wachter 1990, 306-10, gives Roman name '*Pontibvs*' or '*Ad Pontes*'. Smith 1987, 365. *VCH Middlesex* 1, 1969, 73. *TIRCGLL* 1983, 96, minor settlement with bath-house and well. Occupation from late 1st to 4th c. (*Catuvellauni*).

Stainfield, Lincolnshire.

AN Lincs. 1967. *Britannia* 25, 1994, 269, 'a well 1.5m wide and over 4.5m deep, with probable pond'. Scott 1993, 126, LI 155. Whitwell 1982, 311, well.

Stainley North, ?

Wooler 1917, 190. Bath.

Stamford Bridge, North Yorkshire.

Britannia 1, 1970, 40-1, 72, possible association with 'Derwentio'; 9, 1978, 79, possible fort; 26, 1995, 345, 'roadside settlement at North Farm, Scoreby. Two rooms of a stone-founded timber structure with a corridor between, and a well. 13ha enclosure adjacent to River Derwent'.

Stancil, Yorkshire.

JRS 30, 1940, 167. Scott 1973, Vol.1, 170-2. *YAJ* 35, 1943, 261-9, bath. *TIRBS* 1987, 71, villa with bath-block. (*Corieltavi* or *Brigantes*).

Standon, Hertfordshire.

Scott 1993, 96, SMR 1101, HT 62, bath, found in 1756, and again in 1890. *VCH* Hertfordshire 4, 1914, 164.

Stanford in the Vale, Oxfordshire.

Britannia 8, 1977, 421 settlement and villa; 11, 1980, 396; 19, 1988, 454; 20, 1989, 297; 21, 1990, 334. *Oxford Arch. Unit News* 17(2), 1989, 8-9; 17(4), 1989, 21-2. Well, possibly barrel-lined, 2nd c.

Stanton Fitzwarren, Wiltshire.

Britannia 2, 1971, 281, small bath-house, early 3rd c. and demolished c.AD 360, occupation to at least end of 4th c. Scott 1993, 206, SMR SE 300, WZ 151, SMR SE 326, WZ 153. *WAM* 38, 1913-4, 322; 41, 1920-1, 394; 76, 1981, 177.

Stanton Low, Buckinghamshire.

Britannia 21, 1990, 366. *JRS* 48, 1958, 141; 49, 1959, 119, Fig.16, well, bath. *Records of Buckinghamshire* 16, 1953-60, 198-215. *TIRBS* 1987, 72, at SP 842 430, well, associated with 4 buildings. (*Catuvellauni*).

Stanton St. John, Wood Derry/Woodbury, Oxfordshire.

Arch. J. 3, 1846, 116-29. Scott 1993, 161, SMR 1357, OX52. *VCH* Oxfordshire 1, 1939, 343, well.

Stantonbury, Buckinghamshire.

Antiq. J. 61, 1981, 335-6. *Arch. J.* 146, 1989, 135-278. *Britannia* 7, 1976, 337-8, farmstead; 11, 1980, 373; 12, 1981, 344, bath-suite; 13, 1982, 368-9 villa. Scott 1993, 30, SMR 1701, BU 74, bath, well.

Stanwick, Northamptonshire.

Britannia 17, 1986, 396-7; 19, 1988, 452-3; 20, 1989, 149-71, 12 wells, culverts(drain), watertank, spring, possible aqueduct, 165-7 an abandoned 'water tank', so by end of 4th c. piped water supply no longer working; 21, 1990, 333; 22, 1991, 285, bath and watermill; 23, 1992, 285, 312; 25, 1994, 306. Neal 1989, *Britannia* 20, 149-71. *Rescue News* 37, 1985, 9. Scott 1993, 147, NH 106.

Stanwix, Cumbria.

Britannia 1, 1970, 1153; 3, 1972, 249 n. 148; 7, 1976, 106; 16, 1985, 271; 17, 1986, 441; 19, 1988, 499; 22, 1991, 234; 25, 1994, 263-4. TCWAAS(2) 31, 1931, 69-80; 32, 1932, 147-9; 41, 1941, 210-3; 52, 1952, 154; 85, 1985, 53-69. *JRS* 42, 1952, 90. Birley, 1961, 206, comments that this was the largest fort on the wall and confirms Horsley's observation that the fort must have had a bath-house with an aqueduct water supply. Hanson 1970, 372, item 68, comments, 'Horsley (*Britannia Romana*, 1732, 155) records that at Stanwix he was shown the remains of stones which "resembled" those from other Roman aqueducts he had seen'. Stephens 1985, 226, item 32, comments, 'A stone channel was observed to the south of the fort by Horsley (1732, 155). Topography suggests that this supplied the extramural bath-house rather than the fort and further, that the channel was the support of a pipeline. It is undated'. Bath, aqueduct channel, water-pipe. *TIRBS* 1987, 72, *RIB* 2025-9; large fort (3.98ha) on Hadrian's Wall protected the crossing at the river Eden which was the main route to the west of Scotland. Occupied from 2nd c. till 4th c. (*Brigantes*).

Stebbing, Essex.

Britannia 9, 1978, 452; 20, 1989, 305. Scott 1993, 65, SMR 1259, ES 66 (Rodwell's no.33). Rodwell 1978, 1-38, at p.31, comments on the social aspects such as status and ethnic origin of the owners of villas which is seldom revealed by excavation of sites. Burials seem to provide the most significant information about the occupants, but the limitations of such details are obvious. In his last paragraph (p.14) he mentions the type of evidence considered for interpreting the early history of a site. *Colchester Archaeologist* No.2, 1988-9,

18-9. VCH Essex 3, 1963, 183 bath-house, drainage channel lined with imbrices; a water system using wooden pipes, of which iron rings survive.

Stephen Mallet, Somerset.

VCH Somerset 1, 1906, 317-8, item 25, well 3.36m deep.

Stibbington, Sibson Cum Stibbington, Cambridgeshire.

Arch. J. 114, 1957, 10-27. Artis 1828, 'Durobrivae', pl.1 *Britannia* 1, 1970, 287; 3, 1972, 226, 236, 238. JRS 48, 1958, 139. LHA 2, 1964, 33-54. RCHM Huntingfordshire 1926, 231. Scott 1993, 42, SMR 00170, CA 142, well. Swan 1984, fiche 377 four stone-lined tanks or bases of tanks, well.

Stockport, Greater Manchester.

Scott 1993, 80, SMR 1111, GU 5, ?bath. *Cheshire Notes & Queries* 1, 1896-7, 143.

Stoke D'Abernon, Surrey.

Scott 1993, 178, SMR 89, SY 46, drains network. SASB 248, 1990. SyAC 20, 1907, 10-1.

Stoke Gifford, Gloucestershire.

Britannia 9, 1978, 456; 10, 1979, 322-3; 11, 1980, 385; 13, 1982, 381; drain.

Stoke Orchard, Gloucestershire

Britannia 1, 1970, 295, well.

Stoke Rochford(1), Lincolnshire.

Archaeologia 22, 1829, 26-32; 23, 1831, 385-7, illustration, plan and map. Scott 1993, 126, SMR 7164, LI 159, bath. Scott 1973, Vol.1, 160. Whitwell 1982, 314. TIRBS 1987, 72. (*Corieltavi*).

Stoke Rochford(2), North Stoke, Lincolnshire.

AN Lincs. 1959-60. *Archaeologia* 22, 1829, 26-32; 23, 1831, 385-7; EMAB 2, 1959, 9. LAASRP 9 (n.s.), 1961, 16. Scott 1993, 126, SMR 7163/6691, LI 160/161, bath. Scott 1973, Vol.1, 159-60. Whitwell 1982, 314. TIRBS 1987, 72, villa with bath-house. (*Corieltavi*).

Stoke Rochford(3), Lincolnshire.

Archaeologia 22, 1824, 26-32. Condron 1996, 392-3. Scott 1993, 126, NAR SK 92, NW 9, LI 158, bath. Stukeley 1883, Vol.76, 323. Turner 1829. Whitwell 1970, Vol.II, 80. Whitwell 1982, 314. TIRBS 1987, 72. (*Corieltavi*).

Stone, Buckinghamshire.

Archaeologia 32, 1847, 451-5 wells; 34, 1852, 21-32. *Records of Buckinghamshire* 4, 1870, 122; 9, 1909, 209, 270; 10, 1916, 87. *RCHM* 1, 1912, 290, No.87, item b1.

Stonea Grange, Lincolnshire.

Britannia 11, 1980, 375, under name Wimblington; 12, 1981, 341; 13, 1982, 365-6, Fig.16; 14, 1983, 305, Iron Age evidence; 15, 1984, 299-300, Fig.16, shows 9 wells and a bath; 16, 1985, 287-9, Fig.20, timber-lined tanks, and stone-lined well.

Stoneham Aspal, Suffolk.

Moore 1988. Scott 1993, 175, SMR SAL 001, SU 25, bath.

Stonesfield, Oxfordshire.

Archaeologia 11, 1794, 37; 37, 1857, 434-5. *Oxoniensia* 6, 1941, 1-8 bath. Gough's 'Camden' 2, 1806, 15. Scott 1993, 162, SMR 1232, OX 54, bath. *VCH Oxfordshire* 1, 1939, 315-6.

Storrington/Parham, Lickford, Wigginholt, West Sussex.

Antiq. J. 23, 1943, 155-7. Black 1987, 64, bath. *JRS* 19, 1929, 209; 55, 1965, 220. *MOW Exc. Annual Rept.* 1964, 10. Scott 1993, 192, SMR 2369, WS 97. *SxAC* 78, 1937, 13-36; 81; 1940, 55-67; 101, 1963, 20-2; 104, 1966, 103; 112, 1974, 97-151. *Sussex Notes & Queries* 3, 1930-1, 37; 7, 1938-9, 13-4. *VCH Sussex* 3, 1935, 64. Occupation of site before AD 100 to c. AD 125; alterations c. AD 175 & c. AD 300; site destroyed by fire after c. AD 364.

Stowe, Church Field, Shropshire.

Scott 1993, 165, SMR 1776, SH 12. *TSAS* (4th ser.), 10, 1925-6, 1v-vi. Webster 1975, 101. ?Bath, well, drain.

Strathgeath, Perthshire.

Britannia 2, 1971, 248; 5, 1974, 402-4; 6, 1975, 225; 7, 1976, 300; 8, 1977, 361, plan, iron spade; 9, 1978, 411, amphora-urinal, 482; 10, 1979, 274; 11, 1980, 351-2; 12, 1981, 20, 319; 13, 1982, 336-7; 14,

1983, 284-7; 15, 1984, 274-5, 348; 16, 1985, 263-4; 17, 1986, 371; 18, 1987, 36 camp, 309-10, bath-house, drains; 24, 1993, 278. *GAJ* 4, 1976, 19-22, plan. Roy 1793, pl.xxxii. *TIRBS* 1987, 73, Flavian and 2 Antonine forts (1.8ha) superimposed.

Stretton Bridge, Staffordshire.

Britannia 5, 1974, 427. St. Joseph 1953, *JRS* 43, 1953, 81-97, pls.8-16. Barton 1958, *Trans. Birmingham Arch. Soc.* 74, 1958, 6-9. St Joseph 1958, 74, 1-9, Figs.1 & 2. Smith 1987, 229-30. Webster 1958, in 1956, in *BASTP* 74, 1958, 10-11. Jones 1975, 149, 158, 177-78. *PNRB* 1979, 436, Ant.It. 470.1 *Iter II*. Well.

Stroud(1), Gloucestershire.

Glevensis 11, 1977, 38. Scott 1993, 75, SMR 3563, 75, SMR3563/3588, GS92/3, Cashe's Green (SO 824 055)/ New Vicarage (SO 85 05). *TBGAS* 87, 1968, 204. ?Aqueduct.

Stroud(2), Hampshire.

Williams 1908, *Arch. J.* 65, 57-60; Williams 1909, *Arch. J.* 66, 33-52, pls.i-iv. *TIRCGLL* 1983, 97, corridor villa with detached bath, 2 drains and 2 tanks. (?*Regni*).

Sutton Courtenay, Pen Copse, Oxfordshire.

Britannia 5, 1974, 457 enclosures with stone-lined well. *JRS* 57, 1967, 198. Scott 1993, 162, SMR 2852, OX 55. *TIRCGLL* 1983, 97, courtyard villa; coins of 1st to early 5th c. (*Atrebates*).

Sutton Veny, Pit Meads, West Site, Wiltshire.

Scott 1993, 207, SMR SW 301, WZ 158. *VCH Wiltshire* 1, 1957, 110-1. *WAM* 45, 1930-2, 204.

Swaffham Bulbeck, Cambridgeshire.

Britannia 11, 1980, 375, Roman buildings. *RCHM County of Cambridgeshire* 2, 1972, 112-3, No.8, item 82, 'The Swaffham Bulbeck Lode', (=leat): 'first recorded in 1279 (*Rot. Hund*, II, 1818, 484), is probably of Roman origin, an artificial watercourse c. 5.4km (3.33miles) long extending in a direction across the Fens from Commercial End', p.114, co-ords TL 5559 6322 to TL 5219 6725, pl.6, & Fig 104, p.114. In Medieval times it was used as a drain for the Fens.

Swalcliffe Lea Oxfordshire.

Britannia 1, 1970, 117 settlement. Scott 1993, 162, SMR 2444, OX 57. *The Bloxhamist*, 66, 1960, No.477. VCH Oxfordshire 1, 1939, 308-9, well. Occupation area over 50 acres.

Swanwick, Hampshire.

Ashbee 1978, 225. Fox 1928, *Antiq. J.* 8, 331-6; 10, 1930, 30-33; Fox 1930, *Antiq. J.* 10, 30-33; Fox 1963, *Antiq. J.* 43, 286-87. Well, 7.3m deep, 4.25m in diameter at the top, funnel-shaped down to 2.13m at depth 2.74m. Finds seem to indicate that the well had some sort of religious or ritual significance.

Swindon Broome, Manor Lane, Wiltshire.

Arch. Rev. 7, 1972, 45. Scott 1993, 207, SMR SE 313, WZ 162, SMR SE 324, WZ 166. VCH Wiltshire 1, 1957, 112. WAM 68, 1973, 134; 72-3, 1977-8, 206, SU 15 83, 2 wells. WANHM 50, 1942-44, 100. TIRCGLL 1983, 97, villa. (*Dobunni*).

Tallington, Lincolnshire.

Britannia 20, 1989, 176. Condron 1996, 431. Petch D F (ed.), *LAASRP* vii.1, 1957, 1-26. Peacock 1961, *LAASRP* ix.2, 110-24. Whitwell 1970, 128. 2 wells.

Tarrant Hinton, Barton Field, Dorset.

Arch. Rev. 5, 1970, 20; 7, 1972, 28. BAA 1846, 179-82. Branigan 1976, 36. *Britannia* 1, 1970, 299; 2, 1971, 281; 3, 1972, 346-7; 4, 1973, 316; 5, 1974, 455; 6, 1975, 278, bath; 11, 1980, 391-2; 12, 1981, 172, 359-60, 383 well; 13, 1982, 411; 15, 1984, 343; 19, 1988, 410. JBAA(3) 17, 1954, 77-8. *Current Arch.* 80, 1981, 260. Hutchins 1861-70, (3rd ed.), 318-9. *RCHM County of Dorset* 4, 1972, 99, No.26, item 17. *PDNHAS* 91, 1969, 189-90; 92, 1970, 151-2; 94, 1972, 86-7; 95, 1973, 91-3; 96, 1974, 64-6; 98, 1976, 61-2; 99, 1977, 124-5; 100, 1978, 117-8; 101, 1979, 140-1; 102, 1980, 90-1; 104, 1982, 184-6; 105, 1983, 146-8; 106, 1984, 118. Occupation c. AD 161-180 onwards to c. 4th c. Bath-suite, well, 9.12m (30ft) deep. Scott 1993, 54, SMR 2 058 017C, DO 29. TIRCGLL 1983, 97, villa with bath and well; coins of 3rd and 4th c. (*Durotriges*).

Templeborough, South Yorkshire.

Britannia 1, 1970 191; 7, 1976, 157; 9, 1978, 379, 382; 10, 1979, 293; 17, 1986, 82. Hanson, 1970, 372, comments, 'A stone-built channel leading from springs to the north of the fort fed the early

external bath-house at Templebrough'. May 1922, 77, pl.xvii; forts I, II, III; forts II, III in succession were built on the foundations of fort I. Aqueduct, stone-lined channel from a springhead; 2 baths, 5 wells, drains, 2 latrines, spring, 2 watertanks.

Teston, Kent.

Scott 1993, 108, KE 90. VCH Kent, 1932, 125-6, item 45, Fig 30. Bath, drain.

Tewkesbury, Gloucestershire.

Miles & Fowler 1972, *Tewkesbury, the archaeological implications of development*, well, stone-lined. Smith 1987, 313.

Thatcham, Berkshire.

Harris 1931, 92-101; Harris 1937, 219-55. Smith 1987, 244. *TNFC* vi(2), 1931, 92-101; vii(4), 1937, 219-55. *TIRCGLL* 1983, 98, minor settlement, occupied mid 3rd to late 4th c. Well. (*Atrebates*).

Theale, Berkshire.

Britannia 26, 1995, 368, 'excavation revealed Romano-British post-built structure with adjacent well. Two further wells may be of Roman date'.

Thenford, Northamptonshire.

AEx 1972, 62. *BNFAS* 1971, 32-3. *Britannia* 3, 1972, 325, 360, Iron Age occupation; 4, 1973, 294, bath-suite; 5, 1974, 434. *CBA Gr.9*, Newsletter 2, 1972, 10; 3, 1973, 17. *RCHME Northamptonshire* 4, 1982, 143-5. Scott 1993, 147, SMR 124, NH 109. VCH Northamptonshire 1, 1902, 201. Rivet 1969, pl.3.17. Whitwell 1982, 320. *TIRBS* 1987, 74, villa built c. AD 300 with bath-suite. (*Catuvellauni*).

Thetford, Norfolk

Britannia 12, 1981, 347-8; 13, 1982, 410; 14, 1983, 308-9; 15, 1984, 306; 16, 1985, 190; 22, 1991, 69; 23, 1992, 288-9. *EAA* 62, 1993, 1-234, at p.45, 10 wells, also Iron Age occupation to 60s AD; *EAA* 22, 1984, 1-209, at p.14 refers to wells, pits and tanks; comment is made about uncertainty whether some of the c. 500 pits are wells, or not. (This could have been checked by taking undisturbed samples from the lower parts of the pits or by penetrating a deeper with sampling tubes, and checking the degree of saturation. If the degree of saturation was near 100%, it would indicate that the pit had

penetrated the water table, and therefore it was most likely a well). Scott, 1993, 138, SMR 5683 St Helen's Well, NF 192, SMR 17397, NF 193. *TIRBS* 1987, 74, buildings within a tripple ditch enclosure (c. 3.6ha). (*Iceni*).

Thistleton, Dyer, Rutland, Leicestershire.

Britannia 1, 1970, 117, 126 settlement; 3, 1972, 271-3; 4, 1973, 227; 16, 1985, 179. *EMAB* 1958, 11. *JRS* 47, 1957, 212; 48, 1958, 98, pl.15.2, 137-8; 49, 1959, 113; 50, 1960, 224; 51, 1961, 175, Fig.22; 52, 1962, 172-3, Figs.19, 20; 55, 1965, 207. Morris, 1979, 141. Scott 1993, 115-6, SMR SK 91 NW D. Smith 1978, 168, 169, 178. *VCH* Leicestershire 1, 1908, 89, plan. *VCH* Rutland 1, 1908, 90-3, 2 wells. Whitwell 1982, 320. *TIRBS* 1987, 74-5, minor settlement and winged corridor villa, built early 4th c, and destroyed about 50 years later; likely bath-suite. (*Corieltavi*).

Thurgarton, Wood Meadow, Nottinghamshire.

EMAB 1959, 13-4; 1961, 14-5; 1963, 15; 1964, 25; 1966, 40-1. *JRS* 53, 1963, 134; 55, 1965, 207. Scott 1993, 156, SMR 01759, NT 42. *TTS* 58, 1954, 15; 65, 1961, 6. Whitwell 1982, 323, bath. *TIRBS* 1987, 75, villa built in timber, with bath-suite, c. AD 240; later built in stone. (*Corieltavi*).

Thurlby, Lincolnshire.

Arch. J. 91, 1935, 121, 184, wattle and daub huts, probably native, unlikely to be Roman. *LAASRP* 9 (n.s.), 1961-2, 21. Lincoln SMR Ref. AA 44347/1 NMR 20813, ?aqueduct, part of Car Dyke in Park Wood, probably built c. AD 125. Section of c. 190m in length, about 175m east of the Roman road, King Street, on the edge of the Fen. Whitwell 1982, 323, TF 11 NW B, well.

Thurnham, Kent.

Arch. Cant. 74, 1960, 162-70. *Britannia* 2, 1971, 174, 187. Scott 1993, 108, KE 91, probable villa with bath. Occupation 1st to 4th c. (Also spelt Thornham).

Tiddington, Stradford, Warwickshire.

Britannia 1, 1970, 129; 11, 1980, 369; 12, 1981, 339-40; 13, 1982, 361-2, Fig.14; 14, 1983 303-4, Fig.12, SP2165 5565; 15, 1984, 296, SP 221 556; 16, 1985, 238-40; 20, 1989, 288; 23, 1992, 285, SP 217 556 and SP 2180 5559. Burnham & Wachter 1990, 13, 310-3, Figs.106 & 107

show 14 wells, drains. WMA 23, 1980 119, 121. WMANS 22, 1979, 45. Fieldhouse, May & Well Stood, 1931. TIRBS 1987, 75, minor settlement, occupied from 1st to 4th c. (Dobunni).

Tilston, Cheshire.

Britannia 1, 1970, 45, Ant. Itin. 469.3 (Bovio); 11, 1980, 365; 12, 1981, 333; 14, 1983, 299; 15, 1984, 255-7, 341; 19, 1988, 445. TIRBS 1987, 75; settlement with bath; pottery mostly of 2nd and 3rd c. (Cornovii).

Tingwick, Stollidge Field, Buckinghamshire.

Records of Buckinghamshire 2, 1862, 33-50. RCHM 1913, Vol.2, 299, No.208, item 1, '...which was supposed to be part of a Roman bath and hypocaust,...'. Scott 1993, 30, SMR 87, BU 76, bath. VCH Buckinghamshire, ii, 1908, 12-3, plan 13 showing drains.

Titsey, Surrey.

Archaeologia 59, 1905, pt.2, 207-52. Black 1987, 152, Figs.41, 42, pp.238-9, and appendix 5, pp.98-101. Britannia 2, 1971, 192; 7, 1976, 181, 190. Leveson-Gower 1869, SyAC 4, 214-37. Scott 1993, 178, SMR 1344, SY 47. VCH Surrey 4, 1912, 367-9. TIRCGLL 1983, 98, corridor villa with bath, c. AD 100 - 260. (?Atrebates/Cantiaci).

Tixover, Tixover Grange, Leicestershire.

AASR 5, 1859, 106. Britannia 24, 1993, 292. EMAB 1958, 11. JRS 23, 1933, 198, bath-house. McWhirr 1970-1, TLAHS 46, 1-8 (reprint). TLAHS 34, 1958, 84; 35, 1959, 85; 46, 1970-1, 1-8. Whitwell 1982, 324. TIRBS 1987, villa with bath; occupation late 2nd c. to 4th c. (Corieltavi).

Tockington Park, Avon.

Scott 1993, 13, SMR 1472, AV 2. TBGAS 12, 1888, 159-69; 13, 1889, 196-202, Maclean, comments, 'The hypocaust chambers recently discovered (rooms xxx & xxxi) would indicate some extensive heating apparatus and bath accommodation suitable to so large an establishment', 202. TIRCGLL 1983, 98, courtyard villa. (Dobunni).

Tomen-Y-Mur, Merioneths, Gwnedd, Wales.

Arch. Cambr. 117, 1968, 120. Britannia 11, 1980, 348, further details of the leat-system to the north-east of the fort...', tank. Bowen &

Gresham 1967, 230-5, map. Houlder C, 1974, Fig.17. *JRS* 51, 1961, 134-5; 67, 1977, 151. *JMHR* 1962, 1-5.

Totternhoe, Bedfordshire.

Britannia 2, 1971, 110, 113-4, 116. *JRS* 47, 1957, 214-5. Mathews 1963, 61-4. Rainey 1973, 149. Scott 1993, 21, *SMR* 534, BD 30. *TIRCGLL* 1983, 99, courtyard villa with bath; pottery mostly of 4th c. (*Catuvellauni*).

Towcester, Northamptonshire.

Britannia 1, 1970, 42, 49, Ant. Itin. 470.6, 476.11 (*Lactodoro*); 6, 1975, 255, timber corduroy aqueduct; 7, 1976, 335; 8, 1977, 399, drains and well; 14, 1983, 347; 15, 1984, 300 bath; 16, 1985, 289; 20, 1989, 292; 22, 1991, 253; 23, 1992, 285; 24, 1993, 293. Burnham & Wachter 1990, 5, 9-10, 117, 142, 152-7, 160. *RCHM* County of Northants, S-W, 4, 1982, 149-60, No.61, item 5, Figs.113, 114. *Northants Arch.* 15, 1980, 35-118; 17, 1982, 24-59. *VCH* Northamptonshire 1, 1902, 184-6. *TIRBS* 1987, 76, small town (settlement) enclosing c. 11.25ha. (*Catuvellauni*).

Traws-Coed, Cardiganshire, Dyfed, Wales.

Arch. Wales 24, 1984, 50; 25, 1985, 27-8; 26, 1986, 43-4; 28, 1988, 58-9. Davies & Kirby (eds) 1994, 275-306. Davies 1984, *BBCS* 31, 259-92. Occupation from c. AD 70s to final abandonment c. AD 125-30. Aqueduct leat.

Tremadoc Gwynedd, Wales.

BCS 23, 1969, 187-90. Nash-Williams 1954, 33-5. *RCAHMW* Caernarvonshire 2, 1960, 259-60. Scott 1993, 81, *GY* 1, bath-house. *TIRBS* 1987, 76, villa with bath; occupied 2nd to 4th c. (*Ordovices*).

Tripontium, Cave's Inn Farm, Warwickshire.

Britannia (under Caves Inn) 1, 1970, 49, 79 Ant. Itin. 477.2 (*Tripontio*); 2, 1971, 263, bath; 3, 1972, 319, 361; 4, 1973, 288, 290-1; 5, 1974, 431; 7, 1976, 352, drainage system; 9, 1978, 440, *mansio*, ?bath drains; 14, 1983, 349. Cameron & Lucas 1962. Cameron & Lucas, 1971-3, 2 further wells described. *MANS* 1969, 21; 1970, 27; 1975, 52; 1977, 64ff, summary reports. *TBWAS* 80, 1962, 80-2; 5 wells described; 83, 1966-7, 130-79, at Caves Inn, near Rugby, Grid Ref. SP 57, 535 795; 85, 1971-3, 93-144; 7 wells: 1) completely destroyed by a company in 1951-2; 2) stone-lined, circular, bottom courses rectangular, c.

9.1m (30ft) deep; 3) in dispute; 4) top 3m (10ft) destroyed, total depth below turf level was 11.3m (37ft); 5) largest of the wells, 13.7m (45ft) deep; 6) stone-lined, 12.5m (41ft) deep; 7) stonelined 13.1m (43ft) deep.

Turf Wall Mile Castle, Hadrian's Wall, Northumberland.

TCWAAS 35, 1935, facing p.224. Drain.

Twyford, Hampshire.

JRS 49, 1959 131, well, bath. Scott 1993, 88, NAR SU 42 SE 12, HA 97, bath. VCH Hampshire 1, 1900, 309-10. TIRCGLL 1983, 100, winged corridor villa, built mid 2nd c., with bath. (Belgae).

Twywell, Northamptonshire.

Northants Archaeology 10, 1975, 31-93, full report. RCHM County of Northampton, N-E Arch. Sites, 1, 1975, 101a, item 6, a 'Roman Well'.

Upham, Hampshire.

Arch. J. 6, 1849, 397. JBAA 5, 1850, 376 well. Scott 1993, 88, NAR SU 52 SW 15, HA 98, well.

Upmarden, West Sussex.

Britannia 2, 1971, 190. Down 1981. JRS 57, 1967, 198; 58, 1968, 202; 59, 1969, 231. TIRCGLL 1983, 100, corridor villa with bath; occupied early 3rd to late 4th c. (Regni).

Upminster, Great Stanning, Essex.

Britannia 19, 1988, 461, well; 22, 1991, 265; 23, 1992, 291.

Usk, Gwent.

Britannia 1, 1970, 55, 57, Ant. Itin. 484.5, 485.1 (Burrio), 179, 188, 192, 273, wells; 2, 1971, 84, 246-7, well stone-lined; 3, 1972, 78, 302, 354; 4, 1973, 272; 5, 1974, 7, 401-2; 6, 1975, 223-4, 293; 7, 1976, 298-9, 391-2; 8, 1977, 446; 9, 1978, 483-4; 10, 1979, 25, 27-8, 53, 355; 11, 1980, 351; 12, 1981, 269; 14, 1983, 349; 16, 1985, 263; 18, 1987, 309; 19, 1988, 423-5; 20, 1989, 245, 265; 25, 1994, 252-3. Manning 1981. PNRB 1979, 378. TIRCGLL 1983, 100, RIB 396; Fort, fortress, major settlement. Neronian fortress for Legio XX, c. 19.5ha, c. AD 55-67. Flavian fort abandoned mid 2nd c., civil settlement until c. AD 350. Granaries, aqueduct, bath, wells.

Verulamium, St. Albans, Hertfordshire.

Antiq. J. 40, 1960, 1-24, pls.i-viii. *Britannia* 1, 1970, 42-3, 49, 51
Ant. Itin. 471.3, 476.8, 479.8, 80-1, 122, 161, 256-7; 2, 1971, 39,
110, 196-9; 3, 1972, 49, 146, *passim*; 4, 1973, 41, *passim*, 336; 5,
1974, 267, 283; 6, 1975, 258-60, Fig.12, bath; 7, 1976, 175, 179; 8,
1977, 199, 288, 336-8, 401, 442; 9, 1978, 39, 327; 10, 1979, 30,
passim 219, 306; 11, 1980, 130-2; 12, 1981, 386-7; 13, 1982, 133-4;
15, 1984, 241, 304-5; 16, 1985, 202-3 water supply; 18, 1987, 329-30,
Fig 15; 19, 1988, 455-6; 20, 1989, 300; 21, 1990, 276, 338-40. *JRS*
47, 1957, 217; 50, 1960, 225-7, Figs.27, 28; 51, 1961, 178-180,
Figs.24-6, pls.xvii, xviii. *Frere* 1972, Vol.I, 1983, Vol.II, 10,
bath; 12, bath; largest *civitas* capital 19; 3 wells, 19-20, several
wooden pipe-lines indicated by iron collars found in situ, Figs.89 &
115; 2 sewers, Figs.15 & 31, spring. Verulamium was occupied from
before c AD 60 when it was destroyed by Boudicean revolt, and rebuilt,
lasted to late 4th c. *Hertfordshire Archaeol. Rev.* No.9, 1974, 166-
8.

Wadfield, near Sudeley, Gloucestershire.

Annals of Wincombe & Sudeley 1877, 13 and 15 pls. *RCHM* 1976, 112-3
and Fig., bath-house in south wing. *Scott*, 1993, 76, *SMR* 42, *GS* 97.
TBGAS 90, 1971, 124. *Witts* 1883, 66, No.21. *JBAA* (2nd ser.), I,
pt.iii, 1895, 242-50. *TIRCGLL* 1983, 104, courtyard villa, probably of
4th c. (*Dobunni*).

Wainfleet All Saints, Lincolnshire.

Oldfield E, 1839, *Topographical & Historical Account of Wainfleet*.
Whitwell 1982, 327, TF 45 NEJ. *TIRBS* 1987, 78, salt-boiling site.
(*Corieltavi*).

Walesby, Lincolnshire.

AN Lincs. (*Lincs. N & Q*) 1965 8, 1905, 194; 1958, 1965. *Britannia* 9,
1978, 434; 12, 1981, 271, 273-5. *EMAB* 1978, 28. *Gentleman's Mag.* 10,
(n.s.), 1861, 683. *Jewitt L*, 1878, 59-61. *LAASRP* 6, 1861-2, 135-8;
8, (n.s.), 1959-60, 16-7. *LHA* 13, 1978, 84-5, pl.3. *Scott* 1993, 128,
SMR 7922, well, circular lead tank. *Scott* 1973, Vol.1, 141. *Whitwell*
1982, 327, TF 19 SW 4. *TIRBS* 1987, 78. (*Corieltavi*).

Wall, Staffordshire.

AEx. 1975, 18; 1976, 23. *Britannia* 1, 1970, 42, 65, *Ant. Itin.* 470.2
(*Etoceto*), 119-20, 123, 189, 197, bath-house; 2, 1971, 260; 3, 1972,

316; 4, 1973, 287; 5, 1974, 427; 6, 1975, 247, *mansio*; 7, 1976 328, well; 8, 1977, 263, 394; 9, 1978, 435-6; 10, 1979, 296; 11, 1980, 367; 12, 1981, 337; 13, 1982, 356; 16, 1985, 119, water supply; 20, 1989, 287; 21, 1990, 371. CBA Gr.8, West Midland Arch. Newsheet 22, 1979, 49. JRS 63, 1973, 233, 242-4. TBAS 25, 1957, 24-9; 74, 1956, 12-29, bath, spring. TL & SSAHS 5, 1963-4, 1-50; 8, 1966-7, 1-40. TSSAHS 11, 1969-70, 7-31; 15, 1973-4, 13-28; 21, 1979-80, 1-14. TIRBS 1987, 78, RIB 284-5, 2246; walled settlement (2.74ha) near fort, c. 3rd c. (Cornovii).

Walls, Pucknowle, Dorset.

Dorset Proceedings 88, 1966, 107-8. Dorset NHAS 107, 1985, 55-86, drains.

Wallsend, Hadrian's Wall, Northumberland.

Britannia 3, 1972, 193, fort; 7, 1976, 306-8, cavalry barracks, enclosure wall, 388-9, lead sealing; 11, 1980, 18, 355-8, bath-suite; 13, 1982, 340-2, water-tank.

Walton, Radnor, Powys.

Britannia 1, 1970, 270; 8, 1977, 360. JRS 59, 1969, 121; 63, 1973, 239-40 plan. Mont. Coll. 61, 1971, 41. Trans. Radnor Soc. 27, 1958, 62-9; 49, 1979, 10-23. TIRBS 1987, 79; fort (Hindwell Farm) (2.29ha); extra-mural bath-house.

Walton Heath, Surrey.

Black 1987, Appendix 15, 134-140. Britannia 2, 1971, 114, 187, 190, 193. Scott 1993, 178, SMR 979, SY 49. SyAC 2, 1849, 1-13; 51, 1950, 65-81. VCH Surrey 4, 1912, 369. TIRCGLL 1987, 104, villa with bath, c. 2nd c. (?Regni or Atrebates).

Walton-Le-Dale, Lancashire.

Britannia 13 1982, 352, supply base, drain; 14, 1983, 296-7, large stone-lined well, phase III, c. AD 130-140 to 3rd and 4th c.; 15, 1984, 284-6, Figs.6, 7, 'drainage ditches thought to be of Neronian date,...Phase III, as in period 2, the buildings associated with furnaces, 2 wells and industrial pits'. THSLC 109, 1957, 1-46. TIRBS 1987, 79, Flavian to early 3rd c., military supply base(?). (Brigantes).

Walton-on-Thames, Surrey.

Scott 1993, 178, SMR 722, SY 48. Whimster 1931, 147, 238, ceramic drainpipe.

Walton-on-the-Hill(1), Surrey.

Black 1987, 134-40, (TQ 23 53) comments that because of the high elevation of both the villas with baths, there exists a problem of source(s) of water that supplied them. *Britannia* ii, 1971, 114 no.32, 187, 190, 193. Scott 1993, 178, SMR 900, SY50. (on cover marked 1949): Lowther 1950, *SyAC* 51, 65-81, comments: 'The site proved to have been occupied in pre-Roman times, dating from the latter part of the Iron Age', based on pottery of c. AD 10-43. The bath appears to have become ruined c. AD 270-274 (coin of Titrius II), and reconstructed c. AD 280-300.

Walton-on-the-Hill(2), Staffordshire.

Antiq. J. 14, (2nd s.), 1881-83, 110-1, '...and was, I have no doubt, the position of the bath of the establishment', Edwin Freshfield at the April 1882 meeting.

Wanborough (Lower), Wiltshire.

Anderson & Wachter 1980. Black 1995, 42-3. *Britannia* 1, 1970, 57-8 *Ant. Itin.* 485.5, *Durocornovium*, 300, settlement; 2, 1971, 282, timber buildings; 3, 1972, 271-3, 275; 4, 1973, 227; 7, 1976, 362; 8, 1977, 223-7, Figs.1 & 2; 11, 1980, 115-26, Figs.1& 2, early occupation terminated c. AD 80. Later occupation during 3rd & 4th c; 16, 1985, 176, 330; 18, 1987, 347. Burnham & Wachter 1990, 3, 13, 36, 148, 158-64, 272, 293. Phillips & Walters 1977. Scott 1993, 208, SMR SE 337, WZ 176. *WANHM* 63, 1968, 110; 65, 1970, 204-5; 66, 1971, 188-9. Rodwell & Rowley 1975, 233-5. *TIRCGLL* 1983, 104, major settlement, occupied c. AD 70 to 4th c; *mansio*, bath. (*Dobunni*).

Wanstead Park, Essex.

Archaeologia 1,?, 73. *Britannia* 19, 1988, 461; 20, 1989, 305. *Essex Arch. & Hist.*, 16, 1984-5, 132. *RCHM County of Essex, Central & S W*, 248, No.98, a pond is said to occupy the site of a 'Roman well', in the present Hermony Pond. Stukeley, *Surtees Soc.* 1883, Vol.II, 154, Lethieullier. *VCH Essex* 3, 1963, 198. Gough 1789, 'Camden's *Britannia*', Vol.II, 50. Lysons, 'Environs of London', iv, n.d., 23.87. *TEAS I*, 1858, 199.

Ware, Hertfordshire.

AEx 1974, 46-7. *Britannia* 6, 1975, 260; 8, 1977, 401, 403; 9, 1978, 445-6, Fig.12, well; 10, 1979, 350; 12, 1981, 347; 21, 1990, 340. Occupation from 1st to 5th c., when finally abandoned. Large, deep well, silted up in 4th c.

Washingborough, Lincolnshire.

LHA 4, 1969, 104; 7, 1972, 9, aqueduct leat, from TF 024 708 to TF 303 706. Whitwell 1982, 329.

Wasperton, Warwickshire.

Britannia 13, 1982, 361-2; 14, 1983, 296, 'ii) two wells, one timber-lined, the other, stone-lined'.

Watchfield, Little Wellington Wood, Berkshire/Oxfordshire.

VCH Berkshire 1, 1906, 218, 'An ancient well, 15ft (4.56m) deep. Roman pottery and coins found when cleared. 24 coins from reign of Allectus (AD 293-6), on Fox Furlong Farm. A small Romano-British house nearby, at the close of the 3rd c.'.

Water Newton, Huntingdonshire and Peterborough.

Artis 1828. *Britannia* 5, 1974, 277; 11, 1980, 1, 13 as *Durobrivae*; 12, 1981, 101. CBA Gr.7, BAD 4, 1957, 1. *Durobrivae* 2, 1974, 7-9; 7, 1979, 19-21. Howe, Perrin & Mackreth 1981, Fig.5, No. 45. Swan 1984, (1) fiche 385, Coney Field, at TL 1148 9708, (2) fiche 382, Billing Brook Area 2, at TL 1161 9682, two wells. VCH Huntingdonshire 1, 1926, 230-3, item 2(f). TIRBS 1987, 80. (*Catuvellauni*).

Watergate Hanger, West Sussex.

VCH Sussex 3, 1935, 28-9. TIRCGLL 1983, 104, corridor villa with bath-house; date uncertain. (*Regni*).

Weekley, Northamptonshire.

BNFAS 5, 1971, 26. *Britannia* 2, 1971, 266-7; 5, 1974, 272-4, 181, 434. *Northants. Arch.* 1, 1902, 194; 21, 1987, 41-94. RCHM County of Northants, S-W, 4, 1982, 202, (addenda to Vol 2), item a13. Scott 1993, 148, SMR 2660, NH 114. VCH Northants 1, 1902, 194. Whitwell 1982, 329. Stone-lined well c. 0.6m diam., 25m deep, dating from 2nd c. TIRBS 1987, 81, pottery kilns. (*Catuvellauni*).

Weldon, Northamptonshire.

BNFAS 4, 1970, 62. JRS 44, 1954, 93; 45, 1955, 135; 46, 1956, 133-4; 47, 1957, 213-4. Rainey 1973, 89. RCHM County of Northants, Central, 2, 1979, 164-6, No.61, item 3, Figs.146, 147. Scott 1993, 148, SMR 1439, NH 115 (Great Weldon). Smith, Hird & Dix 1988-9, Northants Arch. 22, pp.23, 67, Fig.11, shows 2nd house and bath-suite. TAMS 1 (n.s.), 1953, 74-6. VCH Northants 1, 1902, 193. Whellan 1874, 814. Whitwell 1982, 329. TIRBS 1987, 38. Corridor villa, 1st to early 2nd c.; burnt c. AD 200; larger house built and occupied to the 4th c. (Corieltavi).

Well, North Yorkshire.

Britannia 13, 1982, 323-5. Gilyard-Beer 1951. Yorkshire Roman Antiq. Com. Res. Rep. 1. Hanson 1970, 373, item 73, comments, 'The baths were fed by a stone-built aqueduct 0.45m (1.5ft) wide by 0.47m (1.58ft) deep which led from the Well Beck, a stream running from east to west to the north of the site'. Tyler 1980, 89-90. Lukis 1882. YAJ 7, 1882, 284-5; 34, 1939, 342-9; 35, 1943, 226; 36, 1947, 250, 465-6, aqueduct, cistern. TIRBS 1987, 81, small corridor villa with baths; built in 2nd c., and abandoned late 4th c. (Brigantes).

Wellingborough, Northamptonshire.

BNFAS 2, 1967, 20, 28-9; 3, 1969, 6. Britannia 1, 1970, 288. JRS 59, 1969, 219. Northants. Arch. 10, 1975, 142-4. RCHM County of Northants, Central, 1, 1979, 166-70, No.62, item 12, Figs.148-51, a Roman well 4.2m deep in limestone. TIRBS 1987, 81, pottery works and lime kilns (1st c.). (Catuvellauni).

Wellow, Somerset, Avon.

Gentleman's Mag. 2, 1846, 633. Scott 1993, 18, SMR 1604/1605, AV 74-77, bath for a larger villa. VCH Somerset 1, 1906, 312-5, item 20. TIRCGLL 1983, 105, courtyard villa; coins of 3rd and 4th c. (Belgae).

Welton Wold, Humberside, East Riding, Yorkshire.

AEx 1971, 24-5; 1974, 47; 1976. Britannia 3, 1972, 311, Iron Age occupation; 6, 1975, 237; 7, 1976, 317; 8, 1977, 383, well, estimated depth 30m. Loughlin & Miller 1979, 37, stone-lined well. YAR 1974, 4. TIRBS 1987, 81, corridor villa; occupation c. AD 250- 350. (Parisi).

Welwyn, Hertfordshire.

Antiquity 47, 1911, 7-9. *Antiq. J.* 14, 1940, 317-20; 18, 1938, 339-76. *Britannia* 1, 1970, 289; 2, 1971, 269-70; 4, 1973, 331. *Current Arch.* 27(7), 1971, 106-9. *Herts. Arch.* 1, 1968, 117-8; 9, 1987, 79-165, excavation report. Rook 1968. Scott 1993, 96, SMR 99/1913, HT 69, SMR 1566, HT 68, bath-houses, 1st demolished c. AD 300, occupation mid 1st c. to late 4th c. *TEHAS* 1, 1901, 167-8. *TSAHAAS* 1937. *VCH, Hertfordshire* 4, 1914, 166-8. 2 bath-houses, one demolished and later reconstructed. 2 wells, one timber-lined, the other steined.

Wendlebury, The Castle, Oxfordshire.

Britannia 23, 1992, 287-8, stone-lined well. Scott 1993, 162, SMR 1585, OX 60. *VCH Oxfordshire* 1, 1939, 283-4.

Wentlooge Level, Gwent, Wales.

Allen & Fulford 1986, pls.i-x; *Britannia* 17, 1986, 91-117; 19, 1988, 181-2; 25, 1994, 175-211. Fulford, Allen & Rippon, 1994, 175-211, pls.xiva, b, xva, b. The excavation reports provide evidence of large quantities of pottery and other small finds, including some Roman fabric material, which is said to have been well preserved in the anaerobic environment. The pottery dates to c. AD 250 - 400 and seems to have originated from many different parts of Roman Britain. Much agricultural remains have also been recovered and it has been conjectured that the wetland marshes were used as fields for growing fodder for horses for the Roman army. The settlement seems to have been extensive, but not much building remains have been located up to 1992.

West Dean, Wiltshire.

Scott 1993, 208, SMR NE 300, WZ 179. *VCH Hampshire* 1, 1900, 311-2. *VCH Wiltshire* 1, 1957, 119. *WAM* 13, 1872, 33-5; 22, 1885, 243-50, bath. *TIRCGLL* 1983, 105, courtyard (?) villa. (*Belgae*).

West Deeping, Lincolnshire.

Britannia 26, 1995, 350: '4ha excavation, but enclosures and fields from 0.5ha to 10ha in extent. Many buildings with several rooms each, and some hypocausted, probably indications of bath-structure'.

West Keal, East Lindsey District, Lincolnshire.

Lane & Hayes 1990, SMR 40964, site at TF 36 SE OS. Well.

West Newton, Norfolk.

Gregory 1982, 360, 363. *Norfolk Arch.* 31, 1953-7, 401. *TIRBS* 1987, 81-2; villa near Icknield Way; bath-house, with pottery of the 3rd and 4th c. (*Iceni*).

West Winch, Setchey, Norfolk.

Scott 1993, 139, SMR 2262, NF 207, well.

Westbury, Wiltshire.

Scott 1993, 208, SMR SE 300, WZ 177. *VCH Wiltshire* 1, 1957, 76, 119. *WAM* 45, 1930-2, 483; 62, 1967, 135. Well.

Westerwood, Cumbernauld, Dunbartonshire, Strathclyde.

Britannia 2, 1971, 133; 6, 1975, 228; 7, 1976, 301; 10, 1979, 278, bath-building; 18, 1987, 310; 19, 1988, 429; 20 1989, 270. *DAES* 1978, 278. *GAJ* 5, 1979, 12-8. *JRS* 54, 1964, 178. Macdonald 1934, 253-8. *PSAS* 67, 1933, 277. Robertson 1979, 62-4. Roy 1793, pl.xxxv. *TIRBS* 1987, 81, secondary fort (0.97ha) on Antonine Wall; bath-house.

Weston Underwood, Buckinghamshire.

Condron 1996, 321, Buckinghamshire SMR 1112, bath-house. Settlement dating from 3rd to 4th c.

Wetwang, Wetwang Slacks, Yorkshire.

Britannia 8, 1977, 384; 14, 1983, 35-44, the early unenclosed settlement from 5th c. BC. was replaced in the 3rd to 2nd c. BC by a centralized settlement; 16, 1985, 199, no. 38. Brewster 1975, N.M.R. Dent 1983. *East Riding Archaeologist* 7, 1981 microfiche, summary of excavations 1964-80. Loughlin & Miller 1979, 95, 140. Stephens 1985a, comments '...the identification of a 5 mile long leat leading to it (Wetwang)'. Ramm 1980, Fig.4.6. *TIRBS* 1987, 82, settlement; aqueduct. (*Parisi*).

Wharram Grange, North Yorkshire.

Britannia 11, 1980, 363; 12, 1981, 329, bath, drain. David A, 1978, *Geophysics G* 36/78. Scott 1993, 153, SMR 00984/04028, NK 38/40. Rahtz 1979. Ramm 1978, 86. Tyler 1980, 92. *TIRBS* 1987, 82(2), villa near Wharram Grange with possible bath-house. (*Parisi*).

Wharram Percy, North Yorkshire.

AEx 1975, 28. *Britannia* 3, 1972, 311; 6, 1975, 237; 8, 1977, 382; 9, 1978, 427; 12, 1981, 329-30; 13, 1982, 349; 15, 1984, 282; 16, 1985,

278-9; 19, 1988, 440. Occupation from Iron Age through to 5th and 6th c. Scott 1993, 153, SMR 03036, NK 39. TIRBS 1987, 82, settlement, farming; ?bath.. (Parisi).

Wharram-le-Street, North Yorkshire.

Britannia 10, 1979, 288; 11, 1980, 363, the source of the Gypsy Race river, a spring.

Wheatley, Oxfordshire.

Scott 1993, 162, SMR 2760, OX 62, bath. VCH Oxfordshire 1, 1939, 322-3. TIRCGLL 1983, 105, villa with bath; coins of late 3rd and early 4th c. (Catuvellauni).

Whickham, County Durham.

AA(4) 49, 1971, 120, pl.xi. Britannia 2, 1971, 250 pl.xxxivB, fort; 3, 1972, 183; 18, 1987, 15. Selkirk 1983, 17. TIRBS 1987, 82, fort. (Brigantes). (no water-related structures).

Whilton Lodge, Norton, Northamptonshire.

AEx 1971, 21-2. BNFAS 1971, 27-9. Britannia 1, 1970, 42, 49, 51 Ant. Itin. 470.5 (Bannaventa), 477.1 (Isannavantia), 479.5 (Bannavanto); 3, 1972, 325, item 7, stone-lined well; 4, 1973, 295-6, Fig.9. CBA Gr. 9 Newsletter 2, 1972, 9. RCHME Northamptonshire 3, 1981, 150-2. VCH Northamptonshire 1, 1902, 186-7. WMANS 1971, 14. TIRBS 1987, 82, small town (settlement); defences enclose c. 5ha.

Whitchurch(1), Shropshire.

Arch. J. 34, 1877, 363; 125, 1968, 193-254. Britannia 1, 1970, 42-3, 53, 64-5, Ant. Itin. 469..4, 481.1, 482.4 (Mediolano), 190 early fort; 8, 1977, 394; 9, 1978, 436-7, 2 timber-lined wells; 23, 1992, 282. Gentleman's Mag. 1, 1852, 122. Jones & Webster 1968, 195, 200-1, 254. Lewis 1845, 537. RCHM Herefordshire 1931, 253. RCHM County of Herefordshire 1931, 253. Smith 1987, 302. TWNFC 1882, 258; 1900-2. 2 timber-lined wells: one is c. 1m sq, depth 3.8m. VCH Herefordshire 1, 1900, 197. TIRBS 1987, 82, Flavian fort and later settlement. (Cornovii).

Whitchurch(2), Hereford and Worcester, Hertfordshire.

Arch. J. 34, 1877, 363. Gentleman's Mag. 1, 1852, 122. Lewis 1845, 4, 537. RCHM Herefordshire, South-West, 1, 1931, 253. Scott 1993,

91, SMR 08494. *TWNFC* 1882, 258; 1900-2; 36, 1958-60, 227-33. *VCH Herefordshire* 1, 1900, 122. *TIRCGLL* 1983, 105, iron working. ?bath. (*Dobunni*).

White Staunton, Shropshire.

PSANHS 29, 1929, 98-103. Scott 1993, 172, SMR 53262, SO 69. *VCH Somerset* 1, 1906, 334, item 58, bath, spring, lead piping. *TIRCGLL* 1983, 105, villa with bath. (*Durotriges*).

Whitebeech, Chiddingfold, Surrey.

Cooper 1984, 57-83. Cooper T S, (edited c. 1946), 82-98, (typed copy in the SyAS Library). Nevill 1883, 308-9, 334. Leveson-Gower 1883, 307-8. Scott 1993, 175 (under Chiddingfold), SMR 1534, SY 9. *The Antiquary* 7, 1886, 276. *The Antiquarian Mag. and Bibliographer*, 1883. *VCH Surrey*, 4, 1912, 360. Bath, 5 tanks.

Whitford, Clwyd, Wales.

Scott 1993, 48, SMR 2394, CL 18, lead pipe fragment.

Whitley, Derbyshire.

Britannia 26, 1995, 350, 'large amount of tile and stone and stone flags, confirmed the presence of a masonry building, and considerable quantity of box-tile and tufa suggest a bath-house'.

Whitley Castle, Northumberland.

AA(4) 37, 1959, 191-202. *Arch. J.* 142, 1985, 216-36. Blair R & Carr S, 1925, 249-60. Stephens 1985b, 226, item 35, comments, 'An altar (*RIB* 1198) seems to have been set over a spring near the extramural bath-house (Blair & Carr 1925, 254). The altar may be of the mid 3rd c. date (Wright 1943, 38). Analogy with the Chester altar suggests that, although a dedication to Apollo rather than the Nymphs, the spring may have fed an aqueduct; if so, this will have supplied the extramural bath-house rather than the fort, since the fort would probably have required a more elevated source'. Wooler, 1917, 190. Wright 1943, *JRS* 33, 36-38. *TIRBS* 1987, 82, fort (1.2ha). 2nd to 4th c.; external bath-house. (*Brigantes*).

Whittington Court, Gloucestershire.

Archaeologia 18, 1817, 118-21, pls. vi, vii. *RCHM* 1976, 126-8, Figs. at pp.127-8. Scott 1993, 77, SMR 51, GS 106, bath. *TBGAS* 71, 1953, 13-87. *TIRCGLL* 1983, 105, corridor villa built c. 4thc., bath-house

of earlier villa of 2nd c.; latest coins of Honorius, AD 393-423. (Dobunni).

Whittlebury, Holton Copse, Northamptonshire.

Antiq. J. 18, 1938, 45. *JBAA* 6, 1851, 73-6; 7, 1852, 107-14. *RCHME* Northamptonshire 4, 1982, 168-9. Scott 1993, 148, SMR 518, NH 117. *VCH* Northants 1, 1902, 199-200. Whitwell 1982, 104. *TIRBS* 1987, 83, courtyard villa with bath; coins of 3rd c. (Catuvellauni).

Whittlesford, Chronicle Hills, Cambridgeshire.

Scott 1993, 45, SMR 04308/04309, CA 181/182, drain pipes. *VCH* Cambridgeshire 7, 1978, 46. *TIRBS* 1987, 83, settlement. (Catuvellauni).

Whitton(1), Castle Hill, Ipswich, Suffolk.

Britannia 2, 1971, 190; 15, 1984, 307; 20, 1989, 301; 21, 1990, 341, courtyard villa. Moir & Maynard 1931-33, *PSIA* 21, 240-62; 25, 1949-51, 212. Moore 1988. Bath, water pipe. *TIRBS* 1987, 83, corridor villa; coins from Hadrian to Valens. (Trinovantes).

Whitton(2), St. Lythans, Glamorgan.

AEx 1970, summary report. *Britannia* 2, 1971, 246, dated after c. AD 200, reconstructed c. late 3rd c. or early 4th c.; 16, 1985, 181. Jarrett & Wrathmell 1981, *Celtic Studies* 5, Fig.2, 40, Fig.23, well, 44, Fig.25 section of the well, 7.4m deep, an octagonal frame over the well with 8 posts. *JRS* 56, 1966, 196; 57, 1967, 174; 58, 1968, 176; 59, 1969, 201, Fig 26. *TIRCGLL* 1983, 105-6, pre-Roman farmstead; original round houses replaced with rectangular buildings in 2nd c.; occupation ceased c. AD 340. (*Silures*).

Wickford, Essex.

Antiq. J. (2nd ser.), 50, 1970, 268-71, 274-5; 52, 1972, 338-40, pl.lxx. *Britannia* 1, 1970, 291-2, Fig.8, timber-lined well; 2, 1971, 176, 273; 3 1972, 335; 10, 1979, 349; 17, 1986, 356-8. Buckley 1980. *CBA Res, Rept.* 34, 1980, 65-8, a Pre-Flavian fort and prehistoric Roman village, 68. *Essex Arch. & Hist.* 19, 1968, 242-3. The timber-lined well, dated to late 3rd c. or early 4th c. remarkably well preserved, and yielded a wooden bucket.

Wigginton, Oxfordshire.

Beesley 1848, 41-3. *JRS* 56, 1966, 208. *Oxoniensia* 29-30, 1964-65, 193. Scott 1993, 163, *OX* 64. *VCH Oxfordshire* 1, 1939, 309, No.3, bath. *TIRCGLL* 1983, 106, villa; coins of Victorinus to Valens. (*Dobunni*).

Wiggonholt, Lickford, Storrington/Parham, West Sussex.

Antiq. J. 23, 1943, 155-7. Black 1987, 64. *Britannia* 1, 1970, 122 bath building; 6, 1975, 163-70, 195; 23, 1992, 306. *JRS* 19, 1929, 209; 55, 1965, 220. *MOW Excav. Annual Rep.* 1964, 10. Scott 1993, 192, *SMR* 2369, *WS* 97, *NAR TQ* 01 NE 5. *Sussex Notes & Queries* 3, 1930-1, 37; 7, 1938-9, 13-36. *SxAC* 78, 1937, 13-36 large tiled-drain; 81, 1940, 53-67, Fig., bath; 101, 1963, 20-22; 104, 1966, 103; 112, 1974, 97-151. *TIRCGLL* 1983, 106, villa. (*Regni*).

Wilderspool, Lancashire/Cheshire.

AEx 1974, 50-1; 1976, 36-7. *Britannia* 1, 1970, 281-2; 6, 1975, 240; 8, 1977, 385 clay-lined tanks; 23, 1992, 282; 24, 1993, 285; 25, 1994, 269. Burnham & Wachter 1990, 3, 224, 228-32, 320, Fig.73, ?aqueduct, stone-lined tank equipped with an overflow. May 1900. May 1903-4. *JRS* 57, 1967, 179; 58, 1968, 182. Thompson 1965. *THSLC* 52, 1900, 1-52; 55/56, 1903-4, 209-37. *VCH Cheshire* 1, 1987, 115-236. Watkin 1886, 260-73. *TIRBS* 1987, 83, major settlement; possible Roman fort, late 1st c.; civilian occupation in 2nd and early 3rd c. (*Brigantes*).

Wilmcote, near Stratford-on-Avon, Warwickshire.

Bromehead 1942, 144, Roman well, 2.74m diam., steined with masonry, and penetrated several layers of solid rock. *Gentleman's Mag.* 1841, ii, 81. *JBAA* 29, 1873, 41-2.

Wilsford, Wiltshire.

Antiquity 8, 1934, 459-61; 13, 1939, 155-8; 18, 1944, 8, well sinking by the Romans; 37, 1963, 116-20; 40, 1966, 227-8. Ashbee 1963; 1966; 1978. *Antiq. J.* 20, 1940, 52-71. *Archaeologia* 84, 1935, pl.xxxlx, Fig.2. *Arch. J.* 108, 1951, 1-24; 109, 1962, 16. Hoare Vol.1, 1812-21, 206. *VCH Wiltshire* 1 pt.1, 1957, 225; 1 pt.2, 1973, 383-4, 395-6, originally functioned as a well, but later became a 'ritual shaft'.

Winchester, Hampshire.

Antiq. J. 44, 1964 to 55, 1975. Biddle & Quirk 1964, bath-house. *Britannia* 1, 1970, 49-50, 60-1 *Ant. Itin.* 478.2, 483.2 (*Venta*

Belgarum, 486.11 (*Venta Velgarum*), 301 wooden water-pipe; 2, 1971, 168-93, 283-4; 3, 1972, 271-6, 348-9 wells; 4, 1973, 40, 162, 318; 5, 1974, 456; 6, 1975, 279; 7, 1976, 182, 204-6; 8, 1977, 419; 9, 1978, 465-6; 10, 1979, 331-2; 11, 1980, 395-6; 12, 1981, 362-3; 13, 1982, 391; 15, 1984, 326; 16, 1985, 201 water supply, 311-2; 17, 1986, 421; 18, 1987, 349-51, 370; 20, 1989, 316, 318; 21, 1990, 356; 22, 1991, 288; 23, 1992, 304; 24, 1993, 316-7; 25, 1994, 287-8. *Current Arch.* 110, 1988, 98-102 with plan. Fasham & Whinney 1991, *Hampshire FC & AS Monograph* 7. During the reconstruction of the M3, archaeological investigations indicated a possible line for the aqueduct for the *civitas* of *Venta Belgarum* (modern Winchester). The supposed route is along a very circuitious line from SU 480 299 where it entered the town to the source about 23.5 km to the north-east at c. SU 567 327 (estimated from small scale maps given). Wachter 1995, 291-301, Fig.132 shows the walled town.

Windermere, Belle Isle, Cumbria.

Scott 1993, 48, SMR 2047, CU 1. *Country Life* 88, 1940, 48. Nicolson & Burns 1777, Vol.1, 625. Well.

Wingham, Kent.

Donker G, 1882, Part I, *Arch. Cant.* 14, 134-9, 2 figures of the bath; 15, 1883, 351-7, Part II, sketch drawing of excavation at Wingham villa; 82, 1967, lx. *Britannia* 2, 1971, 187, 193; 20, 1989, 199. *SxAC* 81, 1940, 61-2, (Appendix), baths and drains. *VCH Kent* 3, 1932, 125. *TIRCGLL* 1983, 106, villa with bath. (*Cantiaci*).

Winterborne Kingston, Kingston Down, West Down, Dorset.

Antiq. J. 33, 1953, 74-5. *Britannia* 19, 1988, 476; 21, 1990, 353. *Dorset Proc.* 11, 1890, 1-6. Bromhead 1942, 143. *RCHM* 3(2), 1970, County of Dorset, 300-5, item 21, 'Romano-British Well on Kingston Down', excavated by Mansel-Pleydell, J C, in 1890. The well is at OD 200ft (60.8m), and cut into chalk limestone and is 1.1m in diam, and 25.8m (85ft) deep to water level, so it is probably deeper. The well is not precisely located and is roughly situated at SY 845 975.

Winterton, Lincolnshire.

Antiq. J. 41, 1966 72-84. *Arch. J.* 91, 1934, 186, well. *Britannia* 2, 1971, 258 villa; 3, 1972, 315; 4, 1973, 286; 5, 1974, 424 water-leat; 6, 1975, 245-6; 7, 1976, 327-7 well; 8, 1977, 391; 10, 1979, 295-6; 11, 1980, 366-7; 12, 1981, 330-1; 13, 1982, 351; 14, 1983, 296; 15,

1984, 283; 16, 1985, 281; 17, 1986, 387. *JRS* 49, 1959, 109, pl.viii(1); 50, 1960, 221, 'bath-suite in use from late 2nd c. to early 3rd, another bath-suite in the same wing but to the east...'; 51, 1961, 171; 52, 1962, 167; 54, 1964, 157, 159, Fig.10; 55, 1965, 205; 56, 1966, 202, Fig.9. Scott 1973, 53-4, SE 933 189. Stead 1966. Stead 1976, 233, item 236, lead-pipe for waste water from bath, 234, item 237, iron coupling flanges for two lengths of oak wooden pipes which supplied water to the baths, drain, 25, Fig.14, tank. *EMAB* 1965, 21. Whitwell 1982, 338.

Witchampton, Hemsworth, Wall's Field, Dorset.

PDNHAS 29, 1908, lxxxvii-lxxxviii; 30, 1909, 1-12; 51, 1929, 87, 102, 104. *PBNSS* 1, 1908-9, 63-4. *RCHM Dorset* 5, 1975, 104-10. Scott 1993, 55-6, SMR 3 027 022, DO 37. Bath.

Withington, Woods, Gloucestershire.

Archaeologia 18, 1817, 118-21. Finberg 1955. Scott 1993, 77, SMR 31, 2146, GS 108, 109, well, spring. Smith 1969, 97-101. *TIRCGLL* 1983, 106, courtyard villa. (*Dobunni*).

Wittenham, Berkshire.

VCH Berkshire 1, 1906, 219-222, Fig., p.221, 3 wells.

Wolfhamcote, Sawbridge, Warwickshire.

VCH Warwickshire 1, 1904, 249, well, probably used for ritual purposes, 1.3m square and greater than 13.5m deep, but bottom not reached. At 6.7m 'was a large square stone with a hole in it, on which stood urns of grey ware'; 12 were intact and 12 were broken.

Wollaston, Northamptonshire.

Arch. J. 3, 1966, 1-6. *Britannia* 3, 1972, 325-7; 5, 1974, 253 villa; 16, 1985, 289, bath-house; 25, 1994, 273. Condron 1996, 352. Hall & Nickerson 1966, 1-6. *Northants Arch.* 24, 1992, 67-75, bath-house and drainage ditches. *RCHM(E) Northamptonshire* 2, 1979, 180, site30. *TIRBS* 1987, 84, corridor villa with bath-house, near native settlement. (*Catuvellauni*).

Woodchester, Gloucestershire.

Britannia 5, 1974, 451; 13, 1982, 197-228, with plans and figures and pls.xiv-xvii. Clarke 1982. Lysons 1797. *RCHM* 1976, 132-4, and figure. Richmond, 1969, 62. Scott, 1993, 78, SMR 300, GS 110. *TBGAS*

47, 1926; 48, 1927, 75-96; 74, 1956, 172-5. *TIRCGLL* 1983, 107, large villa with two courtyards, and an aqueduct and bath. (*Dobunni*).

Woodcock Hall, Saham Toney, Norfolk.

Britannia, 9, 1978, 480; 17, 1986, 1-58; 22, 1991, 69; Brown 1986, at p.4 comments 'Fresh water can be obtained from the river, or from wells that need to be no deeper than about 5m (16ft), to draw water from the top of the underlying clay'. The site is along Peddar's Way Roman Road. Appears to be a settlement below a Claudian fort on a nearby hill, apparently confirmed by a find of a bronze petara handle inscribed "*Primi C(enturiae) Primi*" (Property of the century of Primus), in *Britannia*, 9, 1978, 480. Smith 1987, 157, comments, 'A small scale excavation by B A Dennis uncovered a pit and what was either a stone path or a wall-footing, 0.76 to 0.91m wide, made of chalk blocks and flints, and also a timber-lined well (Norwich Museum file)'. *Norfolk Arch.* 37, 1979 220; 38?, 1982, 206-8. Cunliffe 1974, 285.

Woolaston, Gloucestershire.

Arch. Camb. 93, 1938, 93-125; 102, 1953, 100. *Britannia* 20, 1989, 311-2; 22, 1991, 277-8; 23, 1992, 159-215, bath-block. McWhirr 1981, 97-9. Scott 1993, 78, SMR 16, GS 111. *TIRCGLL* 1983, 107, villa with bath; occupied c. AD 130 to 4th c. (*Dobunni*).

Woolstone, Oxfordshire.

Berkshire Arch. J. 57, 1959, 83-5. *JRS* 46, 1956, 144, bath. Scott 1993, 163, SMR 7316, OX 66. *VCH Berkshire* 1, 1906, 222.

Wootton Hill, Hampshire.

Britannia 5, 1974, 434, bath.

Worcester, Worcestershire.

Branigan & Fowler (eds.), 1976, 114-5. *Britannia* 1, 1970, 191 possible early fort; 5, 1974, 346, 354; 8, 1977, 397, water pipeline (?aqueduct); 9, 1978, 439; 16, 1985, 1988, water supply; 20, 1989, 287; 23, 1992, 284; 24, 1993, 293; 25, 1994, 272. Crickmore 1984, 69-70, 105-6. *PNRB* 1979, 496, *Rav. Cos.* 106.30 (*Vertis*). Smith 1987, 312-3. *TWAS*(3) 2, 1968-9, 7-116, at 15-19, 63, 75, 84-5. *VCH Worcestershire* 1, 1901, 203-8. *TIRBS* 1987, 84, town with extensive extra-mural settlement, coins dating from late 3rd to 4th c. and

evidence of iron smelting during this period; Iron Age occupation evidence; a large house excavated. (*Dobunni*).

Worth, Kent.

Antiq. J. 20, 1940, 115-21. *Britannia* 24, 1993, 309, well, upper part was in brick earth and was lined with flint and clay, and the lower part was in chalk and unlined. Lewis, 1966, 3. Ross 1967, 46, 198. *TIRCGLL* 1983, 107, temple in its *temenos* on the site of an Iron Age temple. (*Cantiaci*).

Wortley, Gloucestershire.

Britannia 18, 1987, 341 villa; 19, 1988, 470; 20, 1989, 312; 22, 1991, 278 bath-suite; 23, 1992, 295-6. *Glevensis* 20, 1986, 41-4. Bath, drain to a latrine, apparently dismantled, perhaps c. AD 150.

Wraxall, Avon, Somerset.

Britannia 9, 1978, 356. *PSANHS* 105, 1961, 37-51. *TIRCGLL* 1983, 107, villa with a large bath-suite; occupied c. AD 250 to c. AD 350. (*Belgae*).

Wroxeter, Salop, Shropshire.

Antiquity 58, 1984, 117-20 Fig.1, town plan. *Antiq. J.* 46, 1966, 229, 39; 48, 1968, 296-300. Atkinson 1942 (reissued 1970), aqueduct (133-7); bath-house, 2 drains, cistern (water tower) Fig.11; major sewer (369); water distribution Fig.167. The water supply network distribution appears to be extensive with many channels having been used; this also applies to other aspects of the water-related structures other than the aqueduct. *TBAS* 78, 1962, 27-39. Barker 1975. Barker (n.d.), 'Wroxeter Roman City: Excavations 1966-80'. *Britannia* 1, 1970, 42, 55, 64 *Ant. Itin.* 469.6 (*Urioconio*), 482.9-10 (*Viroconiorum*), 484..9 (*Viriconio*), 122-3, 188-9, 196-7; 2, 1971, 20, 261-2 baths, basilica; 3, 1972, 316-7; 4, 1973, 287; 5, 1974, 158, 197, 428-9; 6, 1975, 78, 106-17, (baths-basilica Wroxeter excavated 1966-74), 247-8; 7, 1976, 328-30; 8, 1977, 323-4, 394-6 reservoir, sewer, tanks, wooden pipe-line; 9, 1978, 339, 437-8; 10, 1979, 297-8, main sewer; 11, 1980, 368; 12, 1981, 337; 13, 1982, 130, 358-60, 419; 14, 1983, 302-3, 337; 15, 1984, 345; 16, 1985, 204-5 water supply; 17, 1986, 391-3; 20, 1989, 72, 178; 22, 1991, 250; 23, 1992, 321-2; 24, 1993, 292; 25, 1994, 271. Bromhead 1942, 185, many wells closed during 2nd c. *JRS* 43, 1953, 118; 44, 1954, 93; 48, 1958, 98; 50, 1960; 51, 1961; 52, 1962, 169-70, '... N of the post office, a cistern

2.43m (8ft) wide and at least 3.65m (12ft) deep, constructed after AD 155, and robbed of its tile lining within the Roman period, probably in the late 3rd century to early 4th century AD'; 53, 1963, ?; 54, 1964, 162-3, 165, Figs.14, 15. Wachter 1995, 19, 21, 22, 30, 46, 151, 159, 362-77, 389, 433, Fig.11, bath-house, Figs.165, 166, 168, 167, water supply and aqueduct; Fig.169 baths during 5th c. Aqueduct (369), major sewer 369, bath-house, 2 drains, cistern Fig.11, water distribution channel Fig.167. *RIB* 291. Webster 1988, 120-44. Webster & Hollingsworth 1957-60, *TSAS* 56, 133-7; 57, 1962-3, 112-31; 58, 1965-8, 197-219; 59, 1969-74, 24-31; 70, 1975-6, 5-39. *TIRBS* 1987, 84-5, fortress, *civitas* capital 1st c; occupied 1st c. to 5th c. (*Cornovii*).

Wyck, Hampshire.

Britannia 20, 1989, 319, bath. *PHFC* 44, 1988, 25-39. Occupation from 2nd c. to 4th c.

Wycombe (High), Buckinghamshire.

Arch. J. 124, 1967, 129-59, Figs.1-7, pls.i-viii. Branigan 1967, 158. Hartley 1959, *Rec. of Bucks.* 16, 227-57. Parker 1878, 3. Scott 1993, 28, *SMR*, BU49. *VCH Buckinghamshire* 2, 1908, 17-9, plan. *TIRCGLL* 1983, 50; villa, double-corridor; detached bath-house; late 2nd c. to late 4th c. (*Catuvellauni*).

Wykham Park, Oxfordshire.

VCH Oxfordshire 1, 1939, 331 (sv Banbury), well. *TIRBS* 1987, 85, building (?); coins from Claudius ii to Valens. (*Dobunni*).

Wyndham, Gann's Close, Leicestershire.

Nichols 1810, 2, pt.II, 889. Scott 1993, 116, *SMR* SK 81 NW V, LE 99, well. Throsby 1889, 2, 149. *TLAHS* 3, 1874, 87; 56, 1980-1, 116-20.

Wyndley (Great), Wyndley Bury, Ninesprings, Hertfordshire.

Britannia 7, 1976, 340 settlement. *JRS* 12, 1922, 256. Scott 1993, 97, *SMR* 467, HT 75. *THNHS* 4, 1886, 43-6. *VCH Hertfordshire* 4, 1914, 169-71, bath-building, rooms 1-3 pl. xx, p.170. *TIRCGLL* 1983, 55, villa; coins date from AD 193 to 392. Samian ware of 2nd c. (*Catuvellauni*).

Yardley Hastings, Northamptonshire.

BNFAS 4, 1970, 14-5; 6, 1971, 19, Yardley Hastings 3. Northamptonshire SMR 3299. *RCHM* County of Northamptonshire, Central, 1, 1979, 182-6, Figs.162-7, No. 67, item 9. Whitwell 1982, 342. Swan 1984, fiche 551. Stone-lined well, 4.7m deep.

Yarwell, Northamptonshire.

Britannia 24, 1993, 318. *Durobrivae* 3, 1975, 15-8. *JRS* 27, 1937, 234. *Northants. Arch.* 11, 1976, 178; 10, 1975, 114-5; 13, 1978, 77. *RCHME* County of Northants, N-E Arch. 1, 1975, 114-5, site 5 at TL 056 985. Scott 1993, 149, SMR 1711, NH 125, site dates from Iron Age through to 4th c. AD, into Late Roman period. *TIRBS* 1987, 85, (TL 061 991 & TL 066 979). ?bath. (*Catuvellauni*).

Yatton, Wemberham, Avon, Somerset.

Britannia 7, 1976, 175, 183 temple. *JBAA* 43, 353-62. *JRS* 55, 1965, 216. Morgan 1887, 353-62. *PSANHS* 31, 1886, 1-9, 64-73; 74, 1828, 122-43. Rainey 1973, 167. *VCH Somerset* 1, 1906, 306-7, item 2, Fig.66. *TIRCGLL* 1983, 107; villa with bath; occupied 3rd to 4th c. (*Belgae*).

Yeovil, Avon, Somerset.

Britannia 22, 1991, 281. *PSANHS* 74, 1928, 122-43. Rainey 1973, 153. *TIRCGLL* 1983, 107; courtyard villa with bath; occupied late 2nd to late 4th c. (*Durotriges*).

York, Yorkshire.

Antiq. J. 44, 1974, 200-17. *Arch. J.* 142, 1985, 216-36. *Britannia* 1, 1970, 41-3, 47, 49, 52 Ant. Itin. 466.1, 468.4, 475.7, 478.6, (*Eburacum*), 192, 257-8, 307-8; 3, 1972, 265-6, 310; 4, 1973, 256, 280-1 bath-house, sewer, 325, 329; 5, 1974, 414, 469; 6, 1975, 83-6, 236-7, 289; 7, 1976, 165-6, 168, 315 well; 8, 1977, 330-2, 382-3; 9, 1978, 426-7; 10, 1979, 160-1, 436; 11, 1980, 318; 12, 1981, 328-9, 394-5; 13, 1982, 349; 14, 1983, 13ff, 294, 337, 349; 15, 1984, 117ff, 282-3; 16, 1985, 279; 17, 1986, 74-6, 84-5, 436; 18, 1987, 319-20, 367, 373-7; 19, 184-9, 439-40; 20, 1989, 178, 188, 278; 21, 1990, 147-57, 221, 275, 325-7; 22, 1991, 341; 23, 1992, 273; 24, 1993, 286; 25, 1994, 267. Hanson 1970, 373, comments, 'A section of one of the lead watermain that distributed the water brought by an aqueduct throughout the fortress was uncovered in the S-W intervallum road at this site, but evidence for the line of the aqueduct itself is so far lacking'. *JRS* 11, 1921, 101-7; 15, 1925, 175-94; 18, 1928, 61-99; 44,

1954 to 48, 1958; 50, 1960 to 59, 1969. *RCHME* City of York 1962, 38. Whitwell 1976, 1-55, pls.ia-xvib, which shows the sewer channel of which 44m traced; fall 0.74m, floor elevation 10.3m OD, 0.45m wide by 1m high, covered with Millstone slabs 1.20 x 0.75 x 0.3 m, representing a main sewer with 6 distribution branches and 3 vertical sections, pls.1a to xib; very good B & W photographs of the sewer. See Figs.1, 2 & 3 of the general plan (scale 1:200) and detailed plan (scale 1:100). Sheahan & Whellan, Vol.1, 1855, 308. *PNRB* 1979, 355-7. Stephens 1985b comments, 'A wooden pipeline has been found outside the S-E angle together with a second to early third century cooking pot. Intramural distribution was by lead mains (Taylor & Richmond 1960, 219; *RCHM* 1962, I, 38, pl. 17). The impressive Church Street drainage system suggests that an aqueduct was laid not later than the Trajanic rebuilding. The environmental evidence from that system suggests that the aqueduct may have been a covered channel (Buckland 1976, 16-8, 27-8) - presumably a pipeline'. *CSIR* I.3, 1983, Nos. 1-14, 21-7, 34-5, 38-93, 108, 116-26, 129-32. *TIRBS* 1987, 85-6, *RIB* 640-706; fortress (20.23ha) established c. AD 71; probable headquarters of Agricola (*RIB* 662-3); internal baths; Colonia by c. AD 237; another settlement established west of the river Ouse, which also had a bath. (*Brigantes*).

APPENDIX 3: DATABASE SITES WITH TYPE AND LOCATIONS*

* A ? indicates that there is some uncertainty either of type, name, or location.
A + before a site type indicates it has been specifically discussed in Chapter 6.

Site Name	Site Type	Roman Name	Eastings	Northings	Location
Abbots Langley	villa		508000	202000	TL 08 02
Abergavenny	fort	Gobannivm	329000	214000	SO 29 14
Abingdon	settlement		449900	197200	SU 499 972
Abinger Hammer	villa		509750	147200	TQ 0975 4720
Abridge	settlement		545700	196400	TQ 457 964
Ackworth Low	villa		444000	417000	SE 44 17
Acton Scott	villa		345800	289800	SO 458 898
Adel	settlement		427000	441000	SE 27 41
Ailsworth(1)	villa		410000	298000	SP 10 98
Ailsworth(2)	small town		511000	297000	TL 11 97
Alcester	fort		408900	257200	SP 089 572
Alchester	small town		457200	220300	SP 572 203
Aldborough	civitas	Isvrvm Brigantvm	440400	466300	SE 404 663
Aldbourne	+settlement?	(Upper Upham)	426250	173550	SU 2625 7355
Aldenham	villa		514000	201000	TL 14 01
Aldermaston	+settlement		460500	168100	SU 605 681
Alfoldean	small town	(minor settlement)	511700	133000	TQ 117 330
Alresford	villa		601600	219900	TM 016 199
Alwinton	settlement		391600	606200	NT 916 062
Ancaster	small town	(early fort)	498100	343600	SK 981 436
Angmering(1)	villa		505000	104000	TQ 05 04
Angmering(2)	villa		508000	104000	TQ 08 04
Apethorpe	villa		502630	294930	TL 0263 9493
Appleshaw	villa		429200	148450	SU 2920 4845
Arbury Road	settlement		545220	260490	TL 4522 6049
Ardoch	fort (falsus)	Alavna	284100	710100	NN 841 101
Armoth	villa		217000	207000	SN 17 07
Arreton	villa		453000	086000	SZ 53 86
Ash	villa		628000	159000	TR 28 59
Ash-Cum-Ridley	villa		560800	165000	TQ 608 650
Ashdon	villa		557800	243500	TL 578 435
Ashill	villa		590900	305800	TF 909 058
Ashted	villa		518000	157000	TQ 18 57
Ashton	small town	(industrial)	504800	204800	TL 048 893
Asthall	+settlement		428600	211500	SP 286 115
Atworth	villa		385600	166500	ST 856 665
Auckley	settlement		465680	400320	SE 6568 0032
Axminster	small town		329700	097400	SY 297 974
Badbury	+settlement		419400	181000	SU 194 810
Badgeworth	villa		393170	216890	SO 9317 1689
Baldock	small town		524730	233570	TL 2473 3357
Balmuildy	fort		258300	671700	NS 583 717
Bancroft	villa		482700	240370	SP 8270 4037
Banwell	villa		340200	157900	ST 402 579
Bar Hill	fort		270800	675900	NS 708 759
Barkby Thorpe	villa		464000	307000	SK 64 07
Barming Heath	villa		572000	154000	TQ 72 54
Barnack	villa		505600	306500	TF 056 065
Barnsley Park	villa		408100	206150	SP 0810 0615
Barnwell(1)	villa		507600	284800	TL 076 848

Site Name	Site Type	Roman Name	Eastings	Northings	Location
Barnwell(2)	villa		505000	285000	TL 076 848
Barochan	fort		241300	669000	NS 413 690
Barrington	villa		420400	213800	SP 204 138
Bartlow(1)	villa		558000	244000	TL 58 44
Bartlow(2)	villa		558800	245000	TL 588 450
Barton Court Farm	villa		451000	197800	SU 510 978
Bath	small town	Aqvae Svlis	375000	165000	ST 75 65
Bathford	villa		378000	165000	ST 78 65
Beadlam	villa		463400	484200	SE 634 842
Bearsden	fort		254500	672100	NS 545 721
Beaufront Redhouse	fortress		397100	565100	NY 971 651
Beauport Park	settlement	(iron mine)	578600	114000	TQ 786 140
Beckfoot	fort		309300	549500	NY 093 495
Beddingham	villa		545800	107400	TQ 458 074
Beddington	villa		529700	165800	TQ 297 658
Beenham	villa		460000	167000	SU 60 67
Benwell	fort		421500	564700	NZ 215 647
Bere Regis	settlement		385140	097140	SY 8514 9714
Berinsfield	settlement		458400	196800	SU 584 968
Bewcastle	fort	Fanvm Cocidi	356600	574700	NY 566 747
Bibury	villa		412200	206400	SP 122 064
Biddenham	villa		501000	250000	TL 01 50
Biglis	settlement		314200	169400	ST 1420 6940
Bignor	villa		498700	114700	SU 987 147
Billericay	settlement		567500	193800	TQ 675 938
Binchester	fort	Vinovia/Vinovivm	421000	531300	NZ 210 313
Binstead	villa		476000	141000	SU 76 41
Birdoswald	fort	Banna	361600	566300	NY 616 663
Birrens	fort	Blatobvlgivm	321500	575400	NY 215 754
Biterne	small town		443400	113200	SU 434 132
Bittesby	villa		449000	285000	SP 49 85
Bitton	villa		367000	169000	ST 67 69
Bledlow-Cum-Saunderton	villa		479900	269000	SP 799 990
Bletchingley	villa		532000	150000	TQ 32 50
Blisworth	settlement		471900	254000	SP 719 540
Blyborough	+settlement		491900	394400	SK 919 944
Boreham	+settlement		575150	211900	TL 7515 1190
Borough Hill	villa		458000	263000	SP 58 63
Bothwellhaugh	fort		272900	657800	NS 729 578
Bottesford	villa		489900	407000	SE 899 070
Boughton	settlement		474500	265700	SP 745 657
Boughton Monchelsea	villa		578000	151000	TQ 78 51
Bourne	villa		510000	320000	TF 10 20
Bourne/Morton	villa		510800	320500	TF 108 205
Bourton-on-the-Water	small town		416100	221000	SP 161 210
Bowes	fort	Lavatris	399300	513500	NY 993 135
Box	villa		382000	168000	ST 82 68
Boxted Farm	villa		585160	166190	TQ 8516 6619
Bozeat	settlement		489590	259980	SP 8959 5998
Bradford Down	villa		397700	104400	ST 977 044
Bradford-on-Avon	villa		381000	161000	ST 81 61
Brading	villa		459000	086000	SZ 59 86
Bradley Hill	settlement		348000	130340	ST 4800 3034

Site Name	Site Type	Roman Name	Easting	Northing	Location
Braintree	small town		575500	223100	TL 755 231
Braishfield	villa		438000	126000	SU 38 26
Brampton	small town		622410	223780	TG 2241 2378
Brandon	fort	(camp)	340100	272400	SO 401 724
Brantingham	villa(falsus)		493200	428800	SE 932 288
Braughing	small town		539140	224330	TL 3914 2433
Brecon Gaer	fortress(A)	Cicvcivm	300000	229000	SO 00 29
Brewood	villa		389000	310000	SJ 89 10
Brislington	villa		362000	171000	ST 620 710
Bristol(1)	villa		355000	178000	ST 55 78
Bristol(2)	villa		353000	177000	ST 53 77
Brithdir	fortlet		277300	318800	SH 773 188
Brixworth	villa		474700	271900	SP 747 719
Broadfields	settlement		525800	135300	TQ 258 353
Bromham(1)	villa		399800	164200	ST 998 642
Bromham(2)	+settlement?		502700	252300	TL 027 523
Brough-by-Bainbridge	fort	Virosidvm	393700	490200	SD 937 902
Brough-on-Humber(1)	fort	Petvaria	493000	426000	SE 93 26
Brough-on-Humber(2)	settlement		494100	426750	SE 9410 2675
Brough-on-Noe	fort	Navio	418100	382700	SK 181 827
Bryncross	settlement		221400	331600	SH 214 316
Buchley	fort		259500	672000	NS 595 720
Bucknowle Farm	villa		395400	141800	SY 954 418
Buckton	fortress(A)		339000	273000	SO 39 73
Bunny	settlement		457950	328900	SK 5795 2890
Burgh	villa		622400	252300	TM 224 523
Burham	villa		572000	161000	TQ 72 61
Burrow-in-Lonsdale	fort	Calacvm	361730	476150	SD 6173 7615
Burton	settlement		496100	374700	SK 961 747
Buxton	small town		405700	373400	SK 057 734
Cadder	fort		261700	672600	NS 617 726
Caerhun	fortress(A)	Canovivm	277500	370400	SH 775 704
Caerleon	fortress(L)	Isca	332300	190900	ST 323 909
Caernarvon	fortress(A)	Segontivm	248200	362500	SH 482 625
Caersws	fortress(A)		303000	291800	SO 030 918
Caerwent	civitas	Venta Silvrvm	346700	198700	ST 467 987
Caister-on-Sea	fort		651700	312310	TG 5170 1231
Caistor-by-Norwich	civitas	Venta Icenorvm	623100	303400	TG 231 034
Calne	villa		398000	170000	ST 98 70
Cambridge	small town	Duroliponte	544400	259300	TL 444 593
Camelon	fort		286500	680600	NS 865 806
Camerton	small town		368000	156000	ST 68 56
Camphill	villa		473000	258000	SP 73 58
Canterbury	civitas	Dvrovernvm Cantiacor	614740	157680	TR 1474 5768
Cantley	settlement		461100	401480	SE 6110 0148
Cappuck	fortlet		369500	621300	NT 695 213
Cardiff Castle	fortress(A)		318100	176600	ST 181 766
Carisbrooke	villa		448000	088000	SZ 48 88
Carlisle	civitas	Lvgvvallvm	339600	556100	NY 396 561
Carlisle-Old	fort	Maglona ?	326000	546400	NY 260 464
Carmarthen	civitas	Moridvnm	241000	220000	SN 41 20
Carpow	fortress(A)		320000	717000	NO 20 17
Carrawburgh	fort	Brocolitia	385900	571200	NY 859 712

Site Name	Site Type	Roman Name	Hastings	Northings	Location
Carsington	settlement		425000	352400	SK 250 524
Carvoran	fort	Carvoran Magnis	366500	565700	NY 665 657
Castell Collen	fort		305500	262800	SO 055 628
Castle Cary	fort		279900	678300	NS 799 783
Castle Greg	fortlet		305000	659200	NT 050 592
Castle Hill(1)	small town	Margidvnm	470000	341500	SK 700 415
Castle Hill(2)	fortlet	Margidvnm	470010	341510	SK 7001 4151
Castle Nick	fort	(Mile Castle 39)	376100	567800	NY 761 678
Castle-Dykes	villa		428500	476500	SE 285 765
Castleford	fort	Lagentivm	442500	425500	SE 425 255
Castleshaw	fort	Rigodvnm	399880	409650	SD 9988 0965
Castlesteads	fort	xellodunum	351200	563500	NY 512 635
Castor(1)	villa		511550	297780	TL 1155 9778
Castor(2)	+settlement		512400	298400	TL 124 984
Catsgore	villa		350700	126600	ST 507 266
Catterick	fort	Cataractonivm	424100	497200	SE 241 972
Cattybrook	settlement		359300	197200	ST 593 834
Caversham	settlement		472860	174090	SU 7286 7409
Chalk	villa		567700	173000	TQ 677 730
Chapel Hill	fort		406000	835000	NK 06 35
Charmy Down	villa		377600	169100	ST 7760 6910
Chedworth(1)	villa		405300	213500	SP 053 135
Chedworth(2)	villa		405200	213400	SP 052 134
Chells Manor	settlement		526600	225900	TL 266 259
Chelmsford	small town	Caesaromagvs	570920	206210	TL 7092 0621
Cheshunt	settlement		535000	202000	TL 35 02
Chester	fortress(L)	Deva	340400	366200	SJ 404 662
Chester-le-Street	fort	Concangis	427600	551300	NZ 276 513
Chesterholm	fort	Vindolanda	376800	566300	NY 768 663
Chesters	fort	Cilvnm	391200	570100	NY 912 701
Chesterton(1)	small town		511000	296000	TL 11 96
Chesterton(2)	small town		512000	296000	TL 12 96
Chesterton(3)	fort		383200	348900	SJ 832 489
Chichester	civitas	Noviomagvs Regnorvm	486500	104600	SU 865 046
Chigwell	+settlement	Dvrolitvm	545000	196000	TQ 45 96
Chilgrove(1)	villa		483000	112000	SU 83 12
Chilgrove(2)	villa		484100	113600	SU 841 136
Chipping Warden	villa		451000	248200	SP 510 482
Chiseldon	villa		419000	180000	SU 19 80
Churchill	settlement	(Grounds Farm)	428500	225500	SP 285 255
Churchill Hospital	settlement		454600	205700	SP 546 057
Cirencester(1)	civitas	Corinivm Dobvnm	402500	201700	SP 025 017
Cirencester(2)	villa		401600	202200	SP 016 022
Claydon Pike	settlement		419000	199600	SU 190 996
Clayton	villa		530000	113000	TQ 30 13
Cliffe House	settlement		473000	465500	SE 730 655
Cnut's Dyke	settlement		526000	293000	TL 260 930
Cobham	villa		508000	159000	TQ 08 59
Cobham Park	villa		567000	168000	TQ 67 68
Coddenham	small town	Combretovivm	611690	252810	TM 1169 5281
Colchester	colonia	Camvlodvnm	599000	225000	TL 99 25
Cold Brayfield	villa		492000	252000	SP 92 52
Cold Knap Point	+settlement		310090	166490	ST 1009 6649
Coldharbour	settlement	(falsus)	355000	203000	SO 55 03

Site Name	Site Type	Roman Name	Hastings	Northings	Location
Colerne	villa		381800	171500	ST 818 715
Coleshill	+settlement		419500	290500	SP 195 905
Collingham	villa		440340	446150	SE 4034 4615
Colliton Park	villa		368950	090960	SY 6895 9096
Colsterworth	settlement		491800	324000	SK 918 240
Combe Down	villa		376800	162200	ST 768 622
Comberton	villa		538450	254890	TL 3845 5489
Combley	villa		453000	087000	SZ 53 87
Compton(1)	villa		479700	112400	SU 797 124
Compton(2)	villa		495000	147000	SU 95 47
Compton(3)	settlement		447600	111400	SU 476 114
Congresbury	villa		344500	162700	ST 445 627
Corbridge	small town		398400	565300	NY 984 653
Corhamby	villa		511700	207900	TL 117 079
Corton	settlement?		654000	297000	TM 54 97
Cosgrove	villa		479470	242120	SP 7947 4212
Cotterstock	villa		503260	291070	TL 0326 9107
Covehithe	villa?		552200	282000	TM 522 820
Cow Roast	settlement		595800	282000	SP 958 102
Cowbridge	small town		299410	174750	SS 9941 7475
Cox Green	villa		487000	179800	SU 870 798
Cramond	fort		318900	676900	NT 189 769
Croy Hill	fortlet		273400	676500	NS 734 765
Dalginross	fort		277300	721000	NN 773 210
Dalswinton	fort		293600	583900	NX 936 839
Darenth	villa		556400	170600	TQ 564 706
Daventry	villa		458800	263200	SP 588 632
Dean Hall	settlement		368200	211900	SO 682 119
Denton	villa		487400	331300	SK 874 313
Derby	fort	Derventio	435200	332800	SK 352 373
Dersingham	settlement		567600	332800	TF 676 328
Desborough	settlement		479420	282590	SP 7942 8259
Desford	settlement		447800	303500	SK 478 035
Dewlish	villa		376800	097200	SY 768 972
Dicket Mead	villa		523400	215900	TL 234 159
Diddington	settlement		520200	265100	TL 202 651
Ditchley	villa		438700	200900	SP 387 009
Dolaucothi	small town	Lventinvm	266400	234400	SN 664 344
Doncaster	settlement	Danvm	457800	403200	SE 578 032
Dorchester(1)	civitas	Dvrnovaria	369400	090500	SY 694 905
Dorchester(2)	civitas	(SomerleighCourt)	369090	090390	SY 6909 9039
Dorn	small town		420700	233900	SP 207 339
Dover	fort	Portvs Dvbris	631000	141000	TR 31 41
Downshay Wood	settlement		397820	079010	SY 9782 7901
Downton	villa		418000	121000	SU 18 21
Drayton(1)	villa ?		483000	293000	SP 83 93
Drayton(2)	villa		481700	291800	SP 817 918
Droitwich	small town		389800	263900	SO 898 639
Dryhill	villa		393000	216000	SO 93 16
Ducklington	villa		436300	207200	SP 363 072
Duncton	villa		496000	117000	SU 96 17
Dunsby	settlement		512200	327100	TF 122 271
Dunstable	small town	Dvrocobrivis	501000	221000	TL 01 21
Duntocher	fortlet		249400	672700	NS 494 727
Durham	+settlement?		428900	541600	NZ 289 416

Site Name	Site Type	Roman Name	Easting	Northing	Location
Duston	small town		473500	260200	SP 735 602
Earith	settlement		539100	275900	TL 391 759
East Coker	villa		354000	112000	ST 54 12
East Ilsley	settlement		449000	180000	SU 49 80
Eastbourne	villa		561000	099500	TV 61 99
Easter Haprew	settlement		319400	640100	NT 194 401
Easton	villa?		628200	258700	TM 282 587
Eaton	settlement		477900	326600	SK 779 266
Eaton-by-Tarporley	villa		357170	363410	SJ 5717 6341
Ebchester	fort	Vindomora	410400	555400	NZ 104 554
Ebrington	villa		419010	239900	SP 1901 3990
Eccles	villa		572200	160500	TQ 722 605
Eckington	villa		392000	241600	SO 920 416
Elginhaugh	fort		332100	667300	NT 321 673
Elsted	villa		481800	115300	SU 818 153
Ely	villa		314500	176700	ST 145 767
Emberton	settlement		488000	250000	SP 88 50
Empingham	villa		494300	307700	SK 943 077
Enfield	settlement		534410	199990	TQ 3441 9999
Engleton	villa		389500	310300	SJ 895 103
Epperstone	villa		467200	349600	SK 672 496
Ewell	small town		522500	162500	TQ 225 625
Ewhurst	villa		509000	140500	TQ 090 405
Exeter	fortress	Isca Dvmoniorvm	291920	092800	SX 9192 9280
Exning	villa		561200	267600	TL 612 676
Falkirk	fort		288200	679900	NS 882 799
Farley Hungerford	villa		304000	140000	ST 04 40
Farmington	villa		413230	215850	SP 1323 1585
Farmoor	settlement		445000	206000	SP 45 06
Farnham Royal	villa		496000	182000	SU 96 82
Farnham(1)	villa ?		636000	260000	TM 36 60
Farnham(2)	villa		484600	146600	SU 846 466
Farnham(3)	settlement		395300	115300	ST 953 153
Farningham	villa		555500	167500	TQ 555 675
Farnworth	settlement		351000	387000	SJ 510 870
Fawler	villa		437200	216900	SP 372 169
Feltwell	villa		569990	292070	TL 6999 9207
Fendoch	fort		293000	728000	NN 93 28
Ffrith	fort		328400	354800	SJ 284 548
Fifehead	villa		377280	111210	ST 7728 1121
Fillingham	villa		495400	386400	SK 954 864
Finchingfield	villa		568500	238500	TL 685 385
Findon	villa		511900	109700	TQ 119 097
Fingringhoe	fort		604700	219400	TM 047 194
Fishbourne	villa		483700	104400	SU 837 044
Flamsteed	settlement		538900	177300	TQ 389 773
Fletton	settlement		519700	296500	TL 197 965
Folkstone	villa		624260	136950	TR 2426 3695
Fordcroft	villa		546780	167580	TQ 4678 6758
Foscott	villa		472000	235000	SP 72 35
Foxcote	villa		472200	235300	SP 722 353
Frampton	villa (falsus)		361000	095000	SY 61 95
Frilford	small town		442000	197000	SU 42 97
Friskney	settlement?		546300	345500	TF 463 455
Frocester Court	villa		378500	202900	SO 785 029

Site Name	Site Type	Roman Name	Eastings	Northings	Location
Funtington	villa		482000	108000	SU 82 08
Gadebridge Park	villa		505500	207508	TL 055 075
Garden Hill	+settlement		544400	131900	TQ 444 319
Garton Slack	settlement		495300	460100	SE 953 601
Gatcombe	villa		352600	169800	ST 526 698
Gayton	settlement		471270	254880	SP 7127 5488
Gayton Thorpe	villa	#	573500	318000	TF 735 180
Gelligaer	fort		313000	196000	ST 13 96
Gestingthorpe	villa		588200	238700	TL 882 387
Glenlochar	fort	?Levcovia	273500	564500	NX 735 645
Gloucester	colonia	Glevvm	383600	218900	SO 836 189
Goadby Marwood	settlement		477600	327000	SK 776 270
Godmanchester(1)	small town	Dvrovigvtvm	524700	270500	TL 247 705
Godmanchester(2)	villa		525000	271000	TL 25 71
Gorhambury	villa		511700	207900	TL 117 079
Goring	villa		510600	103900	TQ 106 039
Grafton Estate	settlement	Bovivm	342500	352200	SJ 425 522
Grandford	settlement		539300	299600	TL 393 996
Great & Little Kimble	villa		482000	206000	SP 82 06
Great Bulmore	+settlement		336100	191500	ST 361 915
Great Casterton(1)	small town		500100	308800	TF 001 088
Great Casterton(2)	villa		500400	309300	TF 004 093
Great Chesterford(1)	fortress(A)		550300	243000	TL 503 430
Great Chesterford(2)	villa		550000	243000	TL 50 43
Great Chesters	fort	Aesica	370400	566800	NY 704 668
Great Dunmow	small town		562600	221900	TL 626 219
Great Linford	villa		484400	241300	SP 844 413
Great Staughton	villa		513600	263500	TL 136 635
Great Tew	villa		440000	210000	SP 40 27
Great Totham	villa		587000	210000	TL 87 10
Great Witcombe	villa		389900	214400	SO 899 144
Greetwell Fields	villa		499600	371600	SK 996 716
Greta Bridge	fort		408400	513100	NZ 084 131
Grimstead	villa		423000	127000	SU 23 27
Grimston	villa		571800	321600	TF 718 216
Grinley on the Hill	settlement		473700	392000	SK 737 920
Hacconby	settlement		511700	325000	TF 117 250
Haceby	villa		502000	336000	TF 02 36
Hacheston	small town		631200	256700	TM 312 567
Haddon	+settlement		514000	293200	TL 140 932
Hadstock	villa		553300	207600	TL 533 076
Hales	villa		372200	333800	SJ 722 338
Halstock	villa		353300	107600	ST 533 076
Halton Chesters	fort	Onnvm	399700	568400	NY 997 684
Hambleden	villa		478000	185000	SU 78 85
Hamilton	villa		464000	307000	SK 64 07
Hampstead Norrey's	settlement		464000	176000	SU 52 76
Hanham Abbots	villa		364000	170000	ST 64 70
Hardham	small town		503000	117000	TQ 03 17
Hardingstone	settlement		476000	257000	SP 76 57
Hardknott	fort	Mediobogdvm	321000	501000	NY 21 01
Harlow	small town		549500	211200	TL 495 112
Harpole	villa		468400	259900	SP 684 599

Site Name	Site Type	Roman Name	Easting	Northing	Location
Harpsden	villa		475000	180000	SU 75 80
Hartfield	villa		545600	138300	TQ 456 383
Hartlip	villa		582000	164000	TQ 82 64
Havant(1)	villa		471000	105000	SU 71 05
Havant(2)	villa		469000	107000	SU 69 07
Hayes	villa		540000	166000	TQ 40 66
Hayton	fort		481800	445600	SE 818 456
Heath and Reach	villa		493600	229200	SP 936 292
Hemsworth	villa		396000	106000	ST 96 06
Heybridge	small town		584700	208200	TL 847 082
Hibaldstow	small town		495900	402800	SE 959 028
High Cross	small town		447300	288600	SP 473 886
High Ham	+settlement		343000	128000	ST 43 28
High Legh	settlement		368900	383100	SJ 689 831
High Rochester	fort	Bremenivm	383300	598600	NY 833 986
Higham Ferrers	+settlement		496460	268810	SP 9646 6881
Hinton Charterhouse	villa		379000	158000	ST 79 58
Holcombe	villa		331500	092800	SY 315 928
Holditch	small town		334000	102000	ST 34 02
Holme House	villa		422100	515200	NZ 221 152
Holt	fortlet		340500	354500	SJ 405 545
Horncastle	settlement		525700	369500	TF 257 695
Horningsea	settlement		549830	263480	TL 4983 6348
Housesteads	fort	Vercovicivm	379000	568800	NY 790 688
Hovingham Park	villa		466300	475700	SE 663 757
Hucclecote	villa	*	387650	217350	SO 8765 1735
Hunsbury	villa		473700	258200	SP 737 582
Huntingdon	villa		524000	271600	TL 240 716
Huntsham	villa		356500	217500	SO 565 175
Hurcot	villa		351050	129780	ST 5105 2978
Ickham	settlement		523100	159100	TR 231 591
Ickleton	villa		549400	243500	TL 494 435
Icklingham	settlement		578200	272200	TL 782 722
Iford	villa		380000	157500	ST 800 575
Ilchester	small town	Lindinis	351000	123000	ST 51 23
Inchtuthill	fortress		312500	739600	NO 125 396
Inveresk	fort		334600	662200	NT 346 722
Irchester	small town		491700	266700	SP 917 667
Islip	villa		497000	278200	SP 970 782
Ivy Chimneys	settlement		581100	136000	TL 811 136
Ixworth	villa		593000	269000	TL 93 69
Jordon Hill	settlement		369000	082000	SY 69 82
Kelvedon	small town		586200	219000	TL 862 190
Kempsford	settlement		417200	199650	SU 1720 9965
Kempston	settlement		501200	247800	TL 012 478
Kenchester	small town	Magna	344000	242000	SO 44 42
Keston	villa		541400	163200	TQ 414 632
Kettering	small town		487220	280480	SP 8722 8048
Keynsham	villa		366800	161700	ST 668 617
Kings Weston Park	villa		353400	177600	ST 534 776
Kingscote	villa		380650	196080	ST 8065 9608
Kinneil	fortlet		297700	680300	NS 977 803
Kintbury	villa		439000	167000	SU 39 67
Kirk Sink	villa		393900	453600	SD 939 536

Site Name	Site Type	Roman Name	Eastings	Northings	Location
Lake Farm	fortress(A)		399700	099000	SY 997 990
Lambourn	villa(falsus)		434000	181000	SU 34 81
Lancaster	fort	Calacvm ?	347400	461900	SD 474 619
Lanchester	fort	Longovicvm	415000	546000	NZ 15 46
Landwade	+settlement		563000	267000	TL 63 67
Langton	villa		481600	467500	SE 816 675
Latimer	villa		499800	198600	SU 998 986
Lea Cross	villa	*	341700	308500	SJ 417 085
Leaden Well	villa		416210	220980	SP 1621 2098
Lease Rigg	fort		481400	504200	NZ 814 042
Lechlade	villa		421000	121000	SU 21 60
Leckhampton Hill	fort		394800	218300	SO 948 183
Leicester	civitas	Ratae Coritanorvm	457900	304200	SK 579 042
Leicester(1)	villa		457500	304300	SK 575 043
Leicester(2)	civitas		458600	304500	SK 586 045
Leintwardine	+settlement	Bravonivm	340600	274000	SO 406 740
Leyton	settlement		538500	186100	TQ 385 861
Lincoln	colonia	Lindvm Colonia	497400	372000	SK 974 720
Linley	settlement		334700	292700	SO 347 927
Linton	villa		557100	246200	TL 571 462
Litlington	villa		531300	242500	TL 313 425
Little Dunmow	villa		566400	221200	TL 664 212
Little Ponton/Stroxtan	villa		492700	333400	SK 927 334
Little Waltham	settlement		570000	212000	TL 70 12
Littlechester	small town	Deruentio	435300	337600	SK 353 376
Littlecote Park	villa		430100	176500	SU 301 765
Littleton	villa		349000	130000	ST 49 30
Llanddewi Brefi	villa?		264000	256000	SN 64 56
Llanddowror	villa		225000	212000	SN 25 12
Llandough	villa		316850	173150	ST 1685 7315
Llanfrynach	villa		306000	225000	SO 06 25
Llanio	fort	Bremia	264400	256200	SN 644 562
Llantwit	villa		295800	169900	SS 958 699
Locking	villa		336000	160000	ST 36 60
Loddington	settlement		481500	278000	SP 815 780
Loddon	villa		636000	298000	TM 36 98
London	municipium (civium)	Londinivm	532000	181000	TQ 32 81
Long Melford	+settlement		586100	245100	TL 861 451
Long Wittenham	settlement		455000	195000	SU 55 95
Longstock	villa		434000	136000	SU 34 36
Longthorpe	fortress(A)		515700	297700	TL 157 977
Loughor	fort		256200	197900	SS 562 979
Low Borrowbridge	fort		361110	500910	NY 6111 0091
Low Ham	villa		343000	129000	ST 43 29
Lower Slaughter	settlement		417400	222600	SP 174 226
Lufton	villa		351000	117000	ST 51 17
Lullingstone	villa		553000	165100	TQ 530 651
Lunt	fort		434700	274600	SP 347 746
Lydney	villa		361600	202500	SO 616 025
Lyminge	+settlement		616000	140000	TR 16 40
Lympne	fort	Portvs Lemanis	611000	134000	TR 11 34
Lynch Farm	settlement		514900	399700	TF 1490 9970
Lyne	fort	Carbantoritvm ?	318800	640500	NT 188 405
Maidenhead	villa		488000	181000	SU 88 81

Site Name	Site Type	Roman Name	Eastings	Northings	Location
Maidstone	villa		575600	156300	TQ 756 563
Malton	fortress(A?)	Derventio	479200	471600	SE 792 716
Mancetter(1)	fort	Mandvessedvm	431840	296490	SP 3184 9649
Mancetter(2)	small town		432600	296700	SP 326 967
Manchester	fort	Mamvcivm	383450	397780	SJ 8345 9778
Mansfield Wood House	villa		452300	364700	SK 523 647
Market Overton	villa		488000	316000	SK 88 16
Marshfield	settlement		379800	176100	ST 798 761
Marsworth	settlement		493000	214000	SP 93 14
Maryport	fort	Alavna	303800	537300	NY 038 373
Melandra Castle	fort	Ardotalia	489000	395000	SK 890 950
Methwold	villa		573100	295800	TL 731 958
Middleham	villa ?		413000	487000	SE 13 87
Mildenhall	small town	Cvnetio	421000	169000	SU 21 69
More	villa		334000	292000	SO 34 92
Moresby	fort	Cabrosentvm	298400	521100	NX 984 211
Morton Bourne	settlement?		513900	323300	TF 139 233
Mountsorrel	settlement		457900	314900	SK 579 149
Mucking	villa		567300	180300	TQ 673 803
Mumrills	fort		291600	679400	NS 916 794
Munthem Court	settlement		407000	012000	SZ 07 12 ?
Nantwich	settlement?		364800	352300	SJ 648 523
Nazeingbury	settlement		538700	206600	TL 387 066
Neath	fort (falsus)	Nidvm	274760	197800	SS 7476 9780
Neatham	small town	Vindomi(s)	474200	141200	SU 742 412
Nether Wild Farm	villa		514200	201200	TL 142 012
Netheravon	villa ?		414000	148000	SU 14 48
Netherby	fort	Castra Exploratorvm	359600	571700	NY 596 717
Nettleton	small town		382000	176000	ST 82 76
Newcastle	fort	Pons Aelii	425000	563900	NZ 250 639
Newhaven	villa		544000	101000	TQ 44 01
Newnham	villa		507500	249200	TL 075 492
Newport	villa		450000	088000	SZ 50 88
Newstead	fort	Trimontivm	357100	634400	NT 571 344
Norden	settlement		395800	082600	SY 958 826
Norfolk Street	villa		457500	304300	SK 575 043
North Leigh	villa		439700	215400	SP 397 154
North Mundham	villa		487000	103000	SU 87 03
North Stainley	villa		428500	476500	SE 285 765
North Wraxall	villa		383000	176000	ST 83 76
Northallerton	settlement?		436000	494000	SE 36 94
Northampton	settlement		474480	258830	SP 7448 5883
Northchurch	villa		497000	209000	SP 97 09
Northfleet	villa		561600	174100	TQ 616 741
Northmoor	settlement		442000	202000	SP 42 02
Norton	settlement	Bannaventa	461200	264500	SP 612 645
Norton Disney	villa		485000	360000	SK 85 60
Norton St. Phillip	villa		379000	158000	ST 79 58
Nunney	villa		374000	146000	ST 74 46
Nursling	settlement		436600	116150	SU 3660 1615
Oakham	settlement		486700	309500	SK 867 095
Oakley	villa		661500	127850	TM 6150 2785
Oakridge	+settlement		464200	153500	SU 642 535
Odell	settlement		495600	256800	SP 956 568

Site Name	Site Type	Roman Name	Easting	Northing	Location
Odiham	villa		473000	152000	SU 73 52
Old Durham	villa		427500	542100	NZ 275 421
Old Kilpatrick	fort		246000	672000	NS 46 72
Old Penrith	fort		349400	538400	NY 494 384
Old South Eau	settlement?		528400	309900	TF 284 099- 292 094
Orpington	villa		545400	165830	TQ 4540 6583
Orton Longueville	+settlement		517600	295600	TL 176 956
Otford	villa		553000	259000	TQ 53 59
Oxford	settlement		454650	205750	SP 5465 0575
Oxford(2)	settlement		454430	204080	SP 5443 0408
Pagans Hill	settlement		355600	162600	ST 556 626
Pamphill	villa		397000	162600	ST 97 04
Paulton	+settlement?		365000	156000	ST 65 56
Pen Llystyn	fortress(A)		248100	344900	SH 481 449
Pen-Y-Darren	fort		305300	206800	SO 053 068
Pennal	fort		270500	300100	SH 705 001
Pentre Ffwrndan Farm	+settlement		325500	372300	SJ 255 723
Peterborough(1)	settlement		521500	298900	TL 215 989
Peterborough(2)	settlement		520600	298900	TL 206 989
Piddington	villa		479650	254000	SP 7965 5400
Piercebridge	fort		421500	515700	NZ 215 157
Pinchbeck	settlement		524000	325000	TF 24 25
Pitmeads	villa		437000	116000	SU 37 16
Pitney	villa		345000	130000	ST 45 30
Pitsford	settlement		474200	267200	SP 742 672
Plas Coch	settlement		332600	351700	SJ 326 517
Plaxtol	villa		561400	153700	TQ 614 537
Poole	settlement		399800	099000	SY 998 990
Portchester	fort		462400	104600	SU 624 046
Portishead	villa		346000	176000	ST 46 76
Portland Island	settlement?		368650	072010	SY 6865 7201
Prestatyn	settlement		306200	381700	SJ 062 817
Puckeridge	settlement		538800	223700	TL 388 237
Pulborough	+settlement		507000	118000	TQ 07 18
Pumsaint	fort	Lventinvm	265600	240600	SN 656 406
Putley	settlement?		364000	237000	SO 64 37
Quernmore	settlement		352220	459340	SD 5222 5934
Quinton	settlement		477500	253500	SP 775 535
Radfield	settlement		593900	162800	TQ 939 628
Raeburnfoot	fortlet		325200	599100	NY 252 991
Rainham	settlement		554500	182000	TQ 545 820
Ravenglass	fort	Clanoventa	308800	495800	SD 088 958
Rayne	settlement		571270	222350	TL 7127 2235
Reach	villa		557260	265180	TL 5726 6518
Reculver	fort	Regvlbivm	622700	169400	TR 227 694
Redlands Farm	settlement		495800	270500	SP 958 705
Reigate	villa		526000	150000	TQ 26 50
Richborough	fort	Rvtvriae	632000	160000	TR 32 60
Ridgewell	villa		573300	240200	TL 733 402
Rippingale	settlement?		512600	328500	TF 126 285 - 150 275
Rivenhall	villa		582000	217000	TL 82 17
Rochester	small town	Dvrobrivae	574200	168500	TQ 742 685
Rock	villa		442400	084100	SZ 424 841

Site Name	Site Type	Roman Name	Eastings	Northings	Location
Rockbourne	villa		412000	117000	SU 120 170
Rockingham	settlement		486660	291280	SP 8666 9128
Rodersham	villa		592000	161000	TQ 92 61
Roecliffe	fort		438700	466500	SE 387 665
Romford	+settlement	(cf Chigwell)	551000	188000	TQ 51 88
Rothley	villa		456900	312200	SK 569 122
Rothwell Haigh	settlement		438000	428000	SE 38 28
Rough Castle	fort		297200	680100	NS 972 801
Rousham	villa		446000	224000	SP 46 24
Rowlands Castle	+settlement?		473000	109000	SU 73 09
Rudston	villa		508800	466700	TA 088 667
Rushton	villa		357000	363000	SJ 57 63
Ruthin	settlement		310300	358200	SJ 103 582
Ryton on Dunsmore	settlement		437000	272000	SP 37 72
Salford Priors	+settlement		407950	251820	SP 0795 5182
Sambourne	+settlement		408000	261000	SP 08 61
Sandringham	+settlement?		569000	328000	TF 69 28
Sandwich	villa		631900	157300	TR 319 573
Sandy Lane	small town	Verlvcio	396000	168000	ST 96 68
Sapcote	villa		449000	293000	SP 49 93
Scampton	villa		495400	378600	SK 954 786
Scawby	+settlement		496900	404600	SE 969 046
Scole	small town		614700	278600	TM 147 786
Scunthorpe	settlement		490500	413800	SE 905 138
Seabegs Wood	fortlet		281200	679200	NS 812 792
Seaton	villa		323800	090900	SY 238 909
Selsey	villa ?		485000	094000	SZ 85 94
Sewingshields	fortlet (MC34)		380800	570300	NY 808 703
Shakenoak	villa		435000	212000	SP 35 12 ?
Shawell/Churchover	villa		453300	279500	SP 533 795
Shepreth	villa		539000	248000	TL 39 48
Shepton Mallet	settlement		363000	142400	ST 630 424
Shipton Gorge	villa		348400	091900	SY 484 919
Shireoaks	settlement		454300	379800	SK 543 798
Shoreham	villa		521000	105000	TQ 21 05
Shortlanesend	settlement		180500	047560	SW 8050 4756
Siberton	settlement?		507000	289000	TL 07 89 ?
Siddington	settlement		402800	198800	SU 028 988
Sidlesham	villa		485000	097000	SZ 85 97
Silchester	civitas	Calleva Atrebatum	463800	162800	SU 638 628
Sixpenny Handley	settlement		396300	118100	ST 963 181
Slack	fort	Camvlodvnm	408400	417600	SE 084 176
Sleaford	small town		507700	345800	TF 077 458
Snodland	villa		570800	162100	TQ 708 621
Somerford Keynes	+settlement		402000	194500	SU 020 945
South Shields	fort	Arbeia	436600	567900	NZ 366 679
South Witham	villa		492000	319000	SK 92 19
Southwark	fort		532500	179900	TQ 3250 7990
Southwark Street	settlement (mansio)		532000	180000	TQ 32 80
Southwell	villa		470300	353700	SK 703 537
Southwick	villa		524000	105000	TQ 24 05
Sparsholt	villa		441500	130100	SU 415 301
Spilsby	settlement		540000	366000	TF 40 66
Spoonley Wood	villa		404500	225700	SP 045 257

Site Name	Site Type	Roman Name	Eastings	Northings	Location
Springhead	small town	Vagniasis ?	561700	172500	TQ 617 725
St. Mary Cray	settlement		547000	167000	TQ 47 67
St. Stephen	villa		514000	203000	TL 14 03
Staden	+settlement		471220	377240	SK 7122 7724?
Staines	small town	Ad Pontes (Pontibus)	503700	171500	TQ 037 715
Stainfield	villa		507000	324000	TF 07 24
Stainley North	settlement		415000	495000	SE 15 95 ?
Stamford Bridge	settlement		470000	454000	SE 700 540
Stancil	villa		461000	396100	SK 610 961
Standon	villa		537000	217000	TL 37 17
Stanford in the Vale	villa		434000	194000	SU 34 94
Stanton Fitzwarren	villa		417400	190100	SU 174 901
Stanton Low	villa ?		483900	242700	SP 839 427
Stanton St. John	villa ?		457000	210000	SP 57 10
Stantonbury	villa		484000	243000	SP 84 43
Stanwick	villa		497100	271100	SP 971 711
Stanwix	fort	Vxelodvnm	340300	556800	NY 403 568
Stebbing	villa		567100	223200	TL 671 232
Stephen Mallet	villa ?		340000	150000	ST 40 50 ?
Stibbington	settlement		508500	298600	TL 085 986
Stockport	villa		389000	380000	SJ 89 80
Stoke D'Abernon	settlement?		512000	158000	TQ 12 58
Stoke Gifford	settlement		361600	180000	ST 616 800
Stoke Orchard	settlement		391300	228900	SO 913 289
Stoke Rochford(1)	villa		492800	327900	SK 928 279
Stoke Rochford(2)	villa	(North Stoke)	493000	328700	SK 930 287
Stoke Rochford(3)	villa		491800	327600	SK 918 276
Stone	settlement		478000	212000	SP 78 12
Stonea Grange	+settlement?		544900	293700	TL 449 937
Stoneham Aspal	villa		613000	259000	TM 13 59
Stonesfield	+settlement		440000	217000	SP 40 17
Storrington/Parham	villa		506000	117000	TQ 06 17
Stowe	villa		330000	273000	SO 30 73
Strathgeath	fort		289800	718000	NN 898 180
Stretton Bridge	settlement	Pennocrvcvm	389000	310000	SJ 89 10
Stroud(1)	villa		382000	205000	SO 82 05
Stroud(2)	villa		472500	123600	SU 725 236
Sutton Courtenay	villa ?		449700	159600	SU 497 596
Sutton Veny	villa		390000	143000	ST 90 43
Swaffham Bulbeck	settlement		352190	167250	ST 5219 6725
Swalcliffe Lea	settlement		438000	238000	SP 38 38
Swanwick	settlement?		451000	109000	SU 51 09
Swindon	villa		416000	182000	SU 16 82
Tallington	settlement		509000	308000	TF 09 08
Tarrant Hinton	villa	Anicetis	392600	111800	ST 926 118
Templeborough	fort		441000	391000	SK 41 91
Teston	villa		569000	153000	TQ 69 53
Tewkesbury	settlement		389000	232000	SO 89 32
Thatcham	settlement		350000	267000	SO 50 67
Theale	settlement		467300	170200	SU 6730 7020
Thenford	villa		452500	241500	SP 525 415
Thetford	villa		586600	284900	TL 866 849
Thistleton	villa		490800	317000	SK 908 170
Thurgarton	villa		467400	349500	SK 674 495

Site Name	Site Type	Roman Name	Easting	Northing	Location
Thurlby	settlement?		510520	316110	TF 1052 1611
Thurnham	villa ?		380000	157000	ST 800 570
Tiddington	small town		421900	255600	SP 219 556
Tilston	+settlement	Bovivm	345300	351700	SJ 453 517
Tingwick	villa		465800	293000	SP 658 930
Titsey	villa		540000	154000	TQ 40 54
Tixover	villa		498200	301900	SK 982 019
Tockington Park	villa		361000	186400	ST 610 864
Tomen - Y- Mur	fort		270600	338600	SH 706 386
Totternhoe	villa		498000	220000	SP 98 20
Towcester	fort	Lactodorum	469000	247900	SP 690 479
Traws-Coed	fort		267100	272700	SN 671 727
Tremadoc	villa		255700	340100	SH 557 401
Tripontium	small town (burgi)		453500	279500	SP 535 795
Turf Wall Mile Castle	fortlet (MC 50)		360800	566000	NY 608 660
Twyford	villa		448000	124000	SU 48 24
Twywell	settlement?		495250	278080	SP 9525 7808
Upham	villa ?		354000	122000	ST 54 22
Upmarden	villa		479000	113000	SU 79 13
Upminster	settlement?		557000	184500	TQ 570 845
Usk	fortress(L)	Bvrrivm	337900	200700	SO 379 007
Verulamium	municipium		514030	206160	TL 1403 0616
Wadfield	villa		502310	226040	TL 0231 2604
Wainfleet All Saints	settlement?		549800	358900	TF 498 589
Walesby	villa		514600	392700	TF 146 927
Wall	fortress(A?)	Le(c)toetvm	409600	306500	SK 096 065
Walls	villa ?		353990	087300	SY 5399 8730
Wallsend	fort	Segedvnm	430000	566000	NZ 30 66
Walton	fort		325700	260500	SO 257 605
Walton Heath	villa		523000	153000	TQ 23 53
Walton-Le-Dale	settlement	(supply base)	355100	428200	SD 551 282
Walton-on-Thames	settlement?		509000	164000	TQ 09 64
Walton-on-the- Hill(1)	villa		522000	155000	TQ 22 55
Walton-on-the- Hill(2)	villa		395000	320000	SJ 95 20
Wanborough (Lower)	small town	Durocornovm	419500	185200	SU 195 852
Wanstead Park	villa		541000	187000	TQ 41 87
Ware	small town		535200	214500	TL 352 145
Washingborough	settlement?		502400	370800	TF 024 708
Wasperton	settlement		426100	258100	SP 261 581
Watchfield	settlement		454000	190000	SU 54 90
Water Newton	small town	Dvrobrivae	511480	297080	TL 1148 9708
Watergate Hanger	villa		475000	114000	SU 75 14 ?
Weekley	settlement		488400	281800	SP 884 818
Weldon	villa		492940	289990	SP 9294 8999
Well	villa		426500	481100	SE 265 811
Wellingborough	settlement		487500	268000	SP 875 680
Wellow	villa		572000	257000	TL 72 57
Welton Wold	villa		497400	427900	SE 974 279
Welwyn	villa		523000	216000	TL 23 16
Wendlebury	villa		456000	220000	SP 56 20
Wentlooge Level	settlement		323000	177600	ST 230 776- 255 790
West Dean	villa		425000	127000	SU 25 27

Site Name	Site Type	Roman Name	Easting	Northing	Location
West Deeping	villa		551150	331000	TF 5115 3100
West Keal	settlement		535920	363090	TF 3592 6309
West Newton	villa		570000	327600	TF 700 276
West Winch	villa ?		563000	313000	TF 63 13
Westbury	villa		386000	152000	ST 86 52
Westerwood	fort		276100	677400	NS 761 774
Weston Underwood	+settlement		454000	250000	SP 54 50
Wetwang	fort		493300	459100	SE 933 591
Wharram Grange	villa		484700	465700	SE 847 657
Wharram Percy	villa		485800	464200	SE 858 642
Wharram-le-Street	settlement		486600	465000	SE 866 650
Wheatley	villa		460000	204000	SP 60 04
Whickham	fort (falsus)		421900	560200	NZ 19 602
Whilton Lodge	small town	Bannaventa	461300	264700	SP 613 647
Whitchurch(1)	small town		354100	241500	SO 541 415
Whitchurch(2)	villa		354000	217000	SO 54 17
White Staunton	villa		328000	110000	ST 28 10
Whitebeech	villa		397840	236100	SO 9784 3610
Whitford	settlement?		312000	376000	SJ 12 76
Whitley	villa ?		345600	309600	SJ 456 096
Whitley Castle	fort	Epiacvm	369000	548000	NY 69 48
Whittington Court	villa		401570	220510	SP 0157 2051
Whittlebury	villa		427300	244500	SP 273 445
Whittlesford	settlement		545200	247600	TL 452 476
Whitton(1)	villa		614000	246000	TM 14 46
Whitton(2)	villa		308100	171300	ST 081 713
Wickford	villa		576200	193700	TQ 762 937
Wigginton	villa		439200	233600	SP 392 336
Wiggonholt	villa		506000	116000	TQ 06 16
Wilderspool	small town		361100	386400	SJ 611 864
Wilmcote	settlement		416000	258000	SP 16 58
Wilsford	settlement?		410860	141480	SU 1086 4148
Winchester	civitas	Venta Belgarvm	448050	129620	SU 4805 2962
Windermere	settlement?		340000	498000	SD 40 98
Wingham	villa		624000	157000	TR 24 57
Winterborne Kingston	settlement		384500	097500	SY 845 975
Winterton	villa		491100	418200	SE 911 182
Witchampton	villa		396320	158700	ST 9632 0587
Withington	villa		403000	214000	SP 03 14
Wittenham	settlement		455500	193500	SU 555 935?
Wolfhamcote	settlement		452000	265000	SP 52 65
Wollaston	villa		490100	265000	SP 901 650
Woodchester	villa		383970	203110	SO 8397 0311
Woodcock Hall	settlement		589000	301000	TF 89 01
Woolaston	villa		359700	198700	ST 5970 9870
Woolstone	villa		329000	187000	ST 29 87
Wootton Hill	+settlement?		443000	161000	SU 43 61
Worcester	small town	Vertis ?	385000	254000	SO 85 54
Worth	settlement		633400	151400	TR 334 514
Wortley	villa		376500	191800	ST 765 918
Wraxall	villa		347000	171000	ST 47 71
Wroxeter	civitas	Viroconivm Cornoviorvm	356800	308300	SJ 568 083
Wyck	+settlement		475700	139300	SU 757 393
Wycombe (High)	small town		487300	192300	SU 873 923

Site Name	Site Type	Roman Name	Easting	Northing	Location
Wykham Park	settlement		443000	237000	SP 43 37
Wymondham	villa		484900	318500	SK 849 185
Wymondley (Great)	villa		521800	226800	TL 218 268
Yardley Hastings	settlement		487400	258100	SP 874 581
Yarwell	+settlement		506690	297900	TL 0669 9790
Yatton	villa		340000	165000	ST 40 65
Yeovil	villa		355000	115000	ST 55 15
York	colonia	Eboracvm	460500	452000	SE 605 520

APPENDIX 4: ABBREVIATIONS

AAA or LAAA - *Liverpool Annals of Archaeology and Anthropology*
AASR - *Associated Architectural Society Reports*
AB - *Archaeology in Britain*
AE - *L'année épigraphique*
AEx - *Archaeological Excavations* (HMSO)
AHCAG - *Archaeological and Historical Collections of Ayrshire and Galloway*
AJA - *American Journal of Archaeology*
AJLSFAM - *Athenaeum Journal of Literature, Science, Fine Arts and Music*
AJPh - *The American Journal of Philology* (Baltimore)
AJSL - *The Antiquaries Journal of the Society of London* ??
AN - *Archaeological Newsletter*
AN Lincs. - *Archaeological Notes in LAASRP* (succeeded in 1966 by LHA)
ANL - *Archaeological News Letter*
Antiquary - *The Antiquary*
Antiq. - *Antiquity*. A quarterly review of archaeology, Newbury.
Antiq. J. - *Antiquaries Journal*
Ant. W. - *Die Antike Welt*
App. - *Appendix*
Arch. - *Archaeology*
Archaeol. - *Archaeologia*
Archist. *The Archaeologist* ??
Arch. Ael, - *Archaeologia Aeliana*
Arch. Anz. - *Archäologischer Anzeiger*
Arch. Atlan. - *Archaeologia Atlantica*
Arch. Camb. - *Archaeologia Cambrensis*
Arch. Cant. - *Archaeologia Cantiana*
Arch. Clwyd - *Archaeology in Clwyd*
Arch. Devon - *Archaeology in Devon*
Arch. Exeter - *Archaeology in Exeter*
Arch. Today - *Archaeology Today*
ASCSA - *American School of Classical Studies at Athens*
ASMS - *The Archaeological Sites and Monuments of Scotland* ??
ASSRP - *Associated Architectural and Archaeological Societies Reports and Papers*
Athen. - *Athenaeum, Pavia*
Arch.W. - *Archaeology in Wales*
Arch. J. - *The Archaeological Journal*

Archaeom. - *Archaeometry*
 Arch. Rev. - CBA Groups 1 to 13 *Archaeological Review*
 AW - *Ancient World*
 BAA - *British Archaeological Association*
 BAARG - *Bristol and Avon Archaeological Research Group*
 BAJ - *Berkshire Archaeological Journal*
 Banwell AN - *Banwell Society Archaeological Newsletter*
 BAR - *British Archaeological Reports*
 BARG - *British Archaeological Research Group*
 BASTP - *Birmingham Archaeological Society Transactions and Proceedings*
 BBAA - *Bulletin of the Berkshire Archaeology and Architecture*
 BBCS - *Bulletin of the Board of Celtic Studies*
 BBOAJ - *Berkshire, Buckinghamshire and Oxfordshire Archaeological Journal*
 BDAS - *Berkshire and District Archaeological Society*
 Beds. Arch. J. - *Bedfordshire Archaeological Journal*
 Beds. Mag. - *Bedfordshire Magazine*
 BIAL - *Bulletin of the Institute of Archaeology, London*
 BLIA - *Bulletin of London Institute of Archaeology*
 BNFAS - *Bulletin of the Northhamptonshire Federation of Archaeological Societies*
 Brit. - *Britannia*
 Bull. Peak Distr. Mines Hist. Soc. - *Bulletin of the Peak District Mines Historical Society*
 Carm. Ant. - *Carmarthenshire Antiqua*
 CBA - *Council for British Archaeology*
 CIL - *Corpus Inscriptionum Latinarum*
 CJ - *The Classical Journal*
 Clas. Ant. - *Classical Antiquity* (Berkley, Univ. of California Press)
 CLAU - *City of Loncoln Archaeology Unit*
 Com. Rescue Arch. Avon - *Committee for Rescue Archaeology in Avon*
 Col. Archeaol. - *The Colchester Archaeologist*
 Contr. - *Contrebis*
 CUAPS - *Catholic University of America, Patristic Studies*
 Current Arch. - *Current Archaeology*
 CVAHS - *Chess Valley Archaeological and Historical Society*
 CW - *Classical World* (Journal)
 CQ - *Classical Quarterly* (Journal)
 DAJ - *Derbyshire Archaeological Journal*
 EAA - *East Anglian Archaeology*
 EAHS - *East Anglian Archaeology and Historical Society*

EMAB - *East Midlands Archaeological Bulletin*
 ERAST - *East Riding Antiquarian Society Transactions*
 Essex Arch. Hist. - *Essex Archaeological and History*
 Gent. Mag. - *Gentleman's Magazine*
 Glevenensis - *Glevenensis*
 GDARG - *Gloucester and District Archaeological Research Group*
 Grantham J. - *Grantham Journal*
 HAR - *Hertfordshire Archaeological Review*
 HBMC - *Historic Buildings and Monuments Commission*
 HBMC Arch. Rep. - *HBMC Archaeological Report*
 Herts. Arch. - *Hertfordshire Archaeology*
 Hesp. - *Hesperia*
 Hist. - *Historia*
 HMSO - *Her Majesty's Stationary Office*
 JAS - *Journal of Archaeological Science*
 JBAA - *Journal of the British Archaeological Association*
 JCAS - *Journal of the Chester Archaeological Society*
 JCAHS - *Journal of the Cambridgeshire Archaeology and Natural History Society*
 JDANHS - *Journal of the Derbyshire Archaeology and Natural History Society*
 JHS - *Journal of Hellenic Studies*
 JEAR - *Journées d'études sur les aqueducs romains* (Boucher J-P, ed. 1983)
 JMHS - *Journal of the Merioneth Historical and Record Society*
 JNNHS - *Journal of the Northamptonshire Natural History Society (Field Club)*
 JRA - *Journal of Roman Archaeology*
 JRAFCC - *Journal of the Royal Air Force Collection, Cranwell*
 JRMES - *Journal of Roman Military Equipment Studies (Great Britain)*
 JRS - *Journal of Roman Studies*
 KAR - *Kent Archaeology Review*
 Klio - *Klio. Beiträge zur Alten Geschichte (Berlin)*
 LA - *The London Archaeologist*
 LAAA - *Liverpool Annals of Anthropology and Archaeology*
 LAHS - *Leicestershire Archaeological and History Society*
 LAASRP - *Lincolnshire Architectural Society Reports and Papers*
 LAT - *Lincoln Archaeological Trust*
 LDASB - *Loughborough and District Archaeological Society Bulletin*
 LHA - *Lincolnshire History and Archaeology*
 Lincs. Mag. - *Lincolnshire Magazine*

LPRIA - Late pre-Roman Iron Age
 Med. Arch. - *Mediaeval Archaeology*
 Mon. Ant. - *The Monmouthshire Antiquary*
 MORG. - *Morganny* (Wales)
 MORGANNWG - *Morgannwg* (Cardiff)
 MOW - Ministry of Works, Archaeology Department
 NMR - National Monuments Record
 NA - *Norfolk Archaeology*
 NAJ - *Norfolk Archaeological Journal*
 Northants. Arch. - *Northamptonshire Archaeology*
 Not. Dig. - *Notitia Dignitatum Occidentis*
 OAHSNS - *Oxford Archaeology and History Society News Sheet*
 OJA or OxJA - *Oxford Journal of Archaeology*
 Ordnance Note Book - Ordnance Survey
 Oxon. - *Oxoniensia*
 PAI - *Proceedings of the Archaeological Institute*
 PAS - *Proceedings of the Archaeological Society*
 PBAAAW - *Proceedings of the British Archaeological Association at
Winchester*
 PBBSANHS - *Proceedings of the Bath Branch of the Somerset Archaeology and
Natural History Society*
 PBNHAFCl - *Proceedings of the Bath Natural History and Archeological Field
Club*
 PBSR - *Papers of the British School at Rome*
 PCAS - *Proceedings of the Cambridgeshire Antiquarian Society*
 PDAS - *Proceedings of the Devon Archaeological Society*
 PDAFC - *Proceedings of the Dorset Antiquarian Field Club*
 PDNHAS - *Procedings of the Dorset Natural History and Archaeological
Society*
 PHFC - *Proceedings of the Hampshire Field Club*
 PIWNHAS - *Proceedings of the Isle of Wight Natural History and
Archaeological Society*
 Plin. NH - C. Plinius Secundus the Elder, *Naturalis Historia*
 PLPLS - *Proceedings of the Leeds Philosophical and Literary Society*
 PLDLHS - *Proceedings of the Leatherhead and District Local History
Society*
 PNRB - *Place Names of Roman Britain*, Rivet A L F and Smith C, 1979
 PNHAS - *Proceedings of the Northhamptonshire History and Archaeological
Society*
 PPS - *Proceedings of the Prehistoric Society*

PRIA - Pre-Roman Iron Age
 PSA or PSAL - *Proceedings of the Society of Antiquaries of London*
 PSANHS - *Proceedings of the Somersetshire Archaeological and Natural History Society*
 PSAN - *Proceedings of the Society of Antiquaries of Newcastle ??*
 PSAS - *Proceedings of the Society of Antiquaries of Scotland*
 PSDANHS - *Proceedings of the Scarborough and District Archaeology and Natural History society*
 PSIA - *Proceedings of the Suffolk Institute of Architecture*
 PSIAH - *Proceedings of the Suffolk Institute of Archaeology and History*
 PTA - *Periodical Title Abbreviations, Vol.I: by Abbreviation, Vol.II: by Title*
 PTRSL - *Philosophical Transactions of the Royal Society of London*
 PUBSS - *Proceedings of the University of Bristol Spelaeological Society*
 RAI - *Royal Archaeological Institute*
 Rav. Cos. - *Ravennatis Anonymi Cosmographia*, (ed. J Schnetz, Leipzig, 1940)
 RCHM(E) - *Royal Commission on Historic Monuments (England)*
 RCAHMS - *Royal Commission on Ancient and Historical Monuments in Scotland*
 RCAHMW - *Royal Commision on Ancient and Historical Monuments in Wales*
 RIB - *The Roman Inscriptions of Britain* (1968)
 RMHR - *Rutland Magazine and History Review*
 ROB - *Records of Buckinghamshire*
 RRSA - *Research Reports of the Society of Antiquaries of London*
 SAF - *Scottish Archaeological Forum*
 SAN - *Society of Antiquaries of Newcastle upon Tyne*
 SANH - *Somerset Archaeology and Natural History*
 SASB - *Surrey Archaeological Society Bulletin*
 SASN - *Sussex Archaeological Society Newsletter, Lewes*
 SCM - *Sussex Collector's Magazine*
 SDAC - *The Scarborough and District Archaeological Society*
 SDNQ - *Somerset and Dorset Notes and Queries*
 SHA - *Scriptores Historiae Augustae*
 SLA or S. Lincs. Arch. - *South Lincolnshire Archaeology*
 SMR - *Sites and Monuments Record*
 SNL - *Shropshire News Letter* (of the Shropshire Archaeological Society)
 SRSHCS - *Staffordshire Records Society (History Collections of Staffordshire)*
 SyAC - *Surrey Archaeological Collections*
 SxAC - *Sussex Archaeological Collections*

SXASN - *Sussex Archaeological Society Newsletter*
 Tab. Peut. - *Tabula Peutingeriana* (The Peutinger Table)
 TAMS - *Transactions of the Ancient Monuments Society*
 TARNSEC - *Transactions and Annual Report of the North Staffordshire Field Club*
 TBAS - *Transactions of the Birmingham Archaeological Association*
 TBGAS - *Transactions of the Bristol and Gloucestershire Archaeological Society*
 TBWAS - *Transactions of the Birmingham and Wolverhampton Archaeological Society*
 TCASFC - *Transactions of the Carmarthenshire Antiquarian Society Field Club*
 TCCS - *Transactions of the Cambridge Camden Society*
 TCHAS - *Transactions of the Cambridge and Huntingdonshire Archaeological Association*
 TCHS - *Transactions of the Caernarvonshire Historical Society*
 TCSVFC - *Transactions of the Cradoc and Severn Valley Field Club*
 TCWAAS - *Transactions of the Cumberland and Westmoreland Antiquarian Archaeological Society* (also as CW^{1,2,3} for series 1,2,3)
 TDA - *Transactions of the Devon Association*
 TDGNHAS - *Transactions of Dumfries and Galloway Natural History and Antiquarian Society*
 TEAH - *Transactions of Essex Archaeology and History*
 TEAS - *Transactions of the Essex Archaeological Society, Colchester*
 TEHAS - *Transactions of the East Hertfordshire Archaeological Society*
 TERAS - *Transactions of the East Riding Archaeological Society*
 TGAS - *Transactions of the Glasgow Archaeological Society*
 THNHS - *Transactions of the Hertfordshire Natural History Society*
 THSC - *Transactions of the History Society of Carmarthen*
 THSFNC - *Transactions of the Hull Scientific and Field Naturalists' Club*
 THSLC - *Transactions of the History Society of Lancashire and Cheshire*
 TIRBS - *Tabula Imperii Romani: Britannia Septentrionalis, 1987*
 TIRCGLL - *Tabula Imperii Romani: Condate-Glevum-Londinium-Lutetia, 1983*
 TLAS - *Transactions Leicester Archaeological Society*
 TLCAS - *Transactions of the Lancashire and Cheshire Archaeological Society*
 TLAHS - *Transactions of the Leicestershire Archaeological and Historical Society*
 TL&SSAHS - *Transactions of the Lichfield and South Stratfordshire Archeological and History Society*
 TLMAS - *Transactions of the London and Middlesex Archaeological Society*

TNDFC - *Transactions of the Newbury and District Field Club*
 TNFC - *Transactions of the Newbury Field Club*
 TNSFC - *Transactions of the North Stratfordshire Field Club*
 TPBAS - *Transactions and Proceedings of the Birmingham Archaeological Society*
 TRAC - *Transactions of the Roman Archaeology Conference*
 TRS or T. Rad. S. - *Transactions of the Radnorshire Society*
 TSAHAAS - *Transactions of the St. Albans, Hertfordshire Architectural and Archaeological Society*
 TSAS - *Transactions of the Shropshire Archaeological Society*
 TSSAHS - *Transactions of the South Stratfordshire Archaeological and Historical Society*
 TTS or TTSN - *Transactions of the Thoroton Society of Nottinghamshire*
 TWAS^{1,2,3} - *Transactions of the Worcestershire Archaeological Society (ser. 1,2,3)*
 TWNFC - *Transactions of the Woolhope Naturalists' Field Club*
 VCH - *The Victoria History of the Counties of England*
 WAM - *Wiltshire Archaeological Magazine*
 WMANS - *West Midlands Archaeological News Sheet*
 WSWHASB - *Watford and South-West Hertfordshire Archaeological Society Bulletins*
 WSWHANS - *Watford and South-West Hertfordshire Archaeological News Sheet*
 YAJ - *Yorkshire Archaeological Journal*
 YAR - *Yorkshire Archaeological Register*
 YASB - *Yorkshire Archaeological Society Bulletin*
 ZPE - *Zeitschrift für Papyrologie und Epigraphik, Bonn*

APPENDIX 5

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