ENGLISH HERITAGE • YORK CITY COUNCIL

YORK DEVELOPMENT & ARCHAEOLOGY STUDY

Ove Arup & Partners

and

York University

in association with Bernard Thorpe

YORK DEVELOPMENT

AND ARCHAEOLOGY STUDY

YORK CITY COUNCIL

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CONTENTS

CONTENTS

CONTENTS

CONTENTS

CONTENTS

Page No.

LIST OF FIGURES

CONTENTS

LIST OF FIGURES (Cont'd)

LIST OF TABLES

CONTENTS

APPENDICES

TECHNICAL APPENDIX

Summary

SUMMARY OF STUDY REPORT

1. AIMS AND METHODS

In relation to development and archaeology, York City Council has two aims:

(a) To develop and redevelop the city to suit current and future needs.

(b) To manage the archaeological resource of the City.

To help achieve these potentially conflicting aims the Council commissioned this study. Its primary purpose is:

> 'To update knowledge of the City's archaeological resource and to provide a framework for ensuring the development of sites is secured in a way which can conserve the most outstanding archaeological resources.'

The archaeological resource defined in this study is primarily that buried below the existing ground level. The resource consists of deposits of potentially informative strata and finds which have survived underground in various states of preservation. Building construction damages or destroys these deposits to a degree dependant on the type of foundations and method of construction used. The aim of the study is therefore to propose ways of resolving the potential conflict between development and archaeology. Our study first isolated four problem areas:

(i) **Archaeology - The Resource**

What is known about the location, character and meaning of archaeological deposits?

(ii) **Archaeology - Preservation, Excavation, Funding**

How do archaeologists go about their business?

(iii) **Development - Building Construction**

What is the likely form of buildings, in particular their foundations, underground parts and supporting soils?

(iv) **Development - Procedures**

How do developers and local authorities go about their business of seeking and permitting development? What are their attitudes to archaeology? What are their cost margins, viability and funding?

We then analysed the common factors and inter-relationships in these four parts so that we could draw conclusions and make recommendations for procedures and actions which should enable the Council's aims to be achieved.

The final part of the study was to consider 35 specific sites which the Council indicated as likely to be developed in the near future.

2. FINDINGS

2.1 Urban Archaeology

Urban archaeology aims at understanding the processes by which historic towns developed and operated, both socially and physically. This aim can be met by the systematic study of the archaeological strata which lie beneath the modern town. Opportunities for such study are provided when the archaeological deposits are exposed - usually when a site is redeveloped. Sometimes the opportunity is welcomed, as the site can answer questions of pressing interest. More often, archaeologists would prefer to preserve the deposits in order to answer future questions, using future techniques.

In towns such as York, the best deposits underlie the historic core. This is also the area where redevelopment is most likely to occur. Modern development has a very high potential for wreaking damage to the remaining archaeological deposit. This is nationally recognised but agreed ways of preventing it are not yet to hand. Hence this study.

2.2 Archaeology - The Resource

The resource lies hidden in the stratified deposits between the present ground level and the natural geological soil level. The deposit thickness varies between 0.5m and 13.5m over the area covered by the modern city. The deposit has been laid down over the past 2000 years, which can be divided into four main historic periods:

Roman (1st to 4th Century);
Anglian (5th to 8th Century);
Anglo-Scandinavian (9th to 11th Century); and
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10 zones (50%) are insufficiently known to be assessed.

Present knowledge therefore allows the quality of deposits to be predicted in general terms for about half of the study area. Even in areas where the deposit is predictable in general terms, the information is normally inadequate for planning purposes. There are very few sites in York where archaeologists, developers or planners could make a decision on the archaeological mitigation required without further information. Therefore this study strongly recommends on-site evaluation of all sites as part of the planning process. A three-stage scope of work for archaeological site evaluation is proposed.

2.3 Archaeological Value

The archaeological importance of a site, which will determine the community's reaction to its destruction, is called here its 'archaeological value'. We have defined archaeological value to be a function of:

(a) the quality of the archaeological deposit, and

(b) the potential for the deposit to make a significant contribution leading to greater knowledge.

Thus archaeological value is high where a deposit is of high quality and also has a high potential for answering questions posed by foreseeable research priorities.

The deposit quality at a site can be forecast from the general deposit model together with a site specific evaluation. The current research potential can be assessed from a research framework, prepared in advance.

2.4 Archaeological Research Framework for York

We have studied the present state of knowledge of York's principal historic periods in order to create a research framework to guide archaeological intervention. Supporting papers are included in the Technical Appendix which consider: the York hinterland; environmental sequence; and the Roman, early Medieval and Medieval periods.

In national and international terms, the research potential of York is very high. A public demand can be anticipated that all archaeological deposits should be either preserved or excavated. Our reaction has been to propose an archaeological framework in which reactive excavation is minimised, and an engineering procedure which minimises damage to the deposits.

The archaeological research framework is expressed as nine projects, which are, in summary:

(a) Project 1 : Site evaluation (low-cost desk and field study) of every site in the designated area subject to a planning application.

(b) Project 2 : Formal excavation (where this option has been exercised by developers), with adequate time allowed, only for those sites of high current archaeological value where deposit quality matches the research agenda. All other sites to be preserved.

(c) Project 3 - 9 : Seven non-destructive projects, including studies of historic buildings, documents, finds, the hinterland, the natural environment, and preservation strategies for underground deposits.

If adopted as an integrated package, these nine projects will increase the research yield for York archaeology, but decrease the frequency and intensity of archaeological intervention. Coupled with our proposals for new building procedures and processes they should satisfy public demand that the archaeological resources of York will be both better cared for and better known.

2.5 Development - Building Construction

It is the foundations and basements of buildings that conflict with archaeological requirements. Any new underground work will carry the possible penalty of destroying archaeological resources.

From our studies at York we show that both the archaeological deposits and the soil immediately below them are not suitable for carrying building loads. We have prepared plans and a computer database of known geotechnical data corresponding to those of known archaeological data. As the horizon of suitable bearing soils is often quite deep, piles are the normal foundation type appropriate for buildings in York. As these occupy the least plan area of any foundation type they will also cause the least damage to the deposit. The different techniques in constructing piles are briefly discussed, and their advantages and disadvantages are highlighted. We propose procedures that will minimise damage to the deposits due to unsatisfactory practices.

Developers are concerned with the uncertainties introduced to the development process by the presence of archaeological deposits, rather than the existence of archaeological deposits on development sites. An unexpected discovery at a late stage could halt operations when the site work has already begun. Furthermore developers might not be interested in purchasing development sites if they have to wait a long time while an archaeological excavation is being carried out.

We make recommendations on to how to reduce uncertainties in the development industry by adopting more rigorous and standardised site evaluation procedures. We show that the typical piled foundations used in York represent an acceptable preservation strategy provided certain construction techniques are adopted. We also propose two procedures which would allow development to proceed while archaeologists are at work. The first procedure would make it possible for the construction to go ahead above ground level while archaeological excavation is in progress below ground level. The attraction of this proposal is that, where planning policy allows, one or two levels of basement can be introduced to the development. This would increase the value of the development and therefore make it more attractive to developers. The second procedure envisages that archaeologists could have access for excavation during the life of the building.

We recommend that the design assumptions used for the foundations of a development are archived by the City Council to ensure that an opportunity is left for future developments to use the same foundations. That would save further destruction of the deposit. We acknowledge that it would be necessary to take account of this possibility in current designs; for example by considering different loading configurations and long term durability.

It is important to bear in mind that it is impossible to design a single foundation solution to suit all kinds of development, archaeological remains and ground conditions. Each site and development will need its own particular solution. But there is a single general solution. This lies in the adoption of procedures and engineering solutions which address the problem of maximising both archaeological preservation and development value. We propose both procedures and engineering solutions.

2.6 Development Procedures

Recent legislation and recommendations have provided greater recognition and control of development in relation to archaeology. A Code of Practice for Developers and Archaeologists (1986) also provides for a standard approach by developers. But we found that current procedures are not geared to meet the needs of York City Council. As much as anything this is probably because of the assumption that development in historic areas will always be preceded by funded excavation. Developers generally accept that they need to make a financial contribution to archaeological excavations or measures to preserve remains but do not consider they should pay for extensive operations. In many cases we would agree that they cannot afford to pay for extensive excavation.

An example is given of a 40,000 sq ft office block on a 15,000 sq ft site. Assuming a 3m deep excavation the archaeological excavation is estimated as taking about 1¼ years and costing about £1 million. The delay is equivalent to £375,000 interest charge on the cost of the cleared site and £775,000 loss of rent. The total cost of the delay is thus of the order of £1.15M or some two years rental or 17% of the realistic value of the development. That equals the developers profit, so cannot be imposed on a developer unless other funds are available.

During the course of the study we have noticed that developers have adopted a less accommodating attitude to the needs of archaeology as the property market has tightened. We acknowledge that developers cannot fund extensive excavations but we think that reasonable archaeological evaluation and preservation engineering are affordable.

We point out that York's ability to use planning powers to control development affecting archaeology is limited by the absence of a local plan which deals with archaeological issues. We make suggestions for alternatives if the Council do not wish to prepare a statutory local plan.

The statutory power to obtain access for a six month excavation of a development site is vested in the 'investigating authority'. Different towns use different authorities. In York it is presently the York Archaeological Trust. As we consider it essential that archaeological requirements are considered in the earliest stages of the planning and development process, we think serious consideration should be given to the possibility of the Director of Development Services being designated the investigating authority. The recently created post of principal archaeologist ensures that the city has the necessary expertise to exercise this power.

Many development sites in York will prove to have important archaeological value. The course of action will require the adoption of an archaeological mitigation strategy. The components of this strategy are archaeological evaluation, archaeological preservation by record (excavation), and archaeological preservation in-situ (minimum destruction by development). We propose and explain seven alternative strategies.

We anticipate that large scale excavation will be rare, will be an option exercised at the discretion of the developer, will be considered only where opportunity and research objectives coincide, will be funded by the private and public sectors (not by the developers alone) and will itself be the subject of planning controls. In most cases, preservation will be the only appropriate option. The required mitigation strategy including building methods and restrictions should be discussed at an early stage with the developer. The agreed mitigation strategy for maximum preservation should not generally prove onerous or expensive.

2.7 Site Specific Studies

The 35 sites identified by York City Council were given a preliminary assessment on the basis of existing knowledge. This work contributes to Project 1. On two sites the archaeological deposit was found to have been largely destroyed by previous activity on the site. But all the others are forecast to have an archaeological value which will necessitate preservation.

2.8 Case Study

On one of the 35 sites, York City Council has approved a planning application subject to a Section 106 agreement. The Section 106 agreement will cover an agreed archaeological mitigation strategy. So far no affordable strategy has been agreed despite considerable reductions in the archaeological requirements.

We studied this case in depth and have reported on it separately. We show that, by application of the engineering techniques described in this report, an appropriate and affordable strategy can be devised. We also show that, by adopting our recommendations, this strategy could have been arrived at before submission of the planning application.

3. RECOMMENDATIONS

3.1 Guiding Principles

Our work showed that a set of guiding principles needed to be established before setting out a framework to control and promote development and archaeological activity in York.

We recommend that the following guiding principles be adopted and published:

1. The archaeological deposits of the City of York are a cultural resource of international importance and shall be preserved whenever possible.

2. The modern development of York shall not be unduly hindered by archaeological constraints.

3. The planning process shall be used to balance the conflicts inherent in the first two principles.

4. Any proposal to develop on a site of archaeological importance shall be supported by an archaeological evaluation.

5. Any planning application to develop on a site of archaeological importance shall be accompanied by a mitigation strategy, informed by archaeological evaluation, designed to reduce the archaeological damage to be caused by development to a minimum.

6. On the majority of sites in the area of archaeological importance the destruction of 5% of the volume of surviving archaeological deposit shall be regarded as an acceptable compromise between the need for preservation and the need for development. This 5% should normally be regarded as a maximum and not as a norm. The location and form of the destruction shall be carefully considered, so as to achieve this aim.

7. The City Council shall be prepared to refuse planning permission, and to defend this decision at Appeal, if a proposed mitigation strategy is inadequate.

3. RECOMMENDATIONS (Cont'd)

3.1 Guiding Principles (Cont'd)

8. Developers shall be encouraged to enter into voluntary agreements under Section 106 of the Town and Country Planning Act 1990 (or other appropriate legal agreements), as a condition of the grant of planning permission, including an agreement to fund or support archaeological investigation and recording in advance of destruction where appropriate.

9. Large scale archaeological projects shall be encouraged and permitted only if they:

   (i) fit into an archaeological research framework agreed by the City Council

   (ii) are carried out to the highest professional standards

   (iii) are adequately resourced in time and money

   (iv) follow a scope of work agreed with York City Council

   (v) deposit the finds and excavation records in a public archive in York, and lead to appropriate publication

10. The City Council shall:

   (i) maintain an archaeological database for the City;

   (ii) adopt an archaeological policy for the City;

   (iii) encourage non-destructive archaeological research; and

   (iv) encourage educational and academic use of the archaeological resource

11. English Heritage shall encourage and support the City Council in the implementation of all these principles.

3.2 Framework For Development of Sites and Conservation of Archaeological Resources

The first aim of this study is 'To update knowledge of the City's archaeological resources...'. This has been done and the results entered in a computerised database. Our recommendations are that York should adopt the database and extend it as further knowledge is gained. This is item 5 in the following recommended framework for development and archaeology. The framework covers our recommendations in relation to all parts of our brief.

Our recommended framework has two parts; institutional and procedural. The first part is concerned with the policy and planning while the second relates to the procedures to be followed in dealing with development proposals.

We recommend that the following framework be adopted and published:

Institutional Framework

(1) York City Council should prepare and publish an Archaeology Subject Plan which incorporates the Guiding Principles and establishes a basis for dealing with development and archaeology under the Town and Country Planning Act 1990.

3.2 **Framework For Development of Sites and Conservation of Archaeological Resources** (Cont'd)

(2) Consideration should be given to designating the Director of Development Services as Investigating Authority (as defined by the Ancient Monuments and Archaeological Areas Act 1979).

(3) York City Council should develop good relations with developers and existing land owners. York City Council should inform them of the policies and principles to be expressed in the Archaeology Subject Plan and of the procedures for its implementation.

(4) An archaeology advisory panel should be established to ensure that the archaeological research framework proposed in this study is generally accepted and that there is a means to update it in the light of new knowledge.

Procedural Framework

(5) York City Council should adopt and maintain the archaeological database created by this Study.

(6) All planning applications should be supported by:

(a) an archaeological site evaluation to a standard scope of work previously agreed with York City Council.

(b) an archaeological mitigation strategy which may be the subject of a planning condition or appropriate legal agreement.

(7) The developer would be expected to meet the costs of the site evaluation and implementation of the mitigation strategy, including publication of the results.

(8) Where the proposed mitigation strategy includes the option of a formal archaeological excavation, and this option is exercised, this will be treated as a further development proposal requiring its own planning permission. The owner, developer and their professional archaeological colleagues will be expected to demonstrate that:

(a) the proposed excavation is compatible with York City Council's Archaeology programme.

(b) adequate time is to be allowed by the Site's owner and developer.

(c) the work is to be adequately funded by the public and private sector.

(d) the work will be carried out scientifically to a high professional standard following an agreed scope of work.

(e) the resulting finds and documentation will be deposited in a public archive in York, and published at an appropriate level.

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(6) All planning applications should be supported by:

(a) an archaeological site evaluation to a standard scope of work previously agreed with York City Council.

(b) an archaeological mitigation strategy which may be the subject of a planning condition or appropriate legal agreement.

(7) The developer would be expected to meet the costs of the site evaluation and implementation of the mitigation strategy, including publication of the results.

(8) Where the proposed mitigation strategy includes the option of a formal archaeological excavation, and this option is exercised, this will be treated as a further development proposal requiring its own planning permission. The owner, developer and their professional archaeological colleagues will be expected to demonstrate that:

(a) the proposed excavation is compatible with York City Council's Archaeology programme.

(b) adequate time is to be allowed by the Site's owner and developer.

(c) the work is to be adequately funded by the public and private sector.

(d) the work will be carried out scientifically to a high professional standard following an agreed scope of work.

(e) the resulting finds and documentation will be deposited in a public archive in York, and published at an appropriate level.

Section 1

1. INTRODUCTION

York has been occupied since the arrival of the Romans in the first century AD. During much of that 2000 years, settlements on the site of York have been important centres of power, trade, religion and culture. The city's history, and the extent of surviving deposits bearing rich remains of past occupation, means that York is one of the most important archaeological sites in Europe. Designation of the historic core as an area of Archaeological Importance is a measure of the national importance of York's archaeological heritage.

During the last 20 years urban archaeologists have been very active in York, undertaking research and excavations. Much of this activity was prompted by the threat to the survival of archaeological deposits imposed by development. This threat has also provided an opportunity for excavation and research which has transformed our understanding of periods in York's past; but there are still many 'gaps' in our knowledge.

It is clear from York's experience that there is a potential conflict between the need to accept and promote new building and redevelopment, with the need to protect the city's archaeological heritage. Such new construction poses a threat to the finite deposits which are the resource for urban archaeology now and in the future.

This study, commissioned by York City Council and English Heritage, is about the future of urban archaeology in York and the potential conflict between development and archaeology. The aims of the study were:-

1. To update knowledge of the city's archaeological resource, and;

2. To provide a framework ensuring development of sites in the City is secured in a way which can conserve the most outstanding archaeological resources.

The study was undertaken by Ove Arup & Partners with input on archaeology provided by the Department of Archaeology University of York. Bernard Thorpe provided input on the influence of archaeology on developers and the development process. The project was directed by Ove Arup and Partners.

This report records the results of this comprehensive study, sets out a framework for future archaeology, and recommends an approach to development and archaeology in York.

Section 2

2. APPROACH TO THE STUDY

2.1 The Study Brief

The terms of reference for the study defined seven issues to be addressed as part of the consultancy. The study was to:

1. Update the knowledge of the archaeological resource in the Area of Archaeological Importance.

2. Provide a detailed assessment of the archaeological resources of each of 35 sites identified by York City Council.

3. Review the responses to archaeology which have been undertaken in York and other cities.

4. Advise on costs of investigating and recording comparable archaeological deposits identified as Category 2 (see Section 3.7 for definition) sites as defined by York City Council.

5. Advise on the feasibility and costs of undertaking further investigation of sites where insufficient data are available.

6. Review experience with novel foundation options which minimise the archaeological damage.

7. Provide advice on how such information can be best applied in the development process.

2.2 The Study Area

The Study Area, shown on Figure 2.1, was taken as the major part of the area designated under Part 2 of the 1979 Ancient Monuments and Archaeological Areas Act. For the convenience of producing a geographical database a rectilinear search area was defined as shown on Figure 2.1.

2.3 Scope of the Study

At an early stage in the study an Inception Report was produced to clarify the study team's understanding of the terms of reference and to define the tasks to be undertaken in the study.

The tasks were identified as follows:

(a) Data collection, which involved a review of available archaeological and geotechnical data sources to produce a geographically referenced computerised database.

(b) A review of current approaches to urban archaeology.

(c) Analysis of data to produce maps showing the depth of deposit to be expected for each of the four occupation periods (i.e. a deposit model).

(d) Development of a research framework for York.

(e) A study of the impact of foundations on archaeological deposits and engineering solutions which could mitigate foundation effects.

2.3 Scope of the Study (Cont'd)

(f) An assessment of the statutory and policy framework for control of development in areas of archaeological importance.

(g) Research into the effect of archaeological issues on the development process.

(h) Recommendations on how the results of the study can be used as a basis for the formulation of policy on the development process.

2.4 The Study Method

2.4.1 Urban Archaeology in England

Section 3 reviews the current state of urban archaeology and describes how archaeological value in a particular location can be defined in terms of the quality of the deposit and the research agenda. Section 3 also draws on a review of the history of archaeological experience and a number of case studies (see Appendix D).

2.4.2 Data Collection and Review

In Section 4, we describe the data collection exercise and give an interpretation of deposit quality and relate this to 20 Zones in the study area. The zone boundaries reflect both the historic pattern of York's development and the quality of deposits. We have also summarised the current state of archaeological knowledge of York by reference to the Andrews Report (1984) and later work.

2.4.3 Research Framework

The research framework and priorities for future investigation are set out in Section 5. This framework was developed after considering research requirements in each of the periods (Roman, Anglian, Anglo-Scandinavian and Medieval) defined in the terms of reference. A series of working papers was produced for each period (Technical Appendix). From these, research agenda were identified. This in turn allowed the definition of 9 projects which make up the current research framework. The research framework provides a basis for establishing priorities for archaeological intervention in York.

2.4.4 Foundations and Archaeology

We have drawn on our general experience of foundation design to review the interaction between foundations and archaeological deposits. In Section 6, we apply this experience to conditions in York and show how different strategies can be applied to achieve preservation and conservation of archaeological deposits, while allowing development of sites in York.

2.4.5 Development Process

We have reviewed the statutory and planning context for controlling or mitigating the effects of development on archaeology. We sought the views of other planning authorities concerned with the archaeological heritage. We also made contact with selected developers and representative organisations so we could give guidance on the general attitude towards York and how the results of the study can be disseminated. This work is presented in Section 7.

2.4 The Study Method (Cont'd)

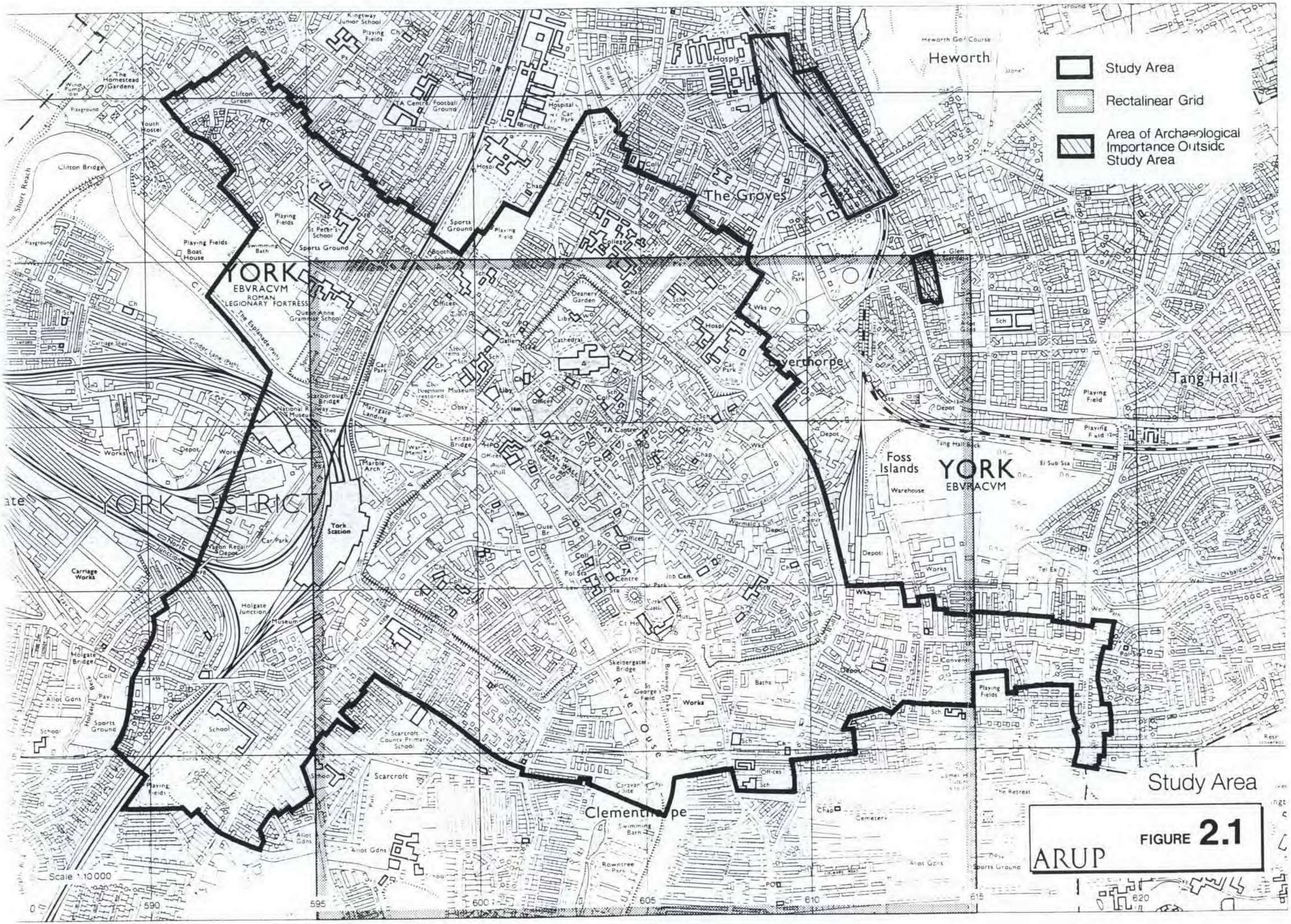
2.4.6 Site Specific Studies

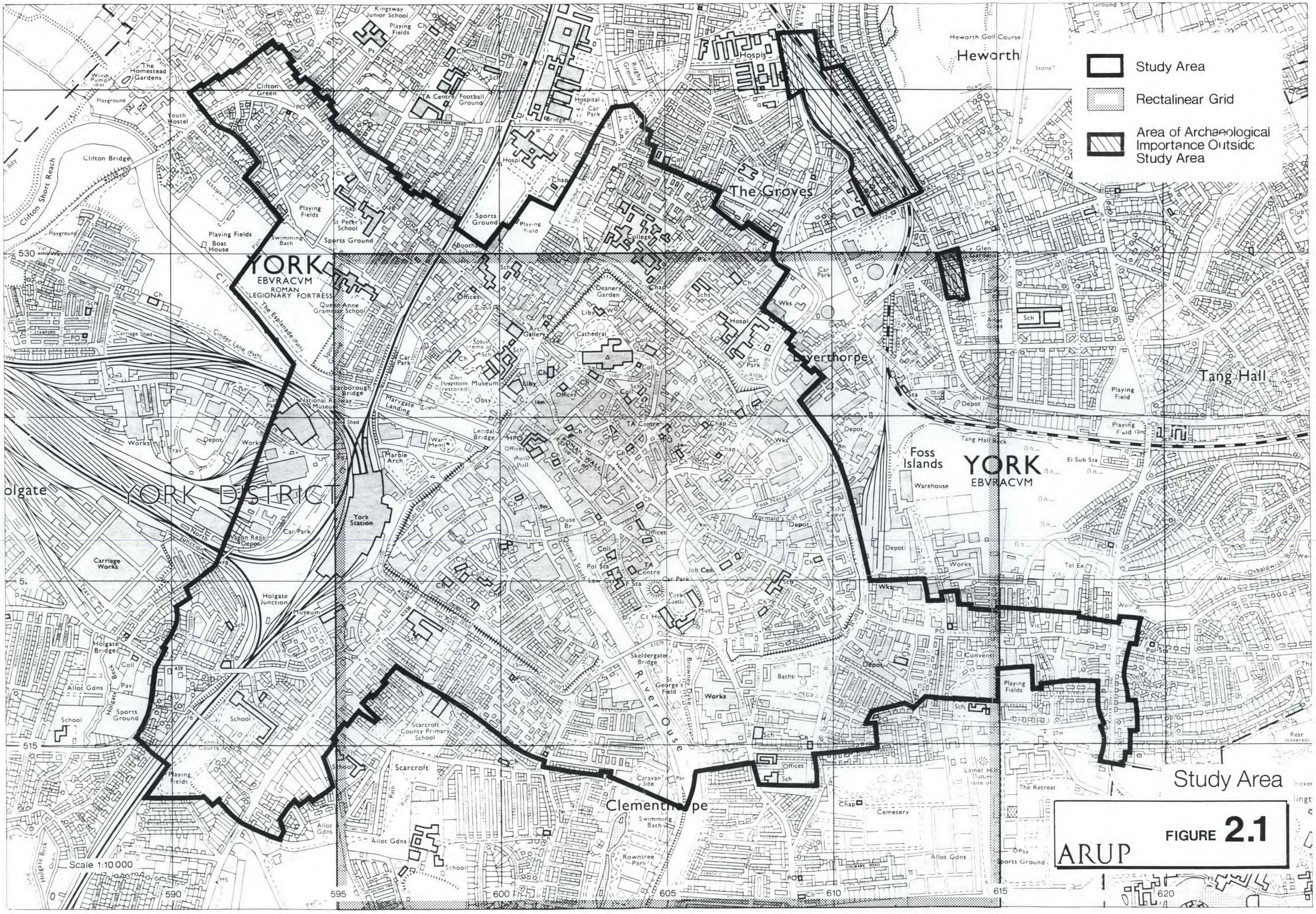
Desk top studies were carried out of each of the 35 sites identified in the terms of reference. The results of this study are summarised in Section 8 and presented in Appendix B of this report using a standard format.

2.4.7 Recommendations

We set out our recommendations in Section 9 of this report. This section incorporates proposals covering:

- The archaeological programme
- Approaches to construction
- Development policies.


Study Area
Rectalinear Grid
Area of Archaeological Importance Outside Study Area
YORK
EBVRACVM
ROMAN LEGIONARY FORTRESS
YORK DISTRICT
The Groves
Heworth
Heworth Golf Course
Layerthorpe
Tang Hall
Foss Islands
YORK
EBVRACVM
Clementhorpe
Scarcroft
River Ouse
York Station
Clifton Bridge
Holgate Junction
Scale 1:10 000
Study Area
FIGURE 2.1
ARUP


Study Area
Rectalinear Grid
Area of Archaeological Importance Outside Study Area
YORK
EBVRACVM
ROMAN LEGIONARY FORTRESS
YORK DISTRICT
The Groves
Heworth
Heworth Golf Course
Tang Hall
Foss Islands
Clementhorpe
Scarcroft
Layerthorpe
Clifton Bridge
Clifton Green
Clifton Short Reach
The Esplanade (Path)
Cinder Lane (Path)
Scarborough Bridge
Marygate Landing
Lendal Bridge
Marble Arch
York Station
Carriage Works
Holgate Junction
Holgate Bridge
Skeldergate Bridge
River Ouse
Foss Navigation
Wormald's Cut
Scale 1:10 000
Study Area
FIGURE 2.1
ARUP

Section 3

3. REVIEW OF URBAN ARCHAEOLOGY

3.1 Scope of Review

Urban archaeology aims at providing an understanding of the processes by which historic towns developed and operated both socially and physically. The research material of the urban archaeologist is found mainly in the deposits which accumulated during the evolution of historic towns and their hinterlands. The best deposits in towns such as York usually lie in built-up areas and generally the opportunity for excavation arises only when redevelopment is in prospect. Such opportunities arise randomly and it is necessary to order the response of archaeology in a consistent way. This section develops the basis for a policy of response by reviewing the history of current practices of urban archaeology as well as the context in which urban archaeology operates.

3.2 The Dilemma

Development in historic towns poses many problems for planning authorities, of which archaeology is but one. Archaeology has a small, if vociferous, community with many interests. The public as a whole (local, national and international) have an interest in what is or is not done in the name of 'The Heritage'.

The archaeological heritage itself, above and below ground, consists of buildings and land, on which the public in another guise is busy living, farming and building. Clearly, there is a conflict between those demanding the conservation of the heritage, and others demanding its destruction in the name of progress and an improved quality of life. Confrontation and controversy are frequent, and offer an attractive subject to the media.

The difficulty for planners and developers is that although progress and improvements in the quality of life can be defined and defended, the definition of 'archaeological value' can be vague and often contradictory. One solution is to simply put the definition of archaeological value in the hands of a representative body, such as a state archaeology service, as is done in the majority of European countries. In this case, the state declares a given sample of the heritage to be worth keeping or allows it be destroyed. It has the power to do this through legislation and does not have to reveal the basis of its decision.

In the United Kingdom, where these central powers are weaker, the valuation of heritage has to be put to open debate and policies are then developed. Since the materials of the heritage are so extensive, so varied and so dependent on individual perception, the potential for confusion in this debate is very high. In historic areas, almost any disturbance of the soil or the built-up environment can be challenged as a diminution of somebody's perceived heritage.

The need therefore is to establish a basis for the definition of archaeological value which can be defended and can become the foundation of a generally accepted public policy. The dilemma lies in the conflicting interests of the heritage and the development which may destroy a part of that heritage.

3.3 Resolving the Dilemma

It is in towns, where the archaeological heritage, the development pressure, and the debating population are most concentrated, that the necessity of resolving the dilemma is most urgent.

The method employed here is first to examine the motivation and procedures practised by archaeologists in towns over the past few decades, and from this to define the different attitudes which contribute to 'archaeological pressure'. The 'archaeological pressure' of the next few decades is then anticipated, and a procedure suggested.

3.3 Resolving the Dilemma (Cont'd)

3.3.1 History

People have long been interested in the history of cities and have dug for it in Europe since the 19th century. The earliest urban archaeologists were adventurers in pursuit of lost civilisations, such as Schielmann at Hissarlik (Troy), Sir Austen Layard at Nineveh, Fiorelli at Pompeii and Wooley at Ur. It was during these expeditions that the activity acquired its extensive and loyal press and public. (See Appendix D for a series of case studies).

The pursuit of lost civilisations was transferred to Britain in the first part of the 20th century. Excavations were mainly carried out on abandoned Roman towns such as Wroxeter, Silchester and Corbridge, whilst Sir Mortimer Wheeler at St Albans with skilful media coverage enhanced the interest of the British public in their own urban heritage.

Only after the Second World War did urban archaeology in the modern sense begin. In bomb-damaged London, between 1947 and 1962, W F Grimes recorded some 53 Roman and Medieval sites. This new phase was characterised by being conducted within the living city, surrounded by traffic and spectators. It offered a continuum with modern town life, and was relevant to the history of the urban community, but, on the other hand, was less exotic and more readily taken for granted. Grimes' campaign was supported by private subscription and sponsorship, neither of which was generous. In the face of such an enormous but underfunded opportunity, the priority was to salvage as much information as possible. The concept of 'rescue' was born.

During the 1960's, a new type of campaign began in Winchester, where Martin Biddle succeeded, with the help of the City Council and central Government, in subjecting the opportunities offered by the development boom to a planned research programme. Over ten years he investigated Winchester's Iron Age predecessor, a Roman cemetery, the Anglo-Saxon Old Minster, the Norman Bishops' Palace, the Norman Castle and a 'typical' area of the conurbation at Lower Brook Street, which gave a sequence of urban life from Roman to Medieval times. This was combined with a programme of documentary and architectural research. Excavations were selected both from sites which were to be developed and others which were 'safe' but available. The campaign as a whole was aimed at revealing the history of the city of Winchester, particularly the Dark Ages between Roman and Medieval which were least understood. Funding continued to rely on private sponsorship, although there were now major contributions from local and central Government.

The process of writing up this successful campaign still continues.

In the 1970's, there was a dramatic upsurge in urban archaeology, caused partly by the inspiration of Biddle, partly by the continued building boom, and partly by a new 'rescue' movement. RESCUE (the Trust for British Archaeology) was formed in 1972, and declared that 'the most important towns of all historic periods will be lost to archaeology in the next 20 years'. At the same time there was a rapid increase in state funding. A new profession of urban archaeologists, dependant on that funding, formed itself into 'Archaeology Units' many of which were based on a single historic city (e.g. Oxford 1967, Norwich 1971, York 1972, Gloucester 1973). The research agenda adopted by these Units varied greatly, but the majority were concerned first and foremost with the rescue of anything and everything. The more structured campaigns imitated Winchester, where the research target was the history of the particular city itself. All were, in general, very successful in revealing new aspects of historic English town life, sometimes in heroic circumstances, but all were, in general, inward looking, and the increase in knowledge relied on every town finding a champion. By 1981, 124 towns had done so.

3.3 Resolving the Dilemma (Cont'd)

3.3.1 History (Cont'd)

A new movement away from research into the individual town was discernible in the mid 1970's. In 1975 the Shrewsbury Archaeology Unit disbanded itself in favour of more regional priorities, and began digging in towns all over the West Midlands in pursuit of the origins of the Anglo-Saxon burh. In tune with the development of archaeological theory, 'new archaeologists' dedicated themselves not to the antiquities or even the history of a particular town, but to processes of urbanism and the role of urbanism in the community in the wider history of the last two millennia. This required a sampling programme over many different towns rather than the intimate dissection of one or two.

It also became plain in the mid 1970's that much urban digging was wasteful. Some valuable and productive sites such as the Dover Painted House (1975) had to be rescued from the teeth of the bulldozer, while others, already more damaged, were excavated at great length without useful outcome. An improvement in techniques, combined with an empirical attitude, caused excavators to look longer, search harder and retrieve more, so that the quantity of undigested information was greatly increased and became more and more difficult to synthesise. The lack of publication, the ubiquity of archaeological activity, the reliance on government funds and the professionalism of the performers all meant that urban archaeology was gradually losing the sense of purpose and public support which had been an important motivation up to the 1960's.

3.3.2 Current Approaches in the United Kingdom

These symptoms disguised the real problem, which was that archaeology had also lost its research agenda, and therefore had no means of prioritising, and no theoretical basis for distinguishing the important from the unimportant. In the 1980's, under pressure from a new government with a radical attitude to centralised funding, the Inspectorate of Ancient Monuments took a lead in re-establishing a mechanism for prioritising their support. All urban excavations were henceforward to be expressed as 'projects'. To earn support a project had to demonstrate that it was both necessary, (e.g. because the site was to be destroyed) and contributed to clear research objectives. 'Core funding' was then withdrawn from Units, who would henceforward rely on obtaining sponsored projects for their survival.

The new fiscal structure favoured two operational methods which had been developed in the West Midlands in the 1970's. The first of these was 'site evaluation' which sought to predict productive sites in advance on the basis of their deposit quality. In this way sites could be given a 'value' even when their research potential was unknown. The second was the 'roving unit', where the unit was no longer tied to local administration, or a particular town, but travelled to sites where rescue and research pressures could be constructed into a viable funded project. Examples of such units were the Birmingham University field archaeology unit (from 1976) and the Central Excavation Unit, formed by the Inspectorate of Ancient Monuments.

In 1983, the Inspectorate of Ancient Monuments became English Heritage, and the government support of urban projects was subjected to still tighter controls and more rigorous research criteria. This control would certainly have forced the production of a national research strategy for urban archaeology as a basis for decision making, but in the mid 1980's two new means of funding appeared which allowed the construction of this strategy and its inherent priorities to be deferred.

3.3 Resolving the Dilemma (Cont'd)

3.3.2 Current Approaches in the United Kingdom (Cont'd)

The first new source was developer funding which was pioneered in the City of London and which allowed any site to be excavated provided the developer was prepared to pay. Within the city of London, and in many large cities, land values generally allow the cost of excavation to be built into the overall cost of development and all that has to be negotiated is time. A Code of Practice for Developers and Archaeologists (1986) was compiled to ease such negotiations, and other instruments, such as the Ancient Monuments and Archaeological Areas Act (1979) and planning controls could be used to gain time, although not money, should these negotiations fail. The system works well in London but is far more difficult to operate in the 300 or so small towns which shared the historic experience but where developers' profit and development values are relatively low.

The second new source of funding was pioneered in York, where the Jorvik Viking Centre was constructed as a way of presenting the merits of urban archaeology to a paying public. The revenue drawn from such commercial ventures can contribute to new excavation projects.

Most Units now derive their income from projects supported by a portfolio of such sources. Thus a modern urban excavation will be on a threatened site, have a specific research purpose and feature an element of public presentation, justifying financial support from the developer, English Heritage and the public.

3.3.3 International Approaches

The approaches adopted in other countries follow from their legal systems and methods of funding. In general, European countries whose legal systems developed under codified laws have defined buried archaeological assets as public property irrespective of who owns the land. Proposed disturbance to any archaeological resource brings with it the legal obligation for archaeological intervention.

The resource is managed by a State Archaeological Service, supported wholly by government funds, whose officers decide in any one case to what extent intervention is necessary. The funds for this intervention come from the development agency; in the case of a shopping centre the agency would be a private sector company or for a motorway, an arm of government. Once intervention is required by the state service then development may proceed only after appropriate excavation.

The two main features of these state archaeological services is that the decision to intervene is made by a government agency and there is provision for public funding, or obligatory funding from a developer.

Similar systems operate in the Soviet Union and in Eastern Europe except that currently all funding comes from the State.

In the United States, with a similar legal history to England, there is no assumption that archaeological resources are public property. In the U.K. the State can control development of an archaeological resource by specially designating specific parts of it, as 'guardianship sites' or 'Scheduled Monuments'. This requires pre-selection of sites to be protected and is quite different to the general European approach which provides powers protecting all archaeological resources.

3.3 Resolving the Dilemma (Cont'd)

3.3.3 International Approaches (Cont'd)

Given the context of this study the Continental system has however the following disadvantages:

(a) the system relies on government funding

(b) where intervention is required before development, lack of funds causes delay

(c) development in historic towns and conservation areas can be inhibited altogether by the prospect of having to find state funds or mandatory developer funding for archaeological excavation.

(d) the numerous records made, and their interpretation, remain the property of the State Service and often are unpublished

(e) there is no public scrutiny of the purpose of intervention or of the value of the knowledge gained

(f) the decision to intervene (or not) is made by an officer of the State and does not have to be justified (normally) to the public

The advantages are:

(a) where the State decides intervention is required the costs are met from public funds or enabled by other legislation

(b) the system is the same for all historic places and developers therefore know what to expect.

The adoption of a 'Continental System' therefore has some disadvantages to both archaeologists and to city councils wishing to promote development.

3.4 Attitudes to Urban Archaeology

The pressure for archaeological intervention can be seen to come from a number of different attitudes amongst archaeologists which have evolved through time; these in turn are shared with the public. This accounts for the wide variation in motivation and objective amongst archaeologists and their supporters. Four different attitudes can be attached to current approaches to the subject. Each of these attitudes, (defined below as Attitudes 1 to 4), could be supported at the same time by different people and by the same person at different times. They conceal a deep popular anxiety that we are destroying the knowable past without understanding what it means. Any new approach must try and satisfy all four.

3.4.1 Attitude 1 'The Antiquarian'

Attitude 1 views 'archaeological value' as expressed in terms of 'antiquities', that is, finds and buildings of stone and preserved timber. This attitude was particularly powerful in the 18th and 19th century, but is still emotive. The demolition of a standing building can be opposed simply because it is old and belongs to a former 'civilisation', usually Roman or Medieval. This attitude can be transferred to underground structures, so that the demolition of a Roman stub-wall by mechanical excavators still has power to give public offence, even after it has been fully recorded. This attitude favours the conservation and displays of structures in-situ and of finds in museums.

3.4 Attitudes to Urban Archaeology (Cont'd)

3.4.2 Attitude 2 'The Local Historian'

Attitude 2 views the archaeological deposits of a particular town as the property of its present citizens. Any attempt to interfere with them is therefore an attack on their own heritage. This attitude favours a declared programme of research into the history of the town concerned, and all and any information which throws light on that history is important.

3.4.3 Attitude 3 'The Social Historian'

Attitude 3 views the archaeological resource as primarily a means of understanding the past and its society. This means having a model for Roman, early Medieval and Medieval society and putting that model to the test whenever the occasion arises; or constructing research projects to test the model if they do not. Adherents to this attitude are quite happy to lose buried walls and finds if they have no context, do not contribute to the research model and therefore cannot be understood. Such remains become simply victims of the entropy of progress.

3.4.4 Attitude 4 'The Conservationist'

Attitude 4 views the archaeological resource as an information base of almost unlimited potential, not at all dependant on current research trends. It must therefore be conserved wherever possible rather than disturbed or excavated. No further justification is needed for such action, other than that the deposit exists.

3.5 A New Approach

The major problem therefore with the present situation, both in Britain and in Europe, is that there is no consensus on what constitutes 'archaeological value'; and yet it is on undeclared and often personal concepts of archaeological value that sites are selected for preservation, or for excavation, or for presentation. It is on the same basis that these activities are sponsored by government, local government, developers, benefactors, and the public.

3.5.1 Archaeological Value

We have defined archaeological value as a resource of knowledge and understanding. To have any utility this definition requires that we also define the resource of knowledge. We have expressed this by setting out an agenda for adding to knowledge using the site of York. This definition excludes factors such as aesthetic value, amenity value or market value, although these may mitigate threats to archaeological value within a planning decision.

Archaeological value is a function of the deposit quality (the source of information) and the research agenda (the information required). These two must be defined in advance and then continually re-defined as knowledge advances. Archaeological value is therefore not a static concept but a set of criteria which are revised in the light of new knowledge.

3.5.2 Factors Affecting Deposit Quality

Archaeological information is drawn from finds and structures within a stratified sequence of soils and debris. By recording the character and position of the stratigraphic elements, activities can be discerned, placed in their order of occurrence and dated. The sequence of episodes from each site examined can then be combined to produce a history of the town, or of trends in art, craft, commerce and affluence over an urbanised region.

3.5.2 Factors Affecting Deposit Quality (Cont'd)

It follows that the definition of strata-quality is crucial to this process. But strata may be damaged, decayed, disturbed and scrambled after deposition, so that their legibility will vary from site to site. Criteria for awarding quality are the state of preservation (particularly of organic materials which normally degrade underground), the spacing of strata (which determines their legibility), and their status (what kind of deposit they represent). The most productive sites, for any period and for any purpose, are those which yield the optimum information allowed by these criteria. Figure 3.1 illustrates how these factors interact ; the 'good site' follows the arrows.

Because towns come in many different shapes and sizes, it is clear that their capacity to capture and conserve strata into this century is also very varied. Peterborough has lost much of its archaeological evidence; the strata depth at Aylesbury is between 1 and 1.5 metres; at the Salwarpe in Droitwich it lies up to 5 metres thick. Parts of the deposit under Truro were waterlogged for centuries, and at Great Yarmouth and St Ives have been buried by windblown sand. The preserved deposits captured in buried valleys at York and London are justly famous. Towns on high soft sub-soil like Shrewsbury and Langport have been terraced down by builders seeking firm foundations, from the 13th century or earlier, tending to remove the traces of their predecessors. Towns with a buried stream running through the centre, like the Walbrook in London, tend to infill and capture earlier strata in a waterlogged state of high preservation. Towns built on flat ground may unconsciously or deliberately rise to avoid flooding or to provide cultivated land, as in 17th century Stafford. The construction of a extensive town wall, particularly one using the robust circuit of the legionary fortress such as that at Chester, has a 'belting effect' on later generations, whose debris rises within it like a cake mixture poured slowly into a cake tin (Carver 1987, 126).

Deposit quality therefore varies not only from site to site but from town to town, just as the corpus of historic buildings and documents relevant to a particular town also varies. A systematic evaluation of the whole urban corpus has not yet been undertaken for England, but there have been a number of attempts at detailed deposit-mapping (Carver 1978, 1980, 1987) eg, in London, Stafford and Worcester.

3.5.3 Method for Determining Deposit Quality

The methodology employed in determining deposit-quality is predominantly non-destructive (see Carver 1987, Chapter 9 and forthcoming). It draws on the records of interventions already made which are contained not only in archaeological reports, but in newspapers, journals, local histories, public documents and archived material associated with the city in question. It also draws on data gathered by engineers and building contractors, and uses the modern topography, its contours, buildings and the penetration of cellars and basements.

This data is used to construct a model of the deposit as it lies beneath the modern pavements, mapping wherever possible its depth, spacing, state of preservation, historical derivation and its date. Presented in the form of maps supported by a database, this model provides a template to guide archaeological intervention. A developed form of the methodology is here applied to York. The deposit model is described in detail in Section 4 of this Report.

3.5 A New Approach (Cont'd)

3.5.4 Intervention Strategy

The value of a particular strata-set following its discovery, in practice, will depend not only on its surviving quality, but on the measures taken to conserve or to retrieve it. Just as deposit quality varies from town to town and from site to site, so it varies within a site, and different intensities of excavation and recording are appropriate to different parts of the sequence. Archaeologists may spend a great deal of time and money and lose a great deal of information by refusing to recognise this variation, or by allowing a variation in their recovery techniques without recording that they have done so. The best method of controlling and monitoring data acquisition on site is to apply a standardised 'data acquisition strategy', which determines 'recovery levels' of strata-definition and recording appropriate to particular strata-sets (Figure 3.2). All site records are then labelled with the 'data acquisition level' employed. The employment of these 'gears' in the excavation is not only economical in time and money but allows pre-determined analyses to be carried out by comparing assemblages recovered at the same level of intensity.

An archaeological intervention can therefore be planned, after evaluation, in much the same way as a building project, in terms of depth, area and data acquisition level. These are the parameters which determine its cost.

3.6 Research Agenda

The research agenda adopted in a particular town will depend on the context in which the research framework is developed. Therefore for many archaeologists loyal to Attitudes 1 or 2 cited above, the agenda has 'everything' on it. These are unselective lists either of all-embracing generality or of enormous length, and they are currently the norm, whether applied to a particular town or to the urban corpus as a whole. This type of agenda is virtually impossible to prioritize and is passive and reactive. It is doubtful if it will prove effective in the next decade, because although it will always be possible to say what a particular excavation is for (we need to know more about the colonia, the river, medieval latrines, Roman pottery etc.) it is impossible on this basis to say exactly what we want to know or why we want to know it. It seems likely that this rationale will collapse under the present climate where funding agencies (whether developers or government) will wish to be assured that they are contributing not to the conservation of antique rubbish of local interest, but to a structured research programme. The creation of research programmes is therefore necessary for the credibility and financial survival of archaeology as well as providing a basis for the development of policy.

3.6.1 Approaches to Research

There is currently no selective national research framework for towns against which that for York could be developed. This study proposes a broad approach which should provide the basis for a general consensus. There is general consensus on the following aspects of research:

(a) Towns are Artifacts
We would therefore like to know what form they took through time.

(b) Towns are concentrations of population
Their potential for revealing economic, ideological and social structure is therefore high.

(c) Towns are often long-lived
Their potential for chronicling changes in society is therefore high.

3.6 Research Agenda (Cont'd)

3.6.1 Approaches to Research (Cont'd)

(d) In long-lived towns, there is potential for discovering the periods of the recent past about which least is known, namely the early Middle Ages - the key period of transition between the Roman and Medieval town - and the 16th century, a period of transition between the Medieval and modern town.

Taking the urban corpus as a whole we can see that the first of these aspects of research is more accessible in abandoned towns. The third aspect on the other hand is accessible only in the longer lived town, which are generally those still occupied. The second and fourth aspects are realisable in either single or multi-period towns, but will require a comparative study, where the towns and the adjacent rural settlement of a particular region or county are investigated together.

3.6.2 Research in York

York is in no sense an abandoned town, so although the establishment of its detailed plan in the Roman and Medieval period is useful to provide a context for the other areas of study, it cannot be an end in itself. A multi-period town such as York which acted as a central place throughout its life has a high potential for the determination of lifestyles, ritual, commerce, trade, craft and social structure, as well as how they were distributed between the town, the countryside and overseas points of contact, and how these things changed with time. By examining the assets suggested by the deposit model and defining the context of York in the country and the countryside in the Roman, early Medieval and Medieval periods, a specific agenda can be drawn up. This agenda is intended to highlight the contributions of York archaeology which will find a place in the cultural and intellectual life of the Europe of the 1990's.

The proposed research agenda is discussed in Section 5.

3.7 Research Management

The present theatre of operations has a number of actors on the stage amongst who may be cited:

The City Council; the Planning Authority.

English Heritage; responsible for archaeological conservation as a whole.

The Local Archaeological Unit; available for excavation and research.

The Developer; able to pay for all or part of preservation or excavation if necessary.

Each of these bodies has, or could have, a consultant archaeologist, who may be motivated by any of the attitudes already described - or indeed by others. The policy of English Heritage is to preserve wherever possible, and where not possible to encourage a record to be made at local expense. English Heritage itself can contribute financially to an excavation and publication project, but will probably do so only on the demonstration of clear research criteria (DOE, 1990). Such contributions are however made only where development is imminent and after planning permission has been granted.

3.7 Research Management (Cont'd)

The terms of reference for this study indicated that the recommended archaeological treatment of a site may fall into one of five categories as follows:

Category 1:	Areas where preservation in-situ is warranted.
Category 2:	Areas where remains should be preserved by excavation, recording and dissemination.
Category 3:	Areas where an archaeological watching brief during development is considered sufficient.
Category 4:	Areas where existing archaeological information is insufficient to allow decisions to be made but on site evaluation would provide sufficient information.
Category 5:	Areas with no surviving archaeological remains.

In the absence of an archaeological site evaluation most sites in York, technically, fall into Category 4 since there is never sufficient information to make a decision about the future treatment of a deposit.

The criteria for the designation of 'national importance' is also difficult to apply within towns, depending as it does on the idea of countable 'monuments', which exhibit 'rarity', 'diversity' or 'duration' rather than on deposit quality. Indeed a recent paper on the subject pronounced urban deposits as 'essentially unclassifiable' (Darvill et al. 1987). The adoption of the actions described in Categories 1, 2, 3 and 5 is therefore almost always done 'blind'.

Further difficulties arise because a development site is not eligible for English Heritage funding until planning permission has already been given and the site under actual threat. Neither can there be developer-funding until there is a developer, ready to develop. In either case, funding comes too late for anything but a salvage operation or an excavation in advance of specified foundations. At present neither of these types of intervention can contribute very much to a research agenda. Such reactive strategies have been seen on numerous occasions, most famously and most recently at the Queens Hotel and The Rose. This is true even in areas of archaeological importance protected under the Act, since very few sites of research interest can be properly excavated in the 4½ months allowed (cf. YAT 1988).

3.8 Principle for Archaeological Intervention in the 1990's

The solution is to adopt a new approach and a new procedure as recommended by this study. In summary:

1. Re-define archaeological value as being a function of deposit quality and a research agenda.

2. Deposit quality should progressively be mapped over the city as a whole to provide a continuously updated assessment of that city's resources.

3. The research agenda for a particular city should be compiled and continuously updated to provide a framework for intervention.

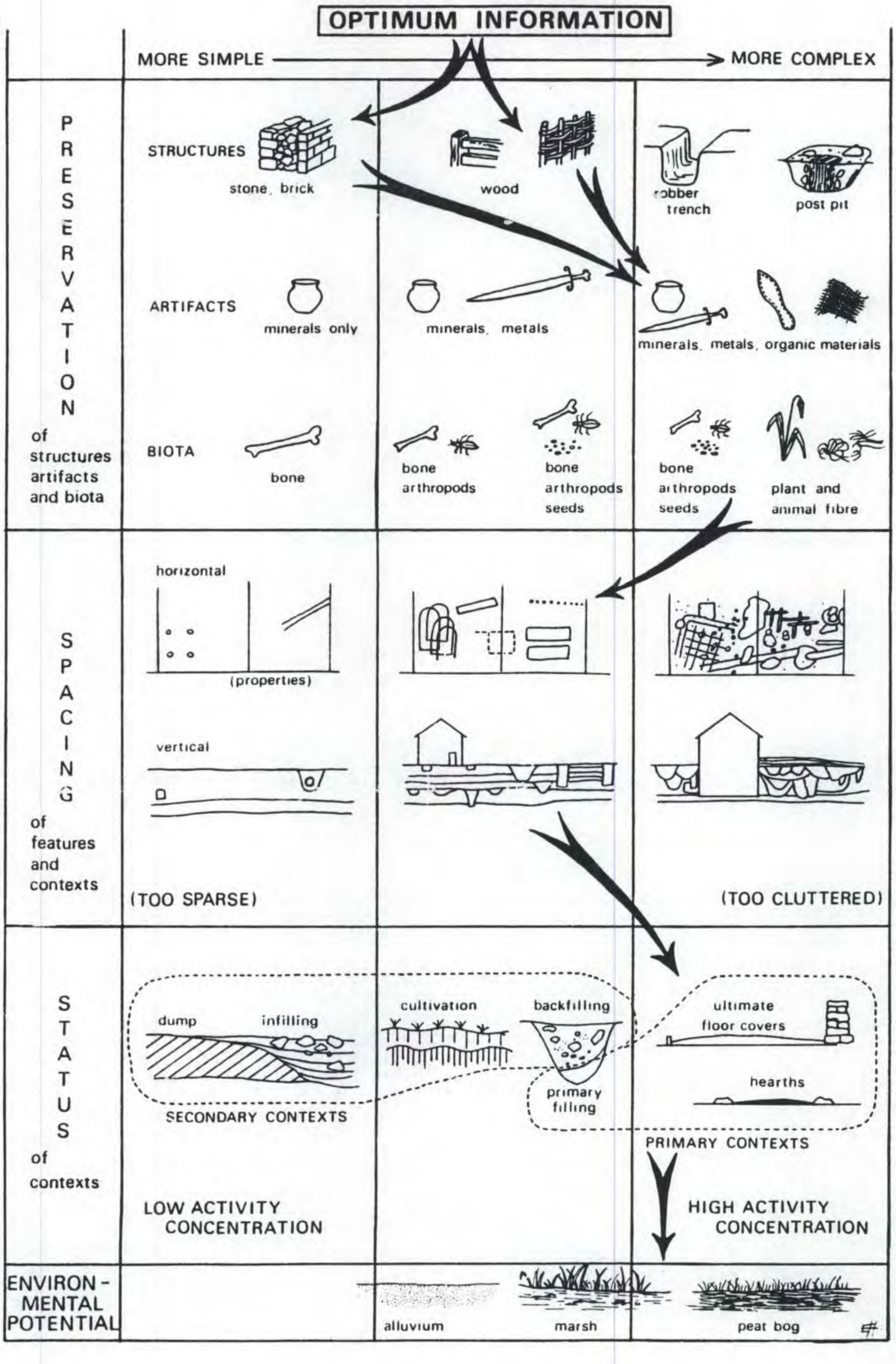
3.8 Principle for Archaeological Intervention in the 1990's (Cont'd)

4. Research into the history and context of the city by methods other than salvage should be encouraged, and sponsorships sought to support it. Such research will greatly improve the basis on which deposits can be chosen for preservation or investigation.

5. Devise management strategies for the archaeological evaluation of development sites.

6. On any development site a mitigation strategy should be agreed which either minimises destruction thus preserving the deposit or maximises research yield.

Section 4



Source: Carver 1983

Defining Archaeological Quality

ARUP

FIGURE 3.1

Level	COMPONENT	ASSEMBLAGE	CONTEXT	FEATURE	STRUCTURE	LANDSCAPE	e.g.
A	(not recovered)	Surface finds PLOT 2-D	Inferred by sensor OUTLINE PLAN	Inferred by sensor OUTLINE PLAN	Inferred by sensor OUTLINE PLAN	Inferred by sensor	Field Walking
B	(not recovered)	Large finds RECORD EXAMPLES KEEP EXAMPLES	Defined by shovel DESCRIBE	Defined by shovel SHORT DESCRIPTION OUTLINE PLAN	as feature	PLOT STRUCTURES on OS	19th-C Houses
C	(not recovered)	All visible finds RECORD ALL KEEP EXAMPLES	Defined by coarse trowel DESCRIPTION (Munsell for mortars and natural)	Defined by coarse trowel FULL DESCRIPTION DETAILED PLAN	Defined by coarse trowel EXCAVATE AS ONE PHOTOGRAPH AS ONE	1:100 PLAN PROFILE	16th-C Pits
D	SAMPLE SIEVING of spoil offsite (spoil not kept)	All visible finds PLOT 2-D and KEEP ALL	Defined by fine trowel DESCRIPTION (incl. Munsell) PLAN 1:20	Defined by fine trowel FULL DESCRIPTION DETAILED PLAN 1:20 (colour coded) CONTOUR PHOTOGRAPH (B/W)	Defined by fine trowel EXCAVATE AS ONE: PHOTOGRAPH by PHASE	1:100 PLAN CONTOUR SURVEY	Timber trace building
E	TOTAL SIEVING of spoil on site for presence of specified material and KEEP SPOIL	All visible finds PLOT 3-D and KEEP ALL	Defined minutely DESCRIPTION (incl. Munsell) PLAN (natural colour) 1:10 or 1:5 CONTOUR	Defined minutely FULL DESCRIPTION PLAN (colour) 1:10 or 1:5 CONTOUR PHOTOGRAPH	Defined minutely EXCAVATE AS ONE: PHOTOGRAPH by PHASE	(as LEVEL D) CONTOUR SURVEY	Skeleton
F	MICRO-SIEVING of soil block in laboratory	(as component)	(as LEVEL E) and LIFT AS BLOCK	(as LEVEL E)	(as LEVEL E)	(as LEVEL D)	Storage Pit Fill

Source: Carver 1987

Information Recovery Levels

ARUP

FIGURE 3.2

4. YORK ARCHAEOLOGY: ASSESSMENT OF RESOURCE

4.1 Scope of Assessment

This section of the report describes the data collection exercise and the procedures adopted to create a computerised archaeological database. We also present the review of the current state of knowledge on York's archaeology.

4.2 Principles

The principles of urban archaeological site evaluation and deposit modelling have been evolved mainly in Britain over the past 10 years (Carver 1978, 1987, forthcoming, a, b). The underground deposit is mapped in three dimensions on the basis of contacts drawn from excavations, boreholes and primary and secondary documentation. Deposit-quality is assessed on the basis of its thickness, state of preservation and stratigraphic status. The same parameters, plus that of depth below the modern surface and the degree to which the site is encumbered provide a measure of the cost of intervention. The deposit-model therefore consists of a set of maps from which the location and quality of deposits can be predicted. Combined with the mapping of research interests, the deposit model offers a basis for defining areas for preservation and archaeological intervention.

4.3 Results: The Database

The intensity of previous research and systematic excavation means that the city of York is rich in predictive information and a database of over 1000 contacts has been compiled. The database is held in a modified database management system using dBase III+ and is available on 3½" or 5¼" disks. It will run on any IBM compatible micro-computer.

The database consists of individual records for each contact, following pre-determined parameters (key-worded) for each field. The format and a typical entry are shown in Appendix A.

The search area, shown in Figure 2.1, was defined as eastings 595-615 and northings 510-530.

The sources of data were assessed and ranked on the basis of their expected reliability and quality. This provided a data-gathering itinerary, ranked in order of priority, as follows:

- York Archaeological Trust records
- Royal Commission volumes
- Yorkshire Philosophical Society Annual Reports
- Yorkshire Archaeological Journal
- RCHM indexes and manuscript records
- Yorkshire Museum manuscript records
- Ephemera, local newspapers

The first four categories were searched as fully as time allowed and the remainder then sampled. The major part of the Corpus has been reviewed, although more work would be highly desirable.

4.4 Zonation

From the results of previous archaeological work, incorporated in the database, the central area of York can be divided into 20 Zones which differ from each other in their topographical character and use throughout the periods being reported (Figure 4.1) The area of the 35 specific sites are shown on Table 4.1. These zones are used in the assessment which follows.

4.5 Coverage

Although the database is reasonably large and often very precise, coverage is uneven as can be seen on Figure 4.1.

Zones 1, 2, 3 and 4 and all suburban Zones 12-19 are particularly weak in contacts and further deposit-modelling is highly desirable in these areas.

To create local deposit-models for particular sites, it is generally inappropriate to extrapolate readings further than 20-50m from the nearest point of contact. Therefore there will be need for detailed site evaluations at a local level for the majority of sites in the development portfolio.

The coverage obtained for each period is also uneven, Anglian and Anglo-Scandinavian readings being particularly sparse. However, it is possible to use the models gathered from such contacts as so far exist, to suggest the character of the deposit overall.

4.6 Character and Distribution of Deposits: Depth and Thickness

The natural topography comprises a group of three plateaux cut by the confluence of two water courses, the Ouse and the Foss (Figure 4.2). Deposits have built up on, infilled or been cut away from the original topography to present different topography in the Roman, Anglian, Anglo-Scandinavian and Medieval Periods (Modelled in Figures 4.3-4.6).

The Roman town planners selected the northern and western plateaux for development, placing the fortress centrally on the northern plateau within the confluence, and the colonia on the (generally higher) western plateau. Deposits in these two areas had risen by up to 2½ metres by the end of the Middle Ages, encouraged by the 'belting effect' of the walled precincts (see Carver 1987). This contrasts with the eastern plateau where deposits had risen only 1-1½ metres by the end of the Middle Ages, and relatively thin deposits are to be found in all suburban zones.

Within the river zones bounded by the plateaux, infilling began immediately, allowing deposits to accumulate to depths exceeding 6 metres along the banks of the Foss and the Ouse.

Subsequent hydraulic engineering in the Medieval period included the construction of a castle moat (Clifford's Tower) and the King's Fish Pool, trapping earlier strata in some places and canalising it in others. The extent of the Kings Fishpool (fed by the Foss and Tang Hall Beck) and water defences around the Castle are currently given by the contours in Figure 4.6 and have been mapped more precisely from documentary and cartographic evidence (see YAT 1988, Figure 5 and Figure 5.4). Later centuries have seen the increasing canalization of the rivers, particularly the Foss. The narrower deeper river bed has removed the deposits along its line, but earlier strata have been trapped behind river-side revetments. The deep pre-Medieval deposits over the former river banks are generally still there.

TABLE 4.1 - RESEARCH ZONES: DEVELOPMENT SITES CONSIDERED

Zone	Description	Specific Sites Occurring In Zone (By Site Number)	Total Of Sites In Zone (ha)
1	Roman Fortress	33(0.25ha)	0.25
2	Vicus, SE (Canabae)	18(0.1ha), (30)1.0ha)	1.1
3	Confluence	19(0.15ha)	0.15
4	SE, Town between Foss and east defences	20(0.6ha), 13(0.5ha)	1.1
5	Foss Waterfront, West bank, north	9, 14(0.8ha), 10-12(9.0ha)	9.8
6	Foss Waterfront, West bank, south	23(1.0ha)	1.0
7	Foss Waterfront, East bank, north		-
8	Foss Waterfront, East bank, south	21(0.6ha), 22(0.15ha), 24(0.2ha), 25(0.2ha)	1.15
9	Ouse Waterfront, East bank	5(0.1ha), 6(0.1ha)	0.2
10	Ouse Waterfront, West bank	26(0.3ha), 27(0.1ha), 28(0.2ha)	0.4
11	Colonia/West Walled City	4(0.3ha), 7(0.15ha), 34(0.25ha), 35(0.1ha), 29(0.4)	1.2
12	Extramural, NE	31(0.15ha)	0.15
13	Extramural, E	8(27ha), 15(1ha)	28.0
14	Extramural, SE		-
15	Extramural, S		-
16	Extramural, SW (West of Ouse)	1(0.5ha), 2(0.3ha), 3(0.3ha), 32(2.5ha)	3.6
17	Extramural, W (South of Ouse)	16(4.0ha), 17(0.25ha)	4.25
18	Extramural, NW		-
19	Extramural, N		-
20	Fortress Annexe		-
		Total Development Area (ha)	52.35

4.6 Character and Distribution of Deposits: Depth and Thickness (Cont'd)

The depth of deposit for all historic periods is summarised in maps, Figures 4.7 and 4.8. These maps have been produced by extrapolation of an uneven and relatively small number of data points and should therefore be used with caution. A general deposit model taking into account the buried river system is given in Figure 4.9.

4.7 Character and Distribution of Deposit: Quality

The two most important parameters for assessing quality are the preservation and coherence of the deposit.

4.7.1 Anaerobic Deposits

Preservation is most readily measured by locating anaerobic deposits, since these contain a markedly elevated representation of cultural material. Anaerobic deposits are those deprived of oxygen shortly after formation, allowing the preservation of organic matter notably vegetation, building timber, skin, leather, textile, fur, feathers, and micro-organisms such as insects and parasites. These deposits offer a greatly increased potential (over aerobic deposits) for the reconstruction of town life. It has been suggested that 70% of all documented Medieval trades require anaerobic or enhanced preservation for their detection (Carver 1987, Ch.6).

Anaerobic deposits which cover a sizable area are generally the exception, though they commonly occur in micro-pockets throughout any urban site. Small scale survival may occur when a deposit is sealed with clay or becomes saturated with still water, such as wells, cess pits and sealed middens.

Large scale anaerobic deposits are often captured as a result of infilling valleys and riverbanks with organic debris. Here the deposits are not necessarily either sealed or wet, since the weight and bulk of the vegetable matter procures the exclusion of air.

Large scale anaerobic deposits are known from all over Europe, and include some Roman sites (such as the infilled Devèze in the centre of Bordeaux). However, most of them, interestingly, relate to the Early Medieval period, and the 9th-11th century in particular. They are prominent in an 'organic crescent' which includes Novgorod, Lund, Ribe, Bergen, Trondheim, Perth and Dublin. This distribution presumably represents the tendency of urban populations in an expansive period to exploit the un-canalised river with timber works infilled with middens. The process often stops with the establishment of the Medieval waterfront.

Deposits with high preservation can be coarsely predicted by locating buried valleys, which imply infilling, and by mapping 'wet' deposits. However neither of these provides a certain indication of preservation status, since prolonged exposure of early deposits may have already taken them some way down the trajectory of decay. An example is given by the deep wet Roman deposits of Coppergate where there was little preservation of timber in spite of the fact that they lay under a thick mantle of anaerobic Anglo-Scandinavian strata (Hall 1984, 19). The most reliable account is therefore achieved by mapping contact with the anaerobic deposits themselves.

4.7 Character and Distribution of Deposit: Quality (Cont'd)

4.7.1 Anaerobic Deposits (Cont'd)

The data for York have not been gathered systematically in the field for mapping purposes but give a reasonably consistent picture (Figures 10-4.11). The topography at different historical horizons predicted that extensive infilling would have occurred particularly in the Early Medieval period along the west bank of the Foss and both banks of the Ouse (see above). Wet deposits occur spasmodically within the Roman town (the northern plateau) and otherwise are concentrated along both banks of the two rivers. The horizon of wet deposits is not level since the water table may be 'perched' locally. Thus it occurs at about 12.6 -13 metres beneath York Minster (compare 6.6m AOD for the general water table), that is roughly the level of the Roman use horizon. All Roman strata here are 'wet' although not anaerobic. Roman levels lower than this outside the fortress are not necessarily 'wet'. The anaerobic deposits follow a similar distribution. The northern plateau and the river valleys are therefore areas where a high level of preservation can be expected more often than not. This outstanding quality of deposit has of course long been known in general terms and has been largely responsible for York's international reputation as a 'plum' site.

4.7.2 Coherence

Coherence is a far more difficult attribute to measure or predict. At the micro-level, individual strata continuously interfere with each other, and it is as well that they do, since such 'interference' is what provides the sequence of events. All multi-stratified sites offer a compromise between high legibility where strata are easy to define but not much happened, and high complexity which are difficult to read, and slow to dissect, but full of incident.

The York database offers little information as yet from which to map trends in stratigraphic coherence. Coherence can only be assessed reliably from large scale excavations, and it is these that generally report a site as disturbed. Observations, watching briefs and small scale interventions inevitably report (selectively) the legible strata (Figure 4.12).

Nevertheless, a few generalisations are possible (Figure 4.9). All slopes and water-fronts, whether wet or dry, beside the ancient river courses encourage the more open vertical spacing of strata and improve the legibility of intensively-used areas (Zones 5-10). Zone 1 is also likely to contain a high preponderance of coherent strata, the spacing in this case being encouraged by depth due to the 'belting effect' and the relatively light development, since Medieval times, in the Minster area.

The estimation of coherence could be greatly improved by a number of studies which did not form part of this consultancy, the most obvious of which is a cellar and basement survey (see Carver 1987 Ch. 9). This would show where deposits have already been disturbed by deep penetrating basements, as well as by foundations of large buildings (such as York Minster). The basement locations will also indicate where previews of strata could be obtained on development sites (by detaching cellar-walls and recording the upstanding sections).

Provisional surveys of basement penetration and the location of monuments were undertaken by Andrews (1984) and are reproduced here as Figures 4.13 and 4.14.

4.8 Grading the Zones

The results of the evaluation are provisionally presented in Table 4.2, where the parameters reviewed here are assessed and placed beside the incidents of strata dating from the principal historical periods for each Zone. Figures 4.15 to 4.17 show contact points in each period. The grading employs the following key:

E: Insufficient data. Systematic evaluation required.

1: Highest quality deposit. Concentrated, well-preserved and coherent strata rich in historical information. High cost intervention usually requiring shoring.

2: Medium quality deposit. Intervention or protective mitigation desirable.

3: Low quality deposits. Archaeological reconnaissance only.

This grading and zonation could be used on its own to inform the planning process. However, the assessment does not take account of the context of York as a historic city among a corpus of historic cities in Europe. The deposit-model offers a zonation of the resource within its own terms of definition. But it is suggested that administrative action should be based on 'archaeological value' rather than physical parameters alone. This archaeological value can only be defined by reference to the research agenda. This is the subject of Section 5.

TABLE 4.2 - DEPOSIT MODEL: ZONAL SUMMARY OF DEPOSIT CHARACTERISTICS

Zone	Description	Av.Depth	Moisture	Anaerobic	Coherence	Periods	Grade
1	Roman Fortress	3-5m	R	R	High	All	1
2	Viscus, SE (Canabae)	*	*	*	*	All	E
3	Confluence	3-5m	R-A	A,S	High	All	1
4	SE Town between Foss and east defences	*	*	*	*	*	E
5	Foss Waterfront, West bank, north	7m	R-M	R-M	High	All	1
6	Foss Waterfront, West bank, south	6m	R-M	R-M	High	All	1
7	Foss Waterfront, East bank, north	*	*	*	*	A-M?	2
8	Foss Waterfront, East bank, south	*	*	*	*	A-M?	2
9	Ouse Waterfront, East bank	5m	*	*	*	All	1
10	Ouse Waterfront, West bank	5m	*	*	High	All	1
11	Colonia/West Walled City	2m	Dry	Spasmodic	Average	All	2
12	Extramural, NE	*	*	*	*	*	E
13	Extramural, E	*	*	*	*	*	E
14	Extramural, SE	1.5	*	*	*	A-M	E
15	Extramural, S	*	*	*	*	*	E
16	Extramural, SW (West of Ouse)	*	*	*	*	R-M	E
17	Extramural, W (South of Ouse)	*	*	*	Poor	R-M	2
18	Extramural, NW	*	*	*	*	*	E
19	Extramural, N	*	*	*	*	*	E
20	Fortress Annexe	1m	*	*	Average	R-M	E

Key:
R Roman
A Anglian
S Saxon
M Medieval
* no information
Grade (see Section 4.8)
E insufficient data
1 highest quality deposit
2 medium quality deposit
3 low quality deposit

4.9 Review of Sources

The volume of essays published by York Archaeological Trust in honour of its chairman, Maurice Barley, in 1984 offers a valuable point of departure for reviewing the state of knowledge of the archaeology of York (Addyman and Black 1984). These are papers on aspects of the material culture of the Roman, Anglian, Anglo-Scandinavian, and Medieval city and its context, and the bibliography reflects the considerable achievements of the York Archaeological Trust itself in adding to and publishing the evidence since 1972.

In particular, the volume provides a statement of the importance and potential of the York Hinterland (Addyman), archaeological reviews of the Roman colonia (Ottaway), Canabae and suburbs (Brinklow) and cemeteries (Jones), and the environmental evidence (O'Connor et al). Most useful of all for the present project is Gill Andrews 'Assessment' of the archaeology of York, which presents the predicted location and survival of Roman, Anglian, Anglo-Scandinavian and Medieval remains based on a gazetteer of excavations.

4.9.1 Summary of Knowledge

The state of knowledge and its implications for future development can be briefly summarised:

(a) Pre-Roman

There is no firm evidence for the environment, appearance, or exploitation of pre-Roman York.

(b) Roman (Figure 4.18)

1st century: the legionary fortress was established c.71 AD for the IX legion and barracks were constructed in timber. Orthogonal roads lead north-west, north-east and south-west across the Ouse. There was settlement in the area adjacent to Micklegate in this period, but settlement in other suburbs is not yet known.

2nd century: the legionary fortress was rebuilt in stone and included a Principia (headquarters building). The IX Legion disappeared and was replaced by the VI Legion.

By 213 AD a colonia was founded on the west bank of the Ouse (zone 11) and an industrial/commercial area (Canabae) had probably developed on the west bank of the Foss (zone 2).

Little is known of the plan of the Roman city in its heyday. The cemeteries (Figure 4.18) imply that the fortress, colonia and canabae were always the main areas of settlement, with possible suburbs to the north-east (zone 12) and north (zone 19).

Table 4.3 produces a check list of the Roman urban monumental apparatus which reveals a relatively meagre knowledge (see Carver 1987, page 25).

In the 3rd century social and economic change is inferred but the evidence is ambiguous.

The 4th century is a major period of prosperity and change. York is an important city in the new Christian Empire and has a rich archaeological assemblage.

4.9 **Review of Sources** (Cont'd)

TABLE 4.3 - ROMAN YORK: MONUMENTAL APPARATUS

Examples contacted and located	Expected but not located
Fortress defences	Imperial Palace
Principia building	Governor's Palace
Temple	Forum
Baths	Amphitheatre
Sewer	Triumphal Arch
Cemeteries	Theatre
Mithraeum	Episcopal Church
	Mansio
	Aqueduct
	Waterfronts
	Workshops and Industrial Centre Shops
	Residential Street Plan (Insulae)
	Colonia Defences

4.9.1 **Summary of Knowledge** (Cont'd)

(c) Sub-Roman/Anglian 400 to 850 (Figure 4.19)

There are very few finds or other types of indication for activity in York between 400 and 700 AD.

From 700 to 850, more plentiful and recognisable finds allow greater expectation of activity.

Settlement is predicted in the fortress, in suburbs (e.g. Zone 14) and on the waterfront.

(d) Anglo-Scandinavian 850 to 1100 (Figure 4.20)

A period of major replanning which gave the city a new shape and plan which has largely endured to the present.

The former approach to the fortress was abandoned in favour of the Micklegate-Ousegate-Pavement access aimed at the heart of the new commercial centre (Zone 2, 3).

The colonia area (Zone 11) may have been developed as a twin town on the west bank.

Expected but as yet unlocated aspects of the Anglo-Scandinavian town include:

The Anglo-Saxon Minster Church
Palace of the English Earls (St Olave's?)
The Palace of the Viking Kings (Kings Square?)
Parishes and Parish Churches
Waterfronts (Zones 5-10)
Residential/Industrial Planned Layout (Zones 1, 2, 3, 11)

4.9 Review of Sources (Cont'd)

4.9.1 Summary of Knowledge (Cont'd)

(e) Medieval 1100 to 1600 (Figure 4.21)

The major topographical changes to the Anglo-Scandinavian topography were:

Construction of the Norman Minster on new east-west alignment.
Construction of Baile Hill Castle (west) and York Castle (east) either side of the Ouse.
River Foss dammed and Kings Fish Pool created in combination with York Castle water defences.
Suburban expansion in Newbiggin (Zone 12) and probably elsewhere.
Expected, but not currently well-documented, is evidence for industry and social differentiation between communities in different parishes.

4.9.2 Andrews Report Research Programme

Andrews gives a number of broad priorities for archaeological work:

(a) Roman: Plan of settlement in colonia and canabae
Objective evidence for construction and use of fortress.
Pottery study from existing collections to determine intensity of settlement in York.

(b) Anglian: Locate and define settlement

(c) Anglo-Scandinavian: Plan and nature of settlement in colonia and fortress.
Locate and excavate waterfront.

(d) Medieval: Initiate major survey of documentary and architectural evidence to guide excavation strategy.
More study of parish churches and urban friaries.

(e) General: More precise information needed on:
The defences and their sequence
Settlement sequence in the suburbs (Zones 12 to 19)
Settlement sequence south-west of the Ouse (Zone 11, 15)
Settlement sequence east of Foss (Zones 4, 13, 14)
Any opportunity should be taken to gather evidence in controlled conditions from the central areas (Zones 1, 2).

4.10 Updating Andrews

Modifications to the Andrews Report (1984) proposals are appropriate because there is now more information available and new ideas to test. But the present Study also adopts a different philosophy for planning archaeological work in York.

4.10 Updating Andrews (Cont'd)

The state of knowledge has advanced in the five years since publication of the Andrews' Report, in particular through:

(a) The completion of the York Minster excavation report

This gives the plans of the principia and barracks in the fortress; and offers a model for the exploitation of the Roman buildings from the 5th to the 11th century AD. A sub-Roman phase (5th to 7th century) portrays the principia building functioning as a hall. An Anglian phase (7th to 9th century) features a prestigious cemetery in a partially horticultural setting. By the Anglo-Scandinavian phase the superstructure of the Roman buildings is largely demolished and artisans' tenements (cf. Coppergate) are established in the stub-walls of the Roman barracks, adjacent to the presumed site of the Anglo-Saxon Minster (Phillips, forthcoming).

(b) The excavation of the Anglian settlement at Fishergate

A short-lived planned settlement of buildings and property boundaries with a possible road was dated 700 to 740 AD and identified as Eoforwic, the Wic or trading settlement of Anglian York. After an interval of abandonment, there was higher status occupation in the period 830 to 860 (Kemp, forthcoming).

(c) Anglo-Scandinavian settlement south-west of the Ouse

Synthesis by Moulden and Tweddle 1986 showed that there was substantial settlement in the former colonia (Zone 11) and beyond (Zone 15) from the 9th century.

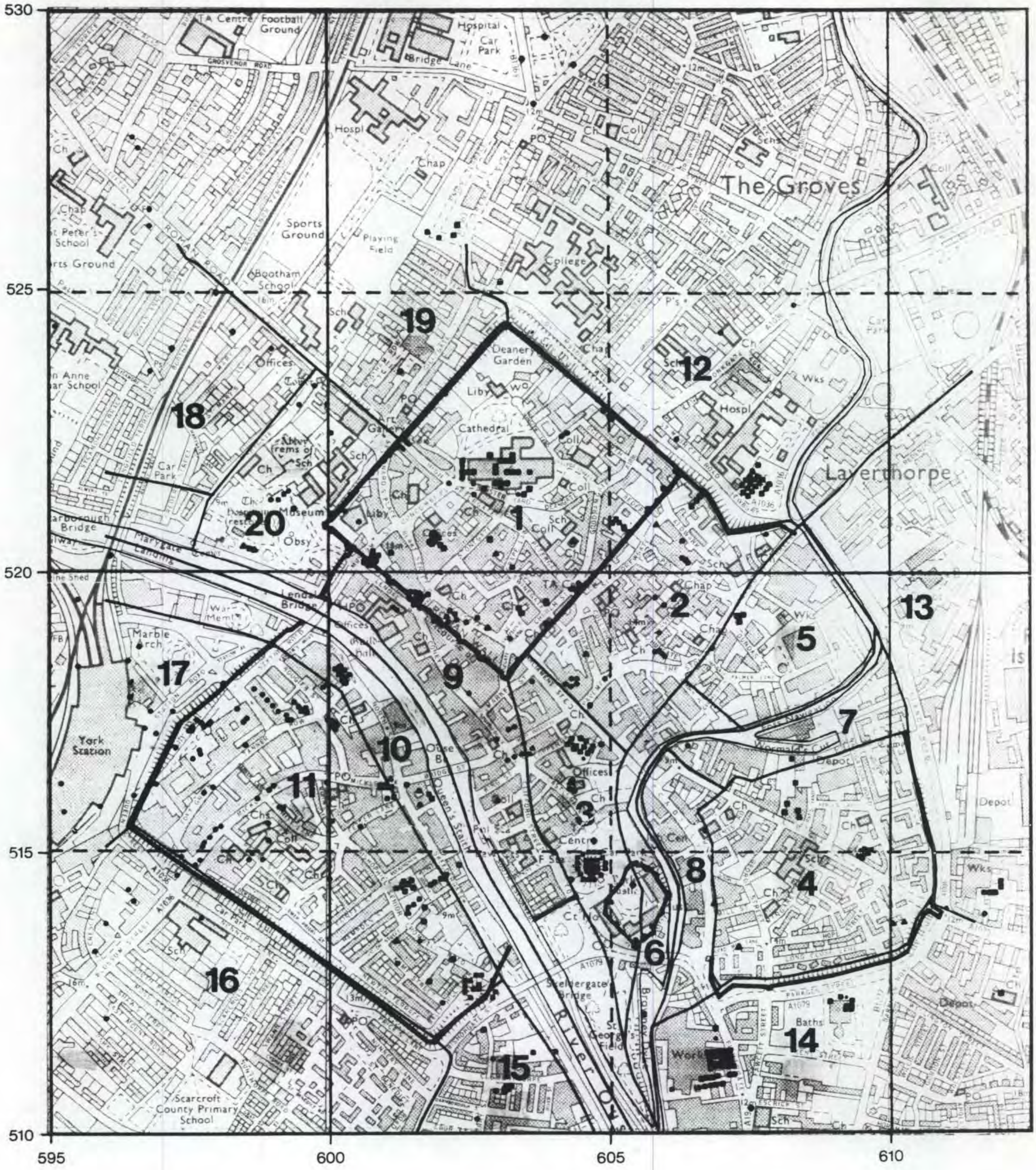
(d) Micklegate Area

Excavations beside the west bank Roman bridgehead (Stakis Hotel site) produced a Roman Temple (Ottaway, forthcoming). A Roman residential or monumental building was contacted beside Micklegate (Queens Hotel site; Brann, forthcoming).

(e) Other Excavations and watching briefs by York Archaeological Trust have allowed an increase in knowledge of early activity in many zones.

4.10 Updating Andrews (Cont'd)

This review of the state of knowledge in 1990 provided the starting point for the development of an archaeological research framework which is considered in Section 5.



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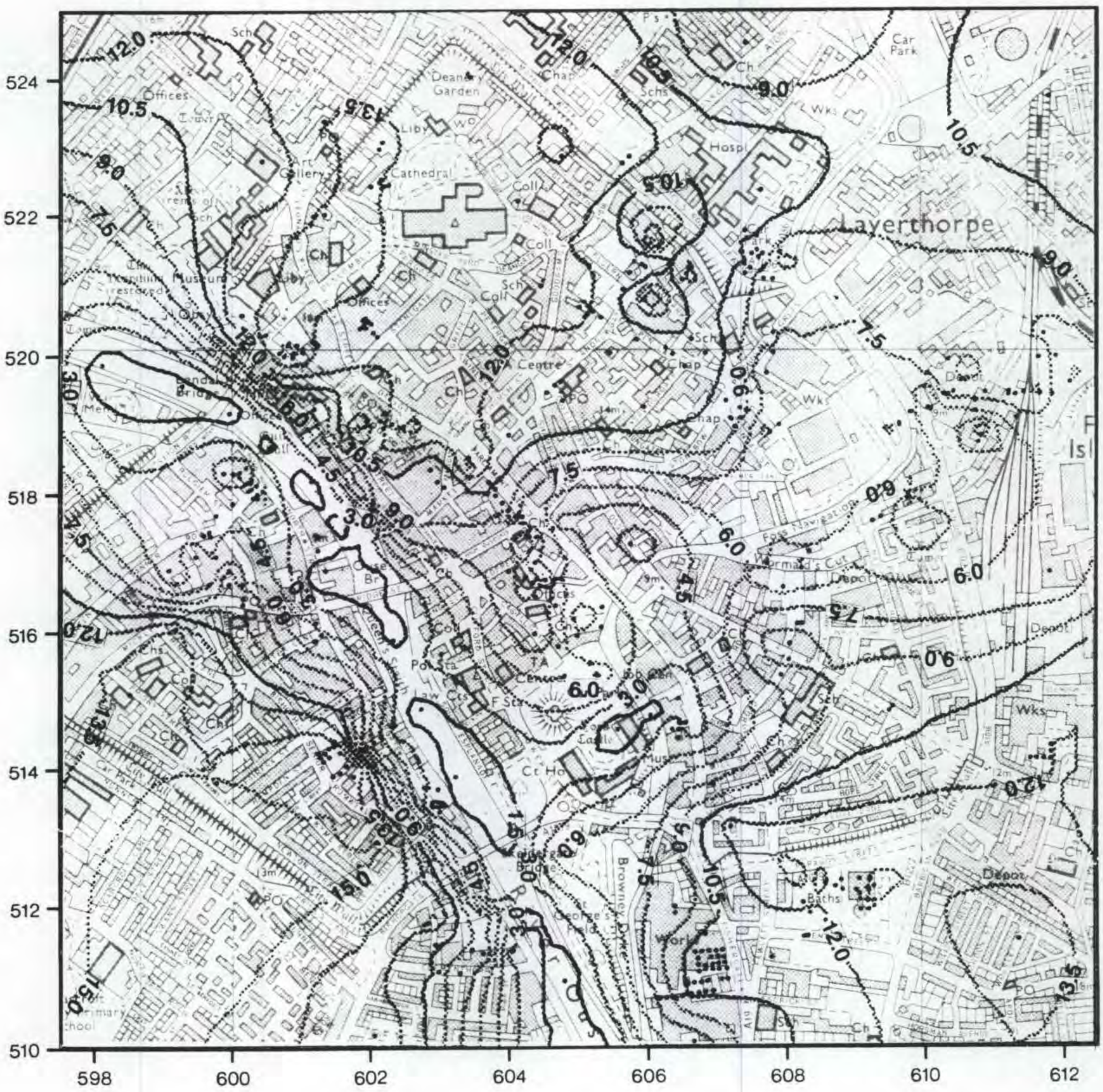
Research Zones with Archeological Contact Points

ARUP

FIGURE 4.1



16.5
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5

Heights in metres above O.D.

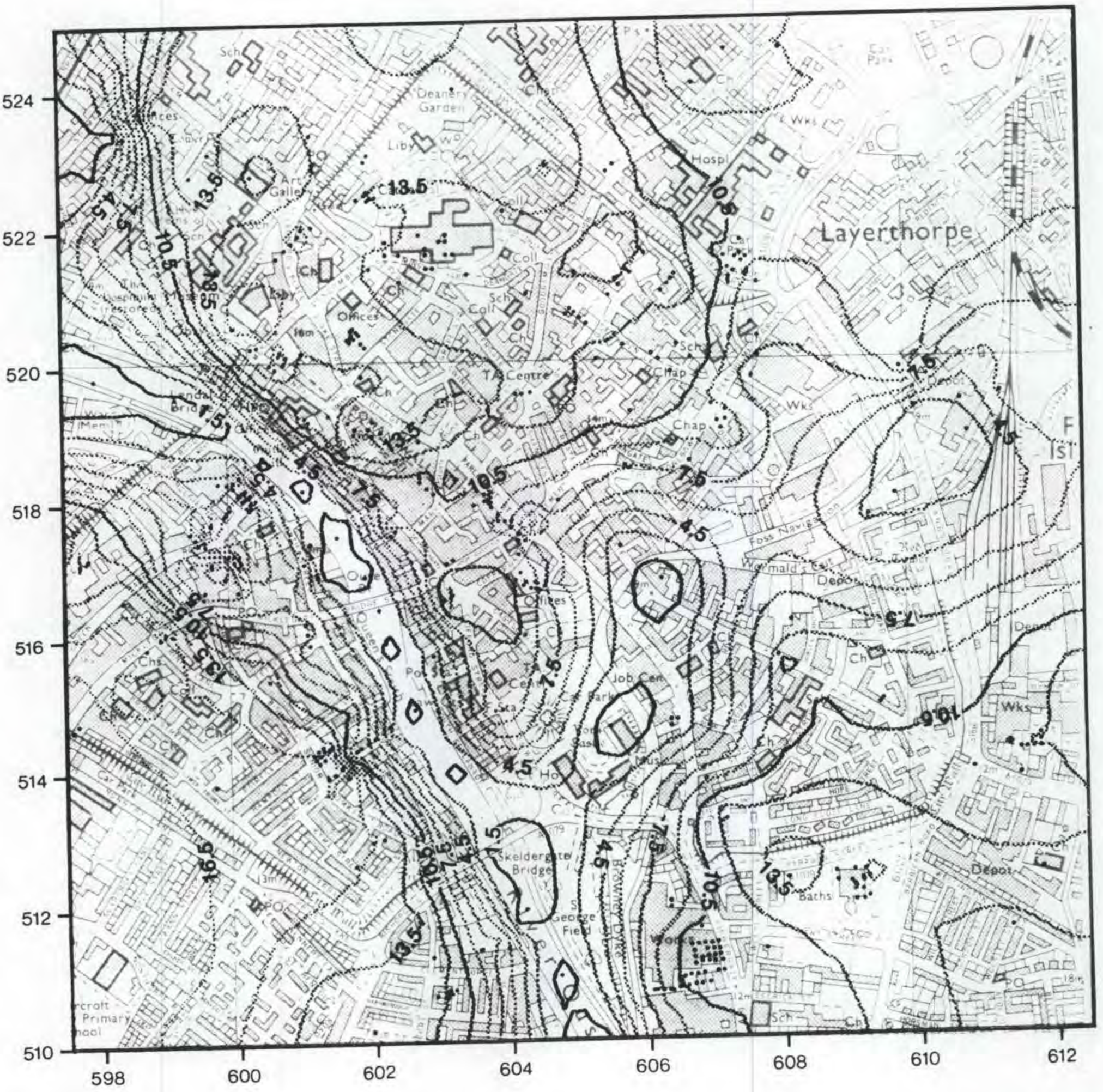
Source: JDR/Univ. of York

Scale 1:10 000

Model of Natural Surface

ARUP

FIGURE 4.2



Scale 1:10 000

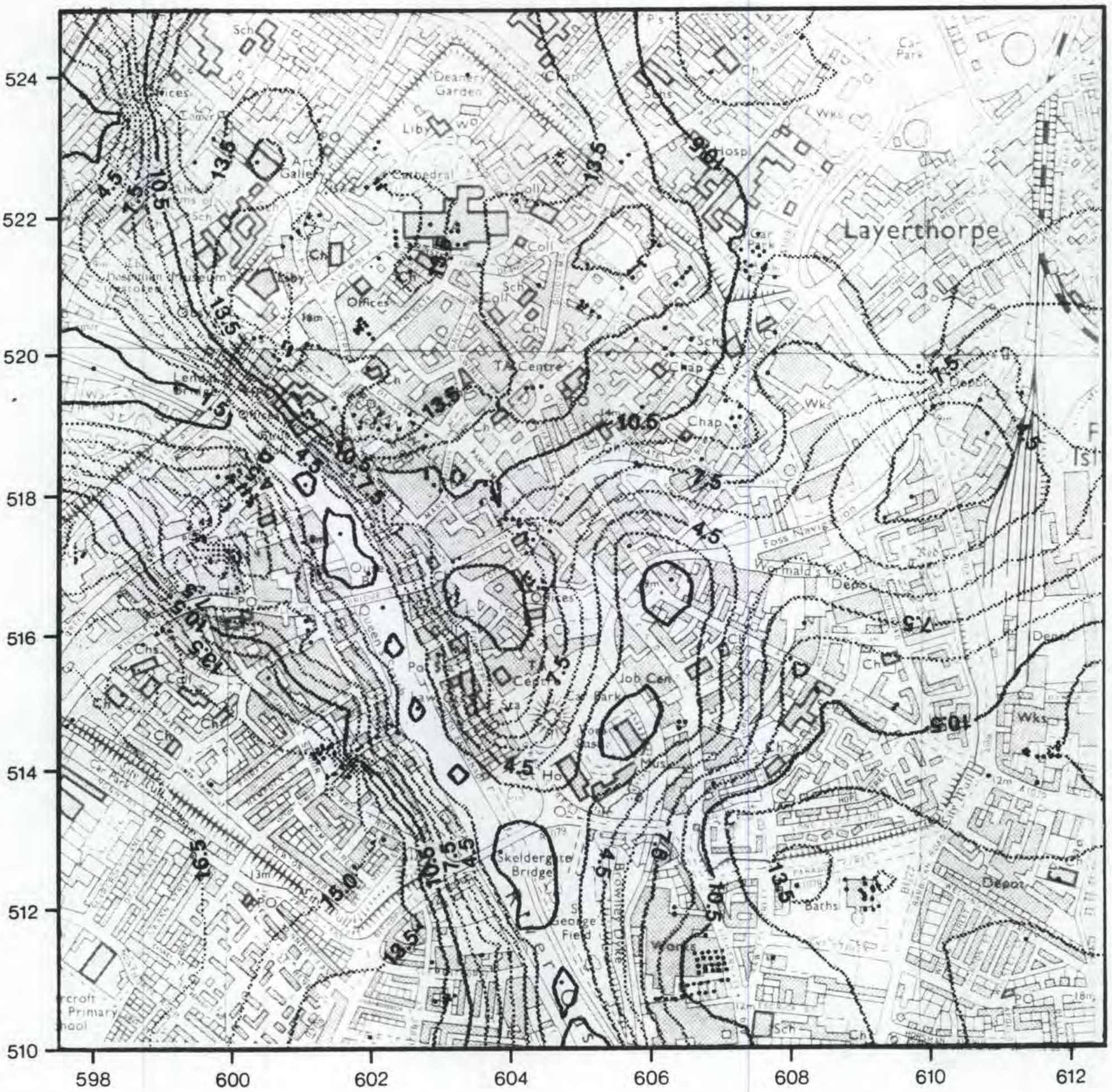
Heights in metres above O.D.

Source: JDR/Univ. of York

Model of Roman Surface

ARUP

FIGURE 4.3



Scale 1:10 000

16.5
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5

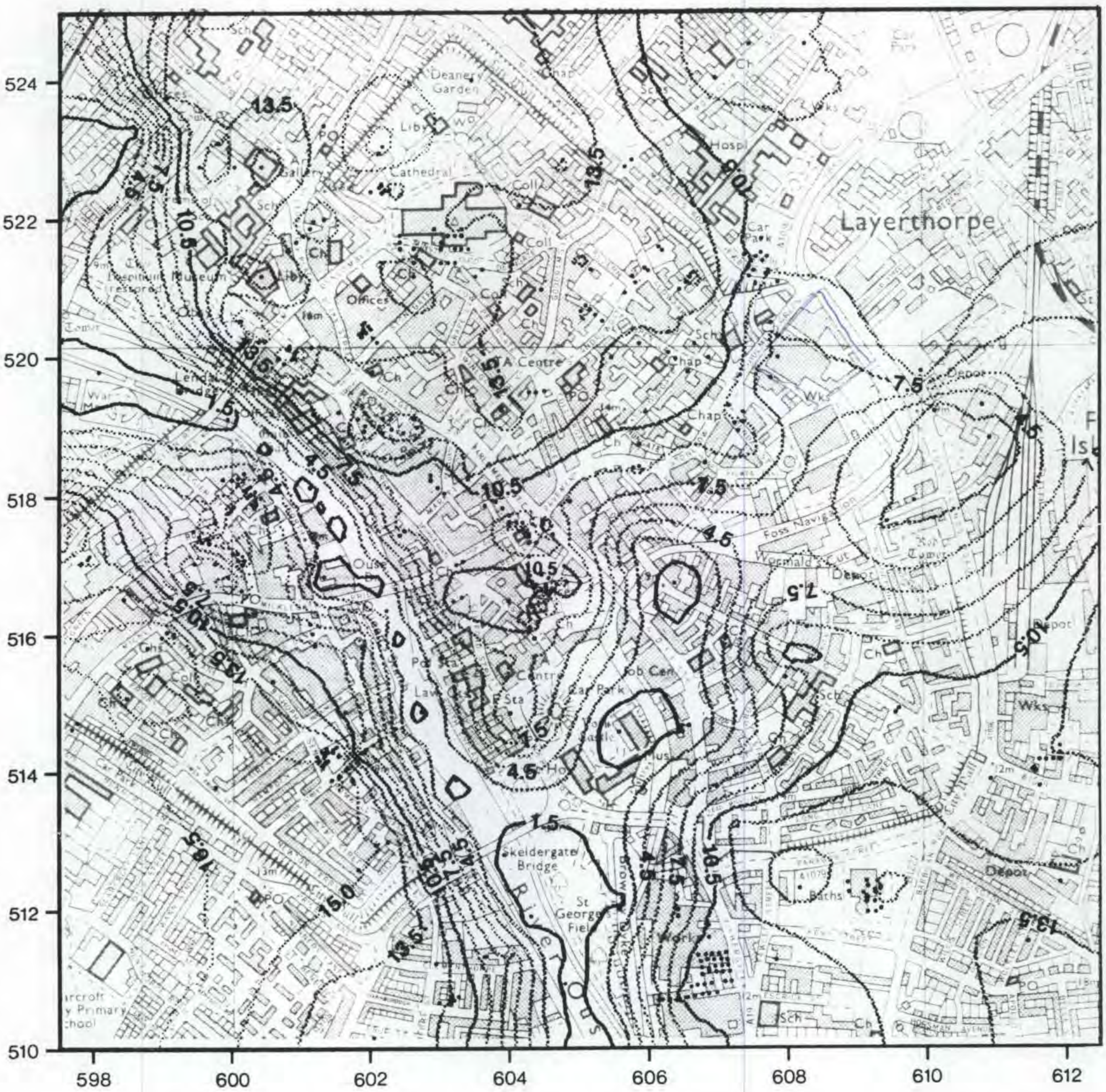
Heights in metres above O.D.

Source: JDR/Univ. of York

Model of Anglian Period Surface

ARUP

FIGURE 4.4



Scale 1:10 000

16.5
15.0
13.5
12.0
10.5
9.0
7.5
6.0
4.5
3.0
1.5

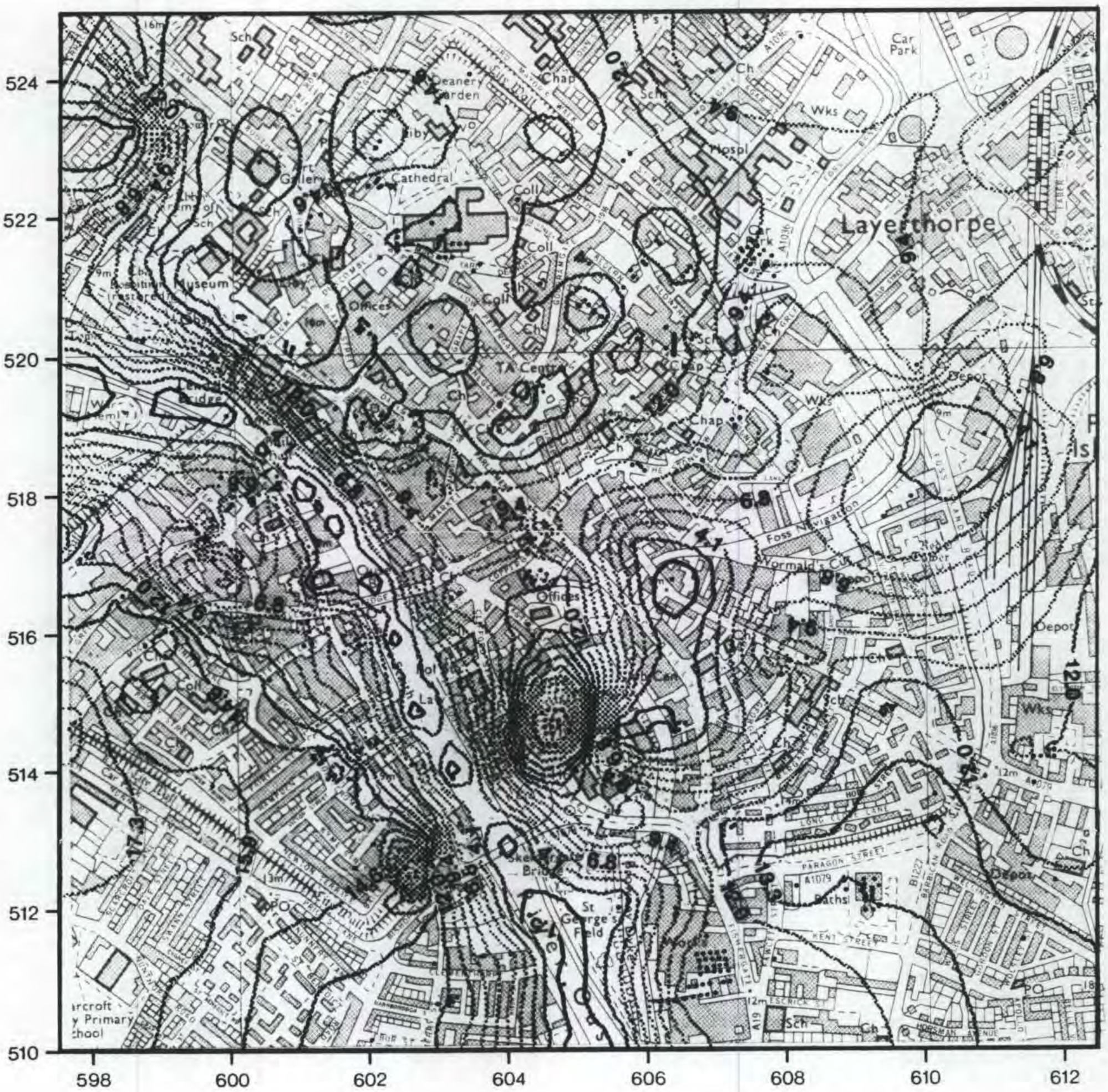
Heights in metres above O.D.

Source: Univ. of York

Model of Anglo-Scandinavian Surface

ARUP

FIGURE 4.5



.....	22.5	.....	10.7
.....	21.2	.....	9.4
.....	19.9	.....	8.1
.....	18.6	.....	6.8
.....	17.3	.....	5.4
.....	15.9	.....	4.1
———	14.6	———	2.8
———	13.3	———	1.5
———	12.0		

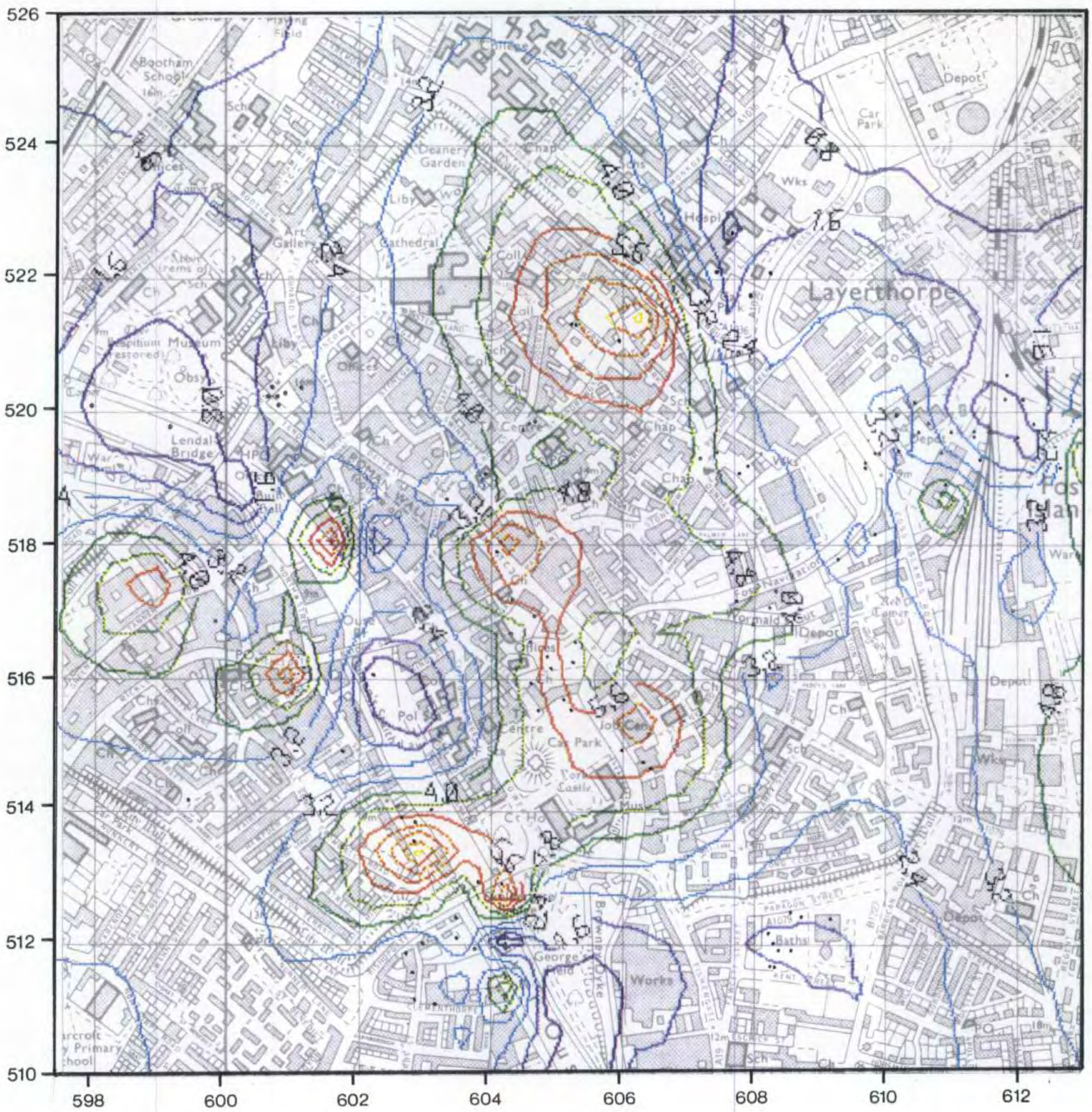
Heights in metres above O.D.

Source: Univ. of York

Model of Medieval Surface

ARUP

FIGURE **4.6**



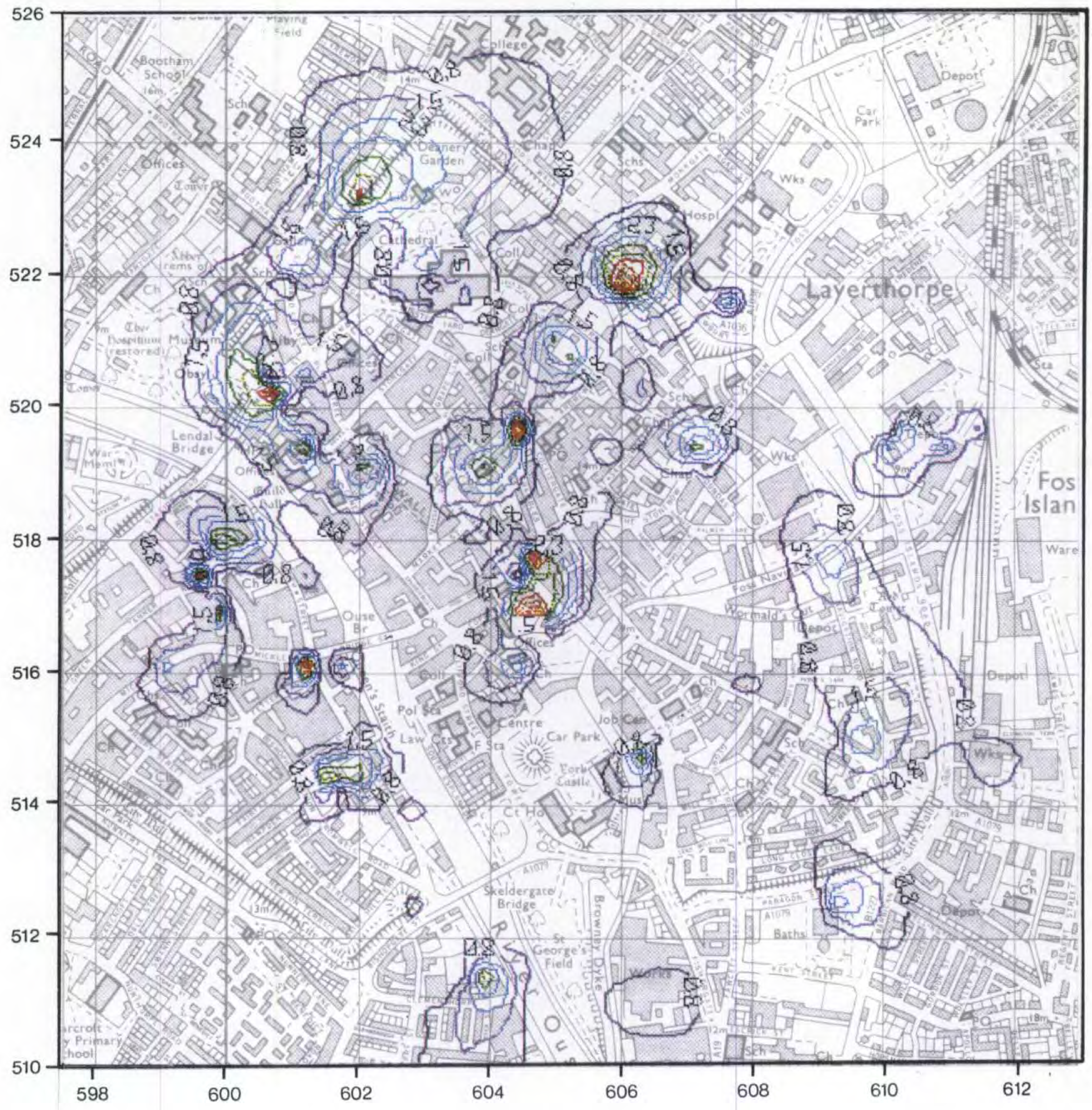
:· Contact Point
Heights in metres above O.D.

Scale 1:10 000

Deposit Model: Depth from Actual G.S.

ARUP FIGURE **4.7**

Source: Univ. of York



Heights in metres above O.D.

Scale 1:10 000

Deposit Model: Depth from Top of Medieval Levels

ARUP

FIGURE **4.8**

Source: Univ. of York

530
525
520
515
510
595
600
605
610
0
500 m

Deposits destroyed (after Andrews 1984)

Running water channels

Buried water channels (after YAT 1988)

Deposits of increasing thickness

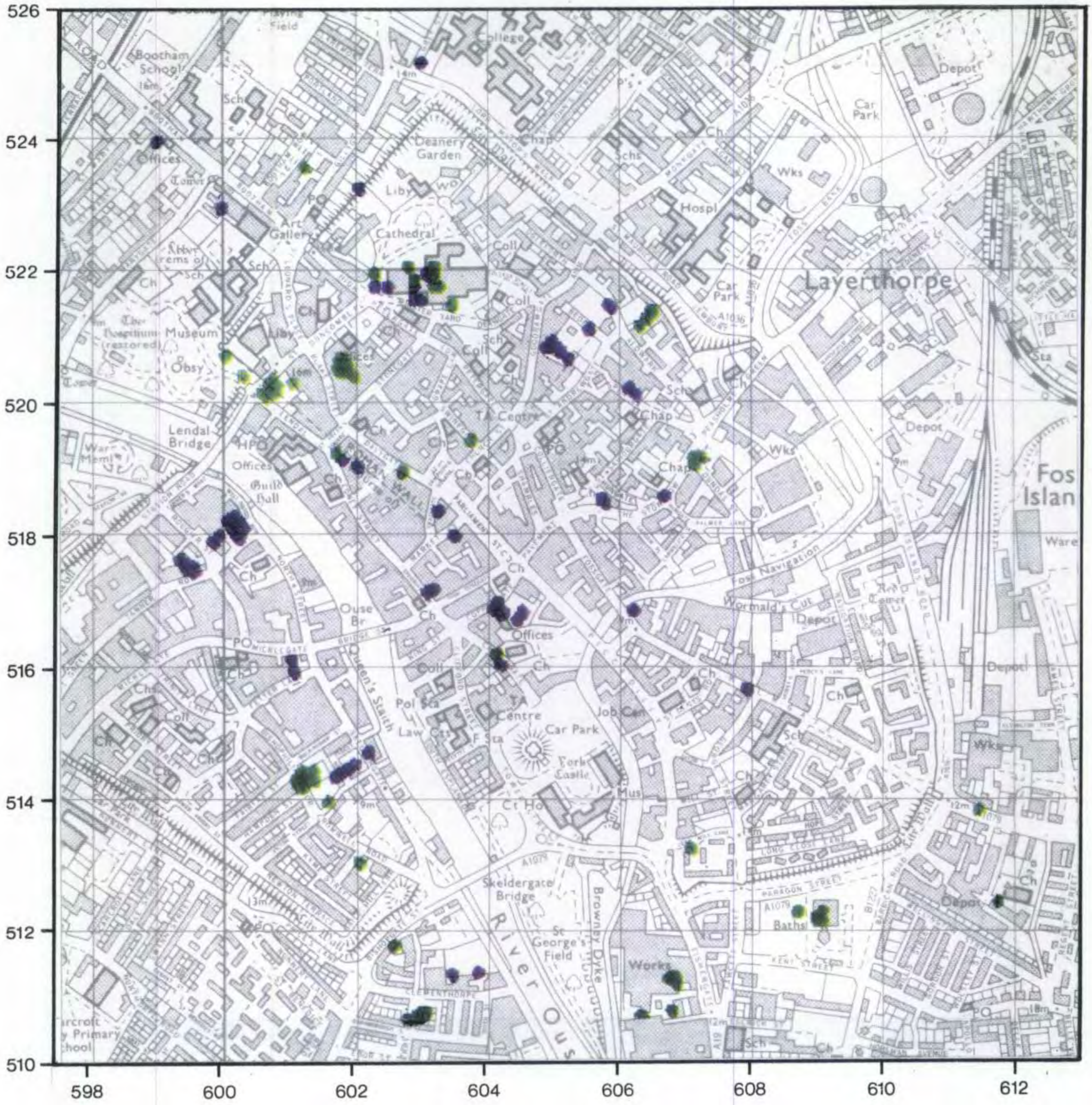
Scale 1:10000

Source: MOHC/Univ. of York

Archaeological Resource Model for York (below ground level)

ARUP

FIGURE **4.9**



Wet

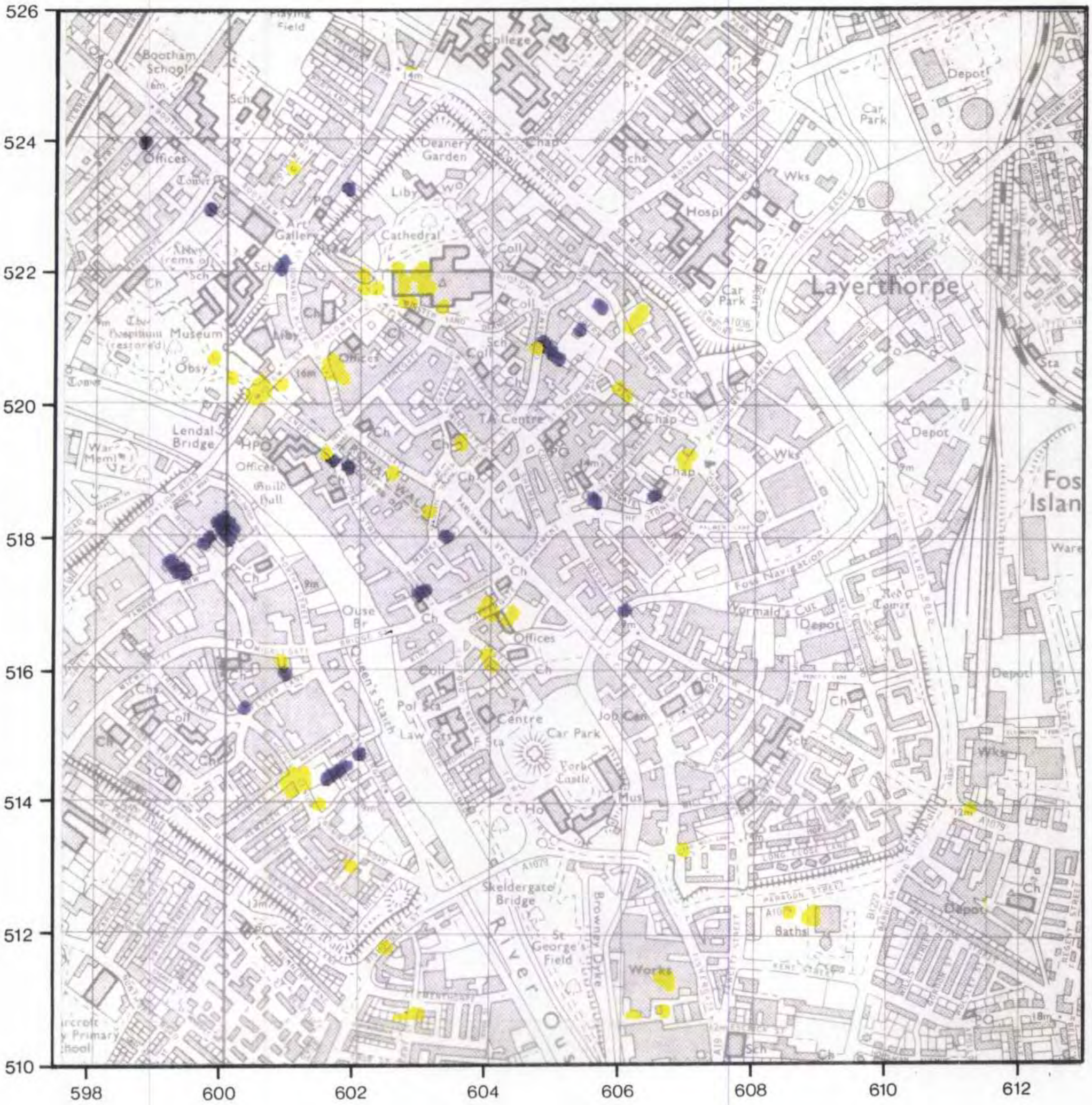
Dry

Source: Univ. of York

Roman York: Moisture Levels

FIGURE **4.10**

ARUP



Source: Univ. of York

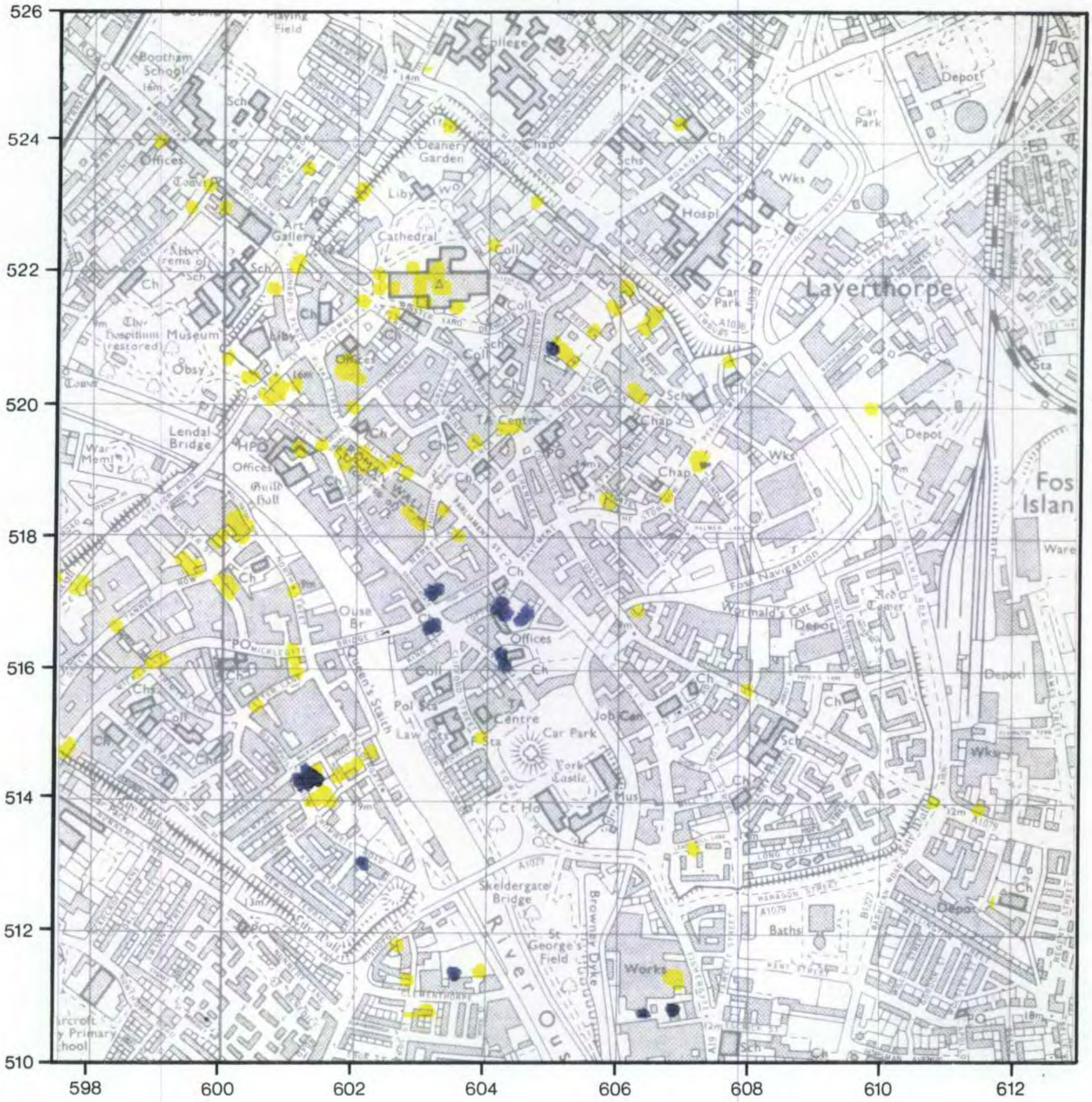
Anaerobic

Aerobic

Roman York: Anaerobic Deposits

ARUP

FIGURE **4.11**



Disturbed

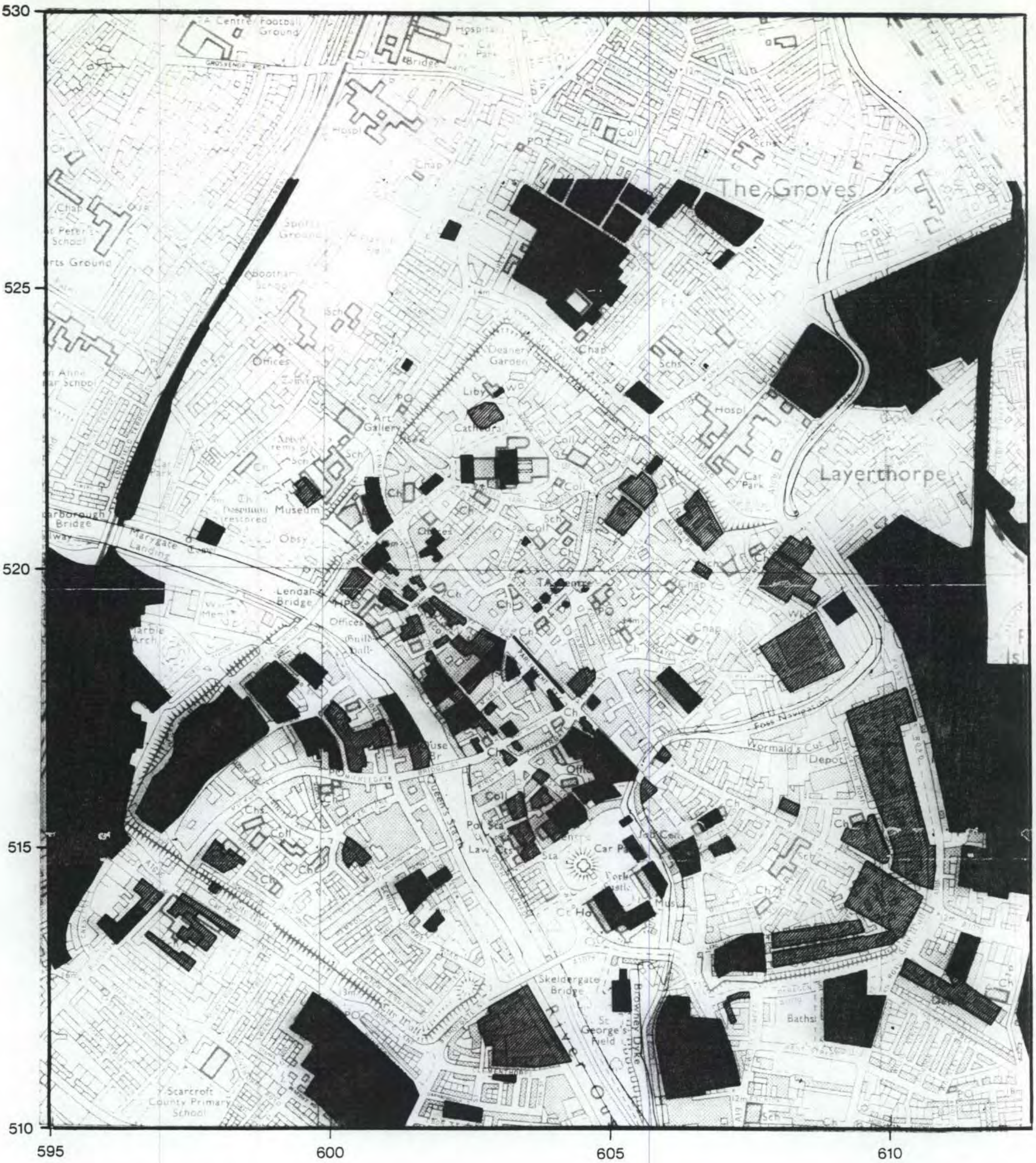
Stratified

Roman York:
Deposit Quality

ARUP

FIGURE 4.12

ce: Univ. of York



All levels destroyed

Roman levels remain
Post – Roman levels destroyed

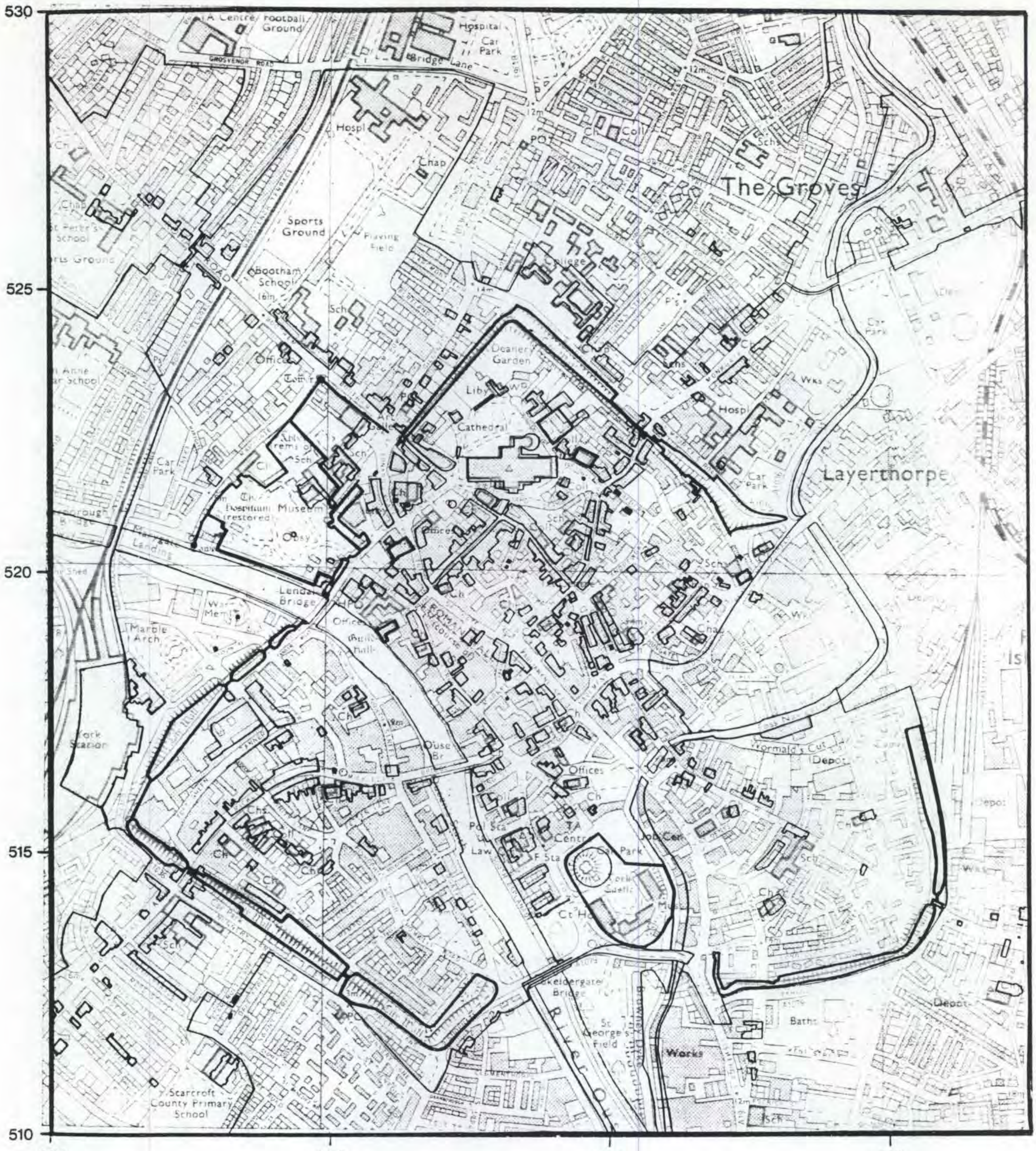
Scale 1:10000

Source: Andrews 1984

Areas Destroyed

ARUP

FIGURE 4.13

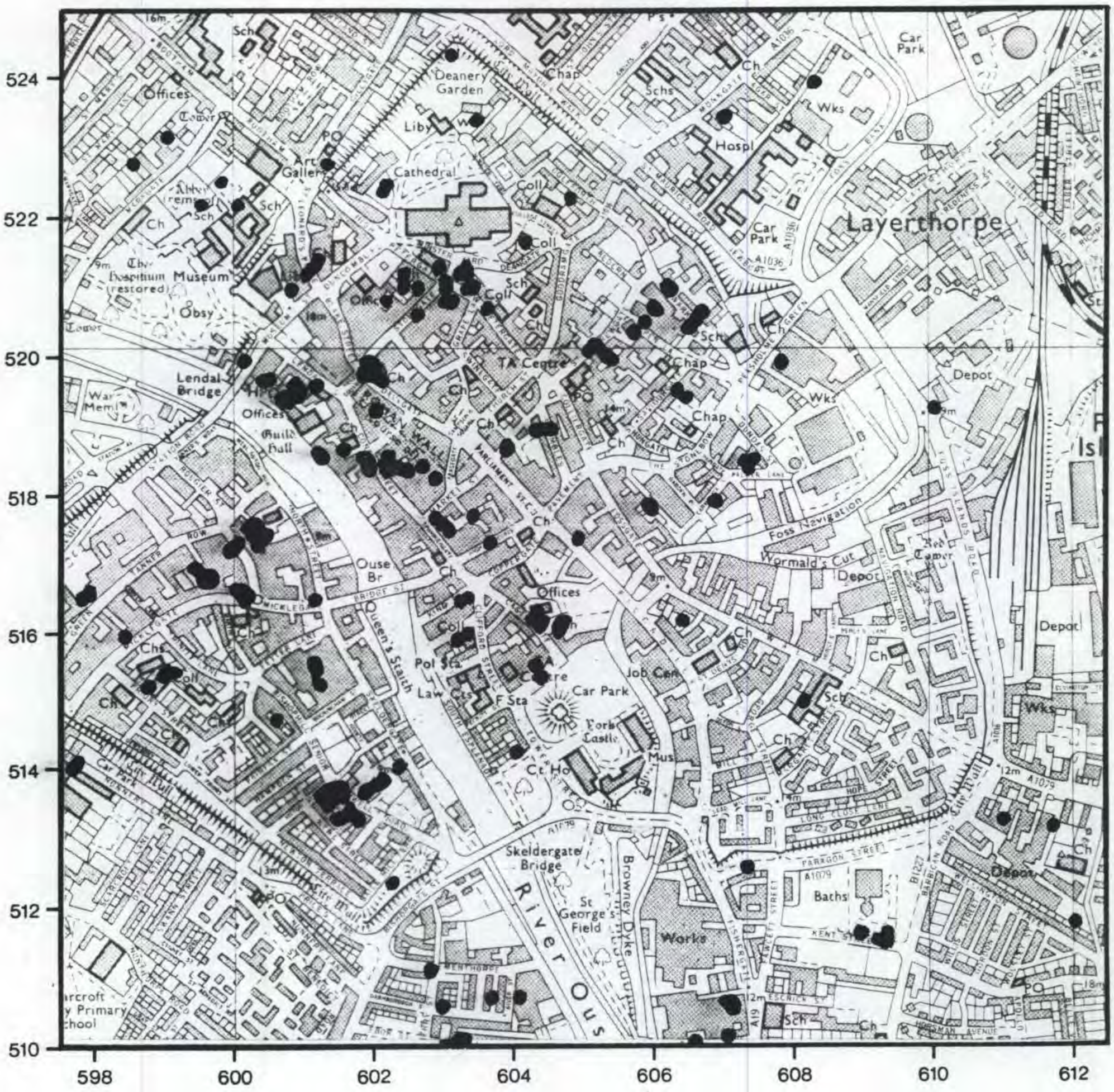


Source: Andrews 1984

Conservation Area, Scheduled Monuments and Listed Buildings

ARUP

FIGURE 4.14



Scale 1:10 000

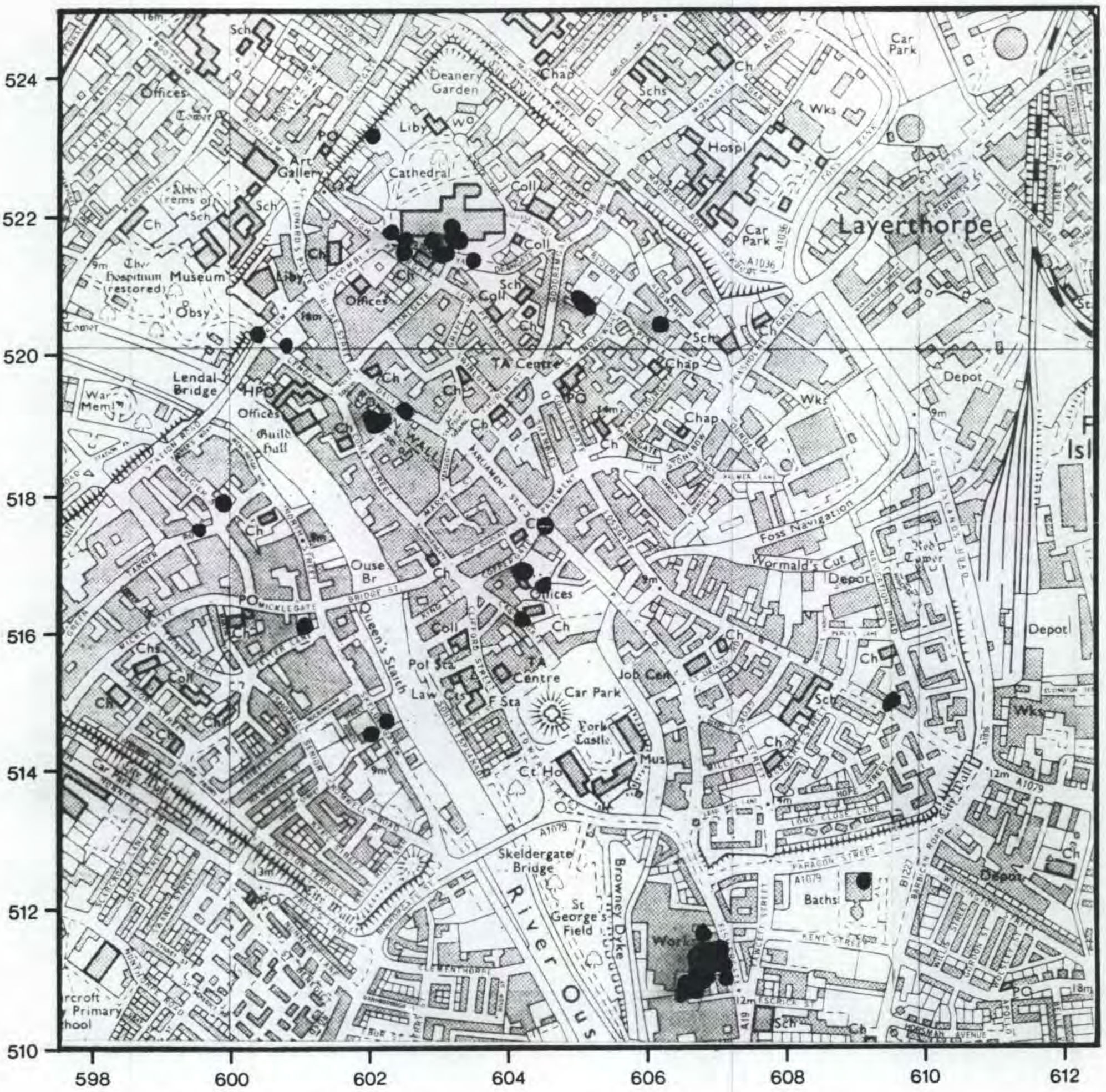
Roman Data Points

ARUP

FIGURE 4.15

Source: Univ. of York

.19



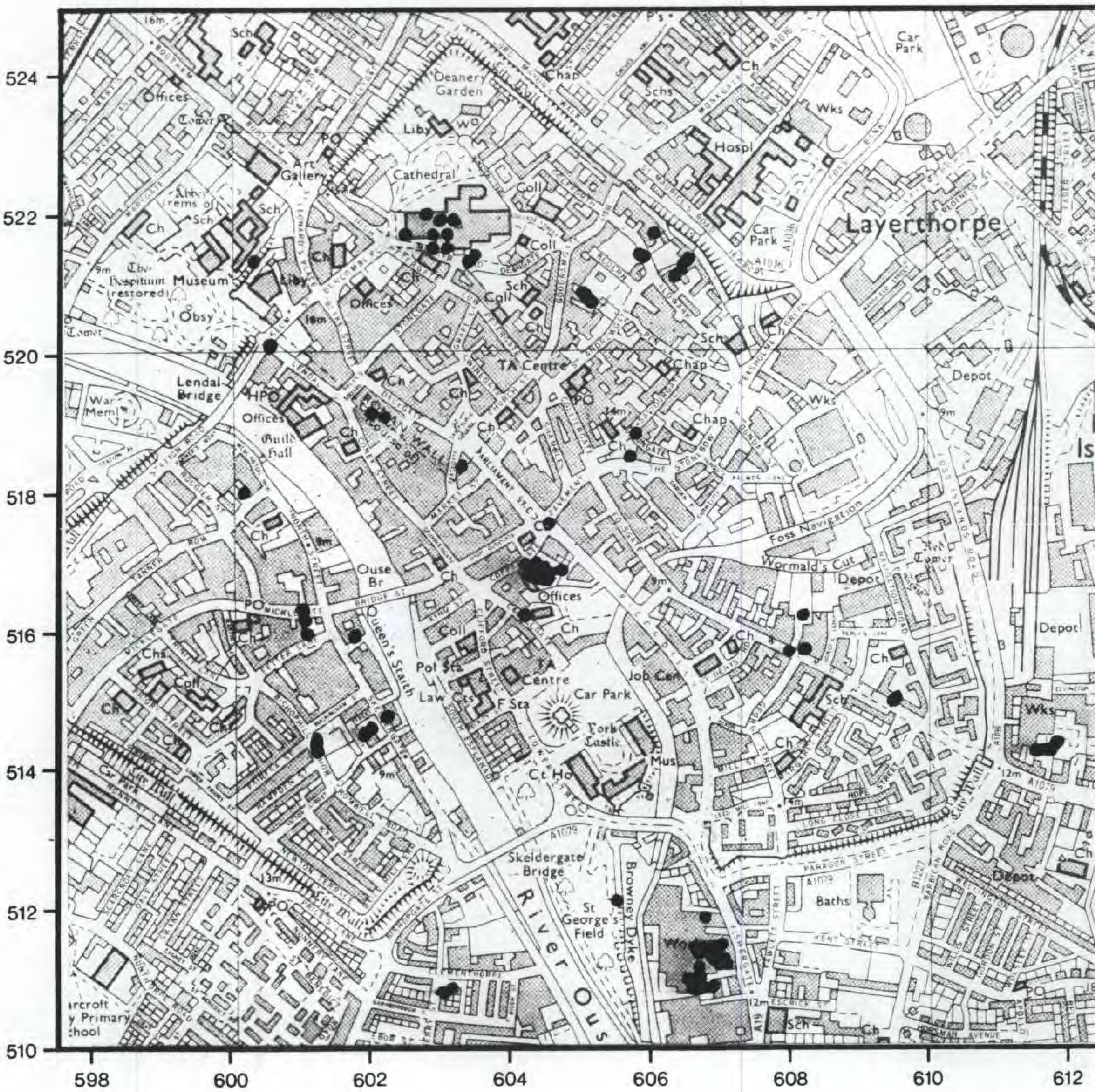
Scale 1:10 000

Source: Univ. of York

Anglian Data Points

ARUP

FIGURE 4.16



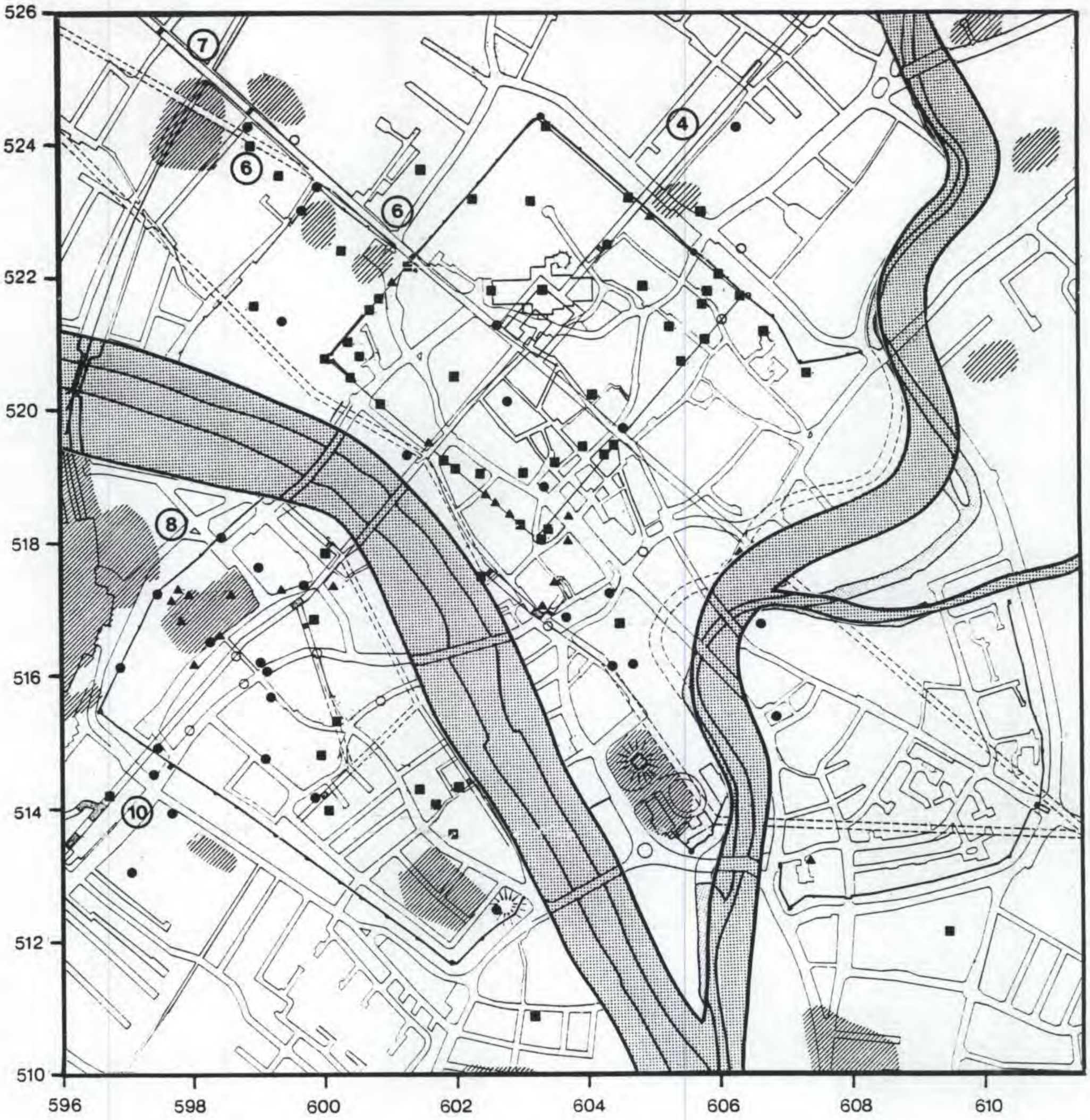
Scale 1:10 000

Anglo-Scandanavian Data Points

ARUP

FIGURE 4.17

Source: Univ. of York



■ Controlled excavation

▲ Observation with details of structures or dating

● Observation – exact location known

○ Observation – exact location unknown

//// Cemeteries

⑧ Roads, numbered as in Eboracum (RCHM 1962)

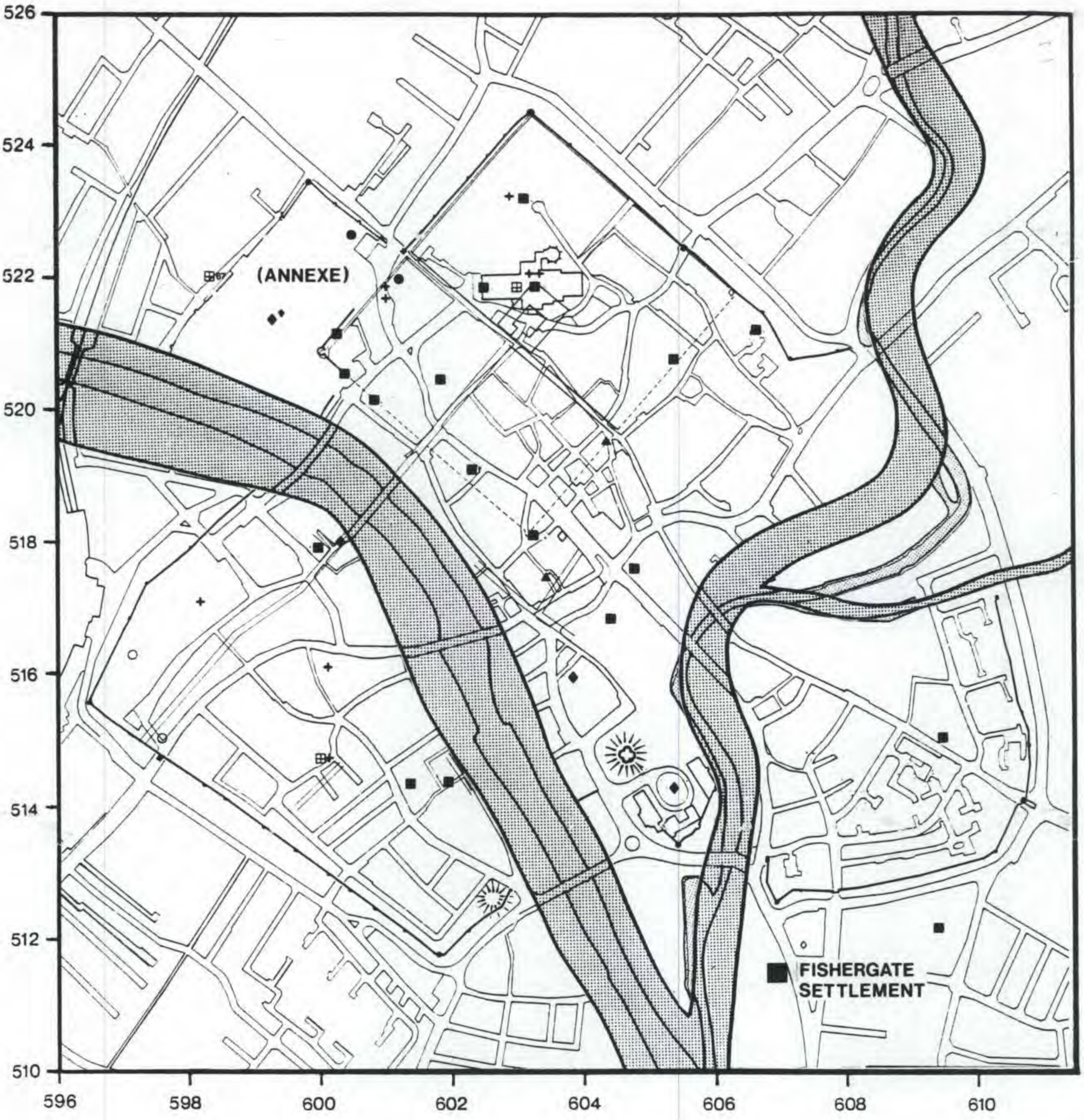
Scale 1:10 000

Source: Andrews 1984, YAT 1988

Roman York, Location of Sites

ARUP

FIGURE 4.18



Scale 1:10 000

- Excavation
- Observation
- Church
- Group of finds
- Single find
- Coin hoard
- \+ Sculptural fragments
- ++ Sculptural fragment

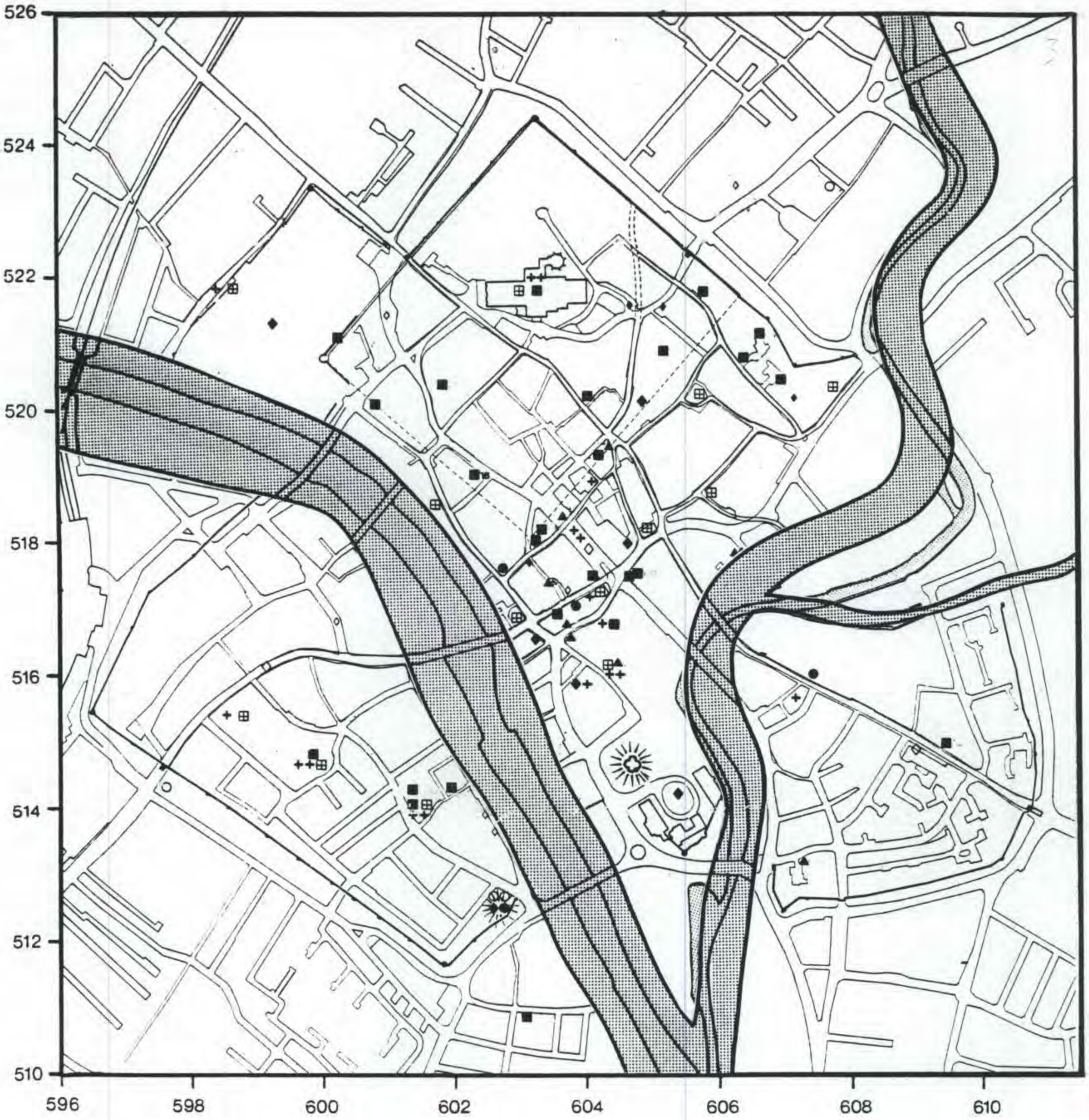
Open symbols – location uncertain

Source: Andrews 1984, YAT 1988

Anglian York, Location of Sites

ARUP

FIGURE 4.19



■ Excavation

▲ Observation

⊞ Church

◆ Group of finds

♦ Single find

● Coin hoard

\+ Sculptural fragment

\+\+ Sculptural fragments

Open symbols – location uncertain

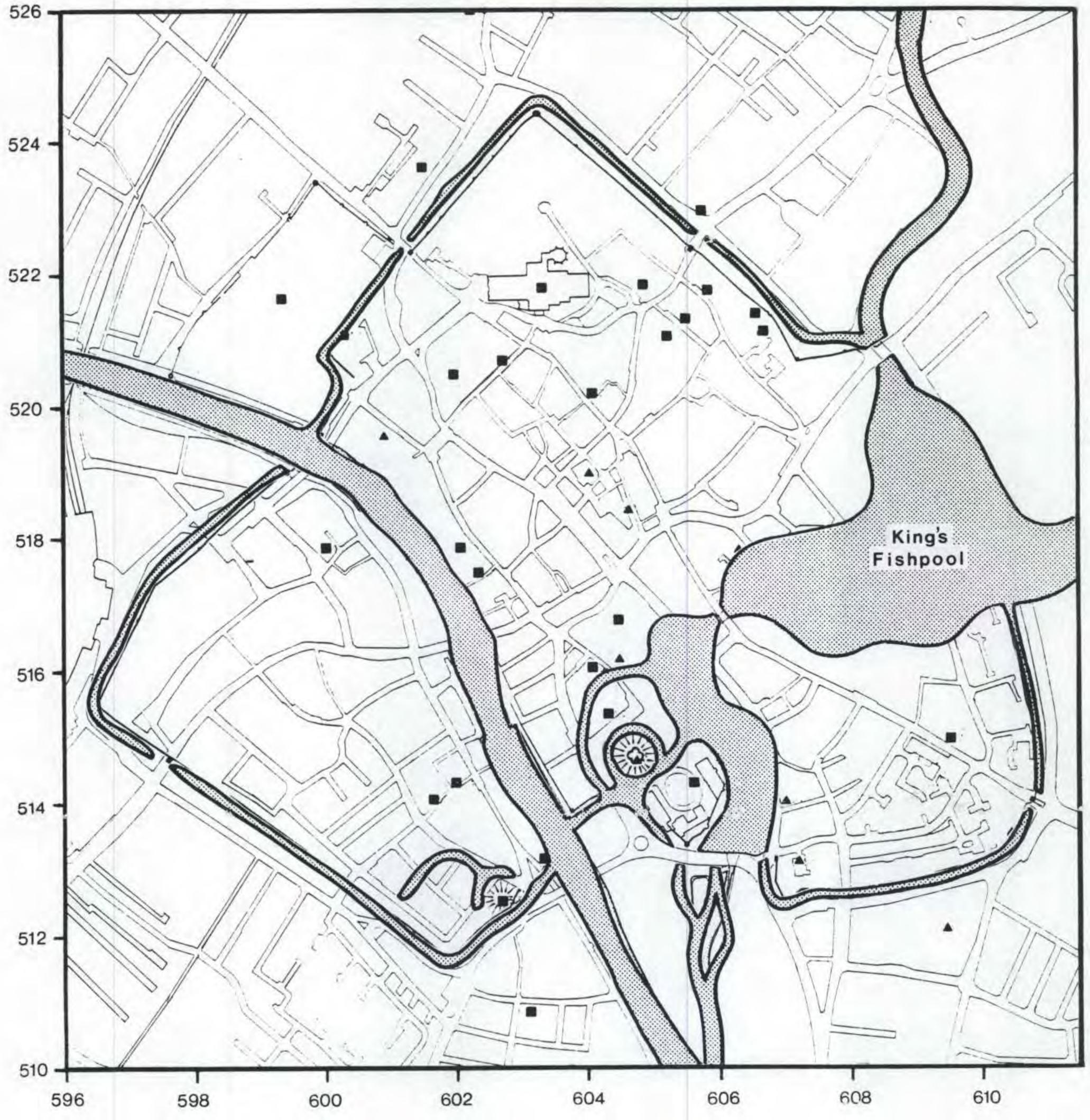
Scale 1:10 000

Source: Andrews 1984, YAT 1988

Anglo-Scandinavian York, Location of Sites

ARUP

FIGURE **4.20**



Source: Andrews 1984, YAT 1988

Medieval York, Location of Sites

ARUP

FIGURE 4.21

Section 5

5. YORK ARCHAEOLOGY: RESEARCH FRAMEWORK AND POLICY

5.1 Background

The form and fabric of the historic European town is largely the story of 2000 years of development sponsorship, and the fluctuating balance between private, local government and state initiatives. This story, therefore, although educational in the most general sense, is also relevant to present day town planning, and development. Indeed it is on this historical experience that the European city as a concept ultimately depends.

The elements of the story are sparsely recorded in writing, the best evidence being for the period from the later 16th century onwards which has seen least change. For the earlier sequence, particularly 3rd-10th and 14th-16th centuries when the changes in the role of cities were at their most revolutionary and dramatic, the written evidence is non-existent or unspecific. For the activities of the city in these periods (and they are evocative for the others too) we rely on the ruins and detritus from the former materials of government, commerce, industry and ritual which are the business of archaeology.

The role of archaeology in the future of the modern city therefore needs no emphasis, but archaeology, enjoyable as it is, is not an end in itself. Its goal is to piece together the earlier experience, create an evocative picture of the Roman and later towns, and above all understand what made them work.

An archaeologist's sources are, briefly, the town plan, the buildings, the crafts, the industries, the commerce, the resources, the symbolism, and the ritual, all of which are in reach of archaeology. From them can be inferred the economics, the ideology and the politics of the day.

The durable fabric of the historic European city may be divided into a number of principal provisions, each of which has both a practical and a symbolic or political function: city walls, bridges, streets, forum/market place, industrial zone, water supply/drainage/sewers, temple/church, basilica/palace/town hall, baths, theatre/concert hall/race course, and parks. Most or all of these have characterised a city and have told people in their own wordless language that they were living in one; and each can and has been the subject of private, co-operative, civic, regional, or imperial sponsorship at different times. The form of the town varies with its system of patronage, and the patronage varies with the politics.

It is clear that planning by a corporate authority has been a feature of historic European towns from the beginning. Even deliberate intervention to use knowledge of the past is not new; the past with all its messages was dug up for the political benefit of the present in 6th century BC Babylon, in 4th century AD Jerusalem, in 9th century AD Ravenna and 12th century AD St Albans (Appendix D). What is being applied in York therefore, one of the best known historic cities of Europe, brings both the excitement of new knowledge and considerable responsibilities.

The evidence provided by archaeology consists of records most of which can only be made during excavation in the ground. Very few arguments for what happened in the past can be sustained by studying the finds alone. The crucial record of archaeology is provided by context: the buildings that can be detected but not preserved; the skeletons which cannot be lifted as they lie; the soils which inter-leave with one another and provide the stratified sequence; the location of sampling points for finds, such as pollen and insects which are too small to see and have to be extracted in a laboratory. These records can only be made once, namely during the excavation. Each site is unique and its excavation destroys the context in which finds are recorded. An excavation cannot be repeated. If an excavation is worth doing, it must be done to the highest scientific standard. It will therefore take time and cost money. The task cannot be contracted out to any organisation that is less than expert, nor can it be successfully accomplished under conditions of harassment. Excavations which are cut short or which bungle the recovery of evidence are a waste of money.

5.1 Background (Cont'd)

However, like any other exercise of scientific research, excavations are only valid when they are carefully planned and designed to answer a set of questions of public interest. The planning of excavations requires both a substantiated model of what kind of question can be answered and an imaginative model of what kind of question needs answering. It follows that there should be two quite different archaeological operations in train at the same time: reconnaissance exercises which serve to enhance the precision of the deposit model (see Section 4) and; set-piece excavations designed to answer specific questions which belong to a structured programme.

The reconnaissance operation is continuous and should take advantage of every contact that is made with the sub-terranian archive. It is proposed in this report that any site up for development (which is not already totally destroyed or previously excavated) will have a site evaluation carried out as part of the planning procedure. Such site evaluations will often be the only work required. But in some cases they will lead naturally to the definition of a further scope of work for formal excavation in area.

Formal excavations will not be undertaken lightly or often. They should not be encouraged except insofar as they conform to the demands of a research programme. Threat of destruction, under the present proposals, should very rarely feature as a justification for excavation. Formal excavation, an expensive and lengthy public operation, can be justified only in terms of the site's archaeological value, a combination of the deposit quality considered in Section 4 and the research agenda, considered below.

5.2 The Philosophy

The principle of the present research design differs from that of the Andrews assessment and from the general approach in the Addyman and Black volume. There it is assumed that the principal research objective is primarily to increase knowledge of the site of the city of York itself over its 2000 or more years of occupation. This objective coincides with those of a number of urban archaeological projects initiated over the last 20 years and of course with the terms of reference of the York Archaeological Trust.

But it is suggested in Section 3 of this Report that the very success of these urban projects can now allow a change of direction from predominantly local targets to questions of national and European history. It is also suggested that the new fiscal framework in which urban archaeology is carried out encourages this change of direction. Under a system dominated by state-financed rescue work the rapid piecemeal retrieval of threatened deposits was both necessary and possible. But under improved local curation backed by European legislation and private sponsorship, the first recourse is to preserve deposits, coupled with highly selective set-piece excavations of international interest.

Although items from the Andrews Report (1984) are noted and often endorsed or emphasised here, the new framework is geared to the new research targets and management procedures visualised for the 1990's.

5.3 Research Agenda

In order to generate an agenda for archaeology in the City of York in the next decade, papers were prepared on five separate topics likely to contribute different viewpoints and demands. These were:

(a) The Hinterland (Stoddart and Richards)

(b) The environmental sequence (O'Connor and Kenward)

5.3 **Research Agenda** (Cont'd)

(c) The Roman period (Roskams)

(d) The early Middle Ages (Carver)

(e) The Medieval period (Morris).

These papers are reproduced in the Technical Appendix.

From each paper was then extracted an agenda defining the information required and a programme for obtaining it. The agenda and related programmes are set out in Appendix C.

Subsequently, these lists of desiderata were merged, enhanced in places, re-ordered and matched with the deposit model (Section 4) to produce a combined action programme for archaeological research. This programme is presented as a list of 9 projects in Section 5.4.

Finally the implications of this programme for modern development are considered to produce a recommended policy for archaeology intervention in the City of York (Section 5.5).

5.4 Research Framework

The purpose of the Research Framework, as expressed in the Terms of Reference for this Study, is to:

> '..... set priorities for future archaeological investigation in York .....'.

We have interpreted 'investigation' in its broadest sense but recognise that excavation is the form of investigation of particular relevance to this Study. The proposal is that reactive piecemeal rescue excavation should cease and be replaced by an archaeological programme which is largely non-destructive.

The Research Framework is expressed as nine projects covering a broad scope of research activity as follows:

1. Urban Evaluation (deposit modelling)
2. Formal excavation projects
3. Remote mapping (non-destructive sensing)
4. Medieval Buildings
5. Artifact Assemblages
6. The River Regime
7. The Hinterland Survey
8. Protection for the Future
9. Research Reviews

Of the nine projects only the first two require archaeological intervention on site. This demonstrates that necessary and significant archaeological research on York can go ahead without recourse to large scale intervention on a multiplicity of sites. However the nine projects are seen as an integrated package. This means that some large scale intervention under Project 2 is desirable in the time scale for which the Framework has been designed.

However such an intervention, if it occurs, will be more selective than current activity and will need to meet the criteria defined in Project 2 (Formal Excavation Projects in sub-section 5.4.1, below).

5.5 Projects for the 1990's

The work detailed under each project is the result of combining the conclusions and recommendations of the five studies given in the Technical Appendix.

Project No. 1: Urban Evaluation

It is clear that the site evaluation is a fundamental part of archaeological resource management, as essential for the management of cultural property as feasibility studies are for engineering. The evaluation programme should combine predictive mapping of the whole resource with specific site investigations whenever the deposit is exposed. The archaeological site evaluations to be carried out as part of the planning procedure will allow a great part of the archaeology programme to be realised as a by-product of development activity. Those employed to carry out site evaluations on behalf of developers or owners should be issued with a scope of work as part of the planning routine (see Table 5.1).

The scope of work should always include:

(a) A detailed deposit model, with period dating.
(b) An estimate of environmental potential.
(c) Environmental sampling of all deposits suspected of being pre-Roman, sub-Roman, Anglian, or Medieval 'dark-earth'.
(d) Collection of samples of all Roman to Medieval industrial residues encountered.
(e) Collection of all pottery, Roman to Medieval at stated recovery level.
(f) Site geometry of Roman structures encountered and position and positive or negative identification of late Roman structures.
(g) A stipulation that the resulting documentation and the finds be deposited in a public archive in York.

Pro-active site evaluation should be initiated in areas which are currently blank (see Section 3). A detailed cellar and basement survey is required to determine degrees of survival in all the areas of deposits so far modelled. The existing monuments already mapped (e.g. Ordnance Survey Map of Roman and Medieval York) and the results of the Medieval building survey (Project 4) should also be added to the database.

Project No. 2: Formal Excavation

Formal excavations may be considered at specified recovery levels, when sites meet the following criteria:

Zones 1, 2 or 11:	Sites containing proven legible Roman, Anglian, Anglo-Scandinavian or Medieval strata in available areas of 20 x 20 metres or more.
Zone 4:	Sites containing proven legible Roman, Anglian, Anglo-Scandinavian or Medieval strata in available areas of 30 x 30 metres or more.
Zone 6:	Sites of any size containing proven tangible evidence for waterfront structures.
Zone 8:	Sites containing proven legible Roman, Anglian, Anglo-Scandinavian or Medieval strata in available areas of 10 x 20 metres of more.
Zones 9 & 10:	Sites of any size containing proven tangible evidence for waterfront structures.

5.5 **Projects for the 1990's** (Cont'd)

Zone 11:	Sites containing proven legible Roman, Anglian, Anglo-Scandinavian or Medieval strata in available areas of 30 x 30 metres or more.
Zone 12, 14, 15, 16, 17, 18 & 19:	Sites containing proven legible Roman, Anglian, Anglo-Scandinavian or Medieval strata in available areas of 30 x 30 metres or more.
Zone 20:	Sites of any size which become available for excavation.
All Zones	Any site containing late Roman buildings Any settlement nucleus of the Anglian period Any Early Medieval or Medieval church and its cemetery Any Roman cemetery.

The scope of work for any formal area excavation must specify minimum levels of data acquisition (see Section 3.5.4, Figure 3.2) and the total recovery of closed groups of animal bone, anaerobic deposits and industrial residues. More detailed standards of data acquisition should be defined (from this minimum) following receipt of the site evaluation. It should be noted that certain research targets (e.g. Sub-Roman and Anglian activity) automatically demand an enhanced data acquisition level. Excavations in this category will always take more time and need more resources than normal.

Recovery levels are explicit in the data acquisition required (see Section 3.5.4, Figure 3.2) and vary widely in cost from Level A (the cheapest) to Level F (the most expensive). The cost of each level in each zone will have to be established by contractors with experience of using them in the first instance. Thereafter it is likely that a norm will be agreed.

The scope of work for a formal excavation should also include conditions of copyright, publication and the deposition of records and finds in a public archive in York.

Project No. 3: Remote Mapping (excluding Hinterland)

Remote mapping to define wall-lines and linear features susceptible to available instrumentation should be initiated on land which is currently open space within the search area.

The priorities are the areas of the Fortress Annexe (Zone 20) and the Minster Precinct (Zone 1). If radar is used, the latter zone may be used to calibrate the former. However, a specification should be given to the archaeological contractor as to the radar that is to be employed and as to the availability of the data collected.

Remote mapping should be extended to other areas of open ground (while they are still open), paying particular attention to the confluence at St Georges Field and land beside both rivers upstream and downstream from York. Aerial photography, geophysical survey, surface collection and the digging of test pits should all be viewed as methods of mapping.

Remote mapping projects can be supported as part of site evaluation exercises or be the subject of separate applications for research or rescue funding.

Project 4: Medieval Buildings

A documentary and architectural survey is required. This study should include a survey of historic engineering solutions for structural foundations in the different terrains from Roman to Medieval times, to assist evaluation and development.

5.5 **Projects for the 1990's** (Cont'd)

Project 5: Artifact Assemblages

Resources in this case are dedicated to the definition of artifact groups against which evaluation and excavation results can be measured. Input is to all other projects. The priority studies are:

(i) Roman residual pottery ('background noise').
(ii) All Anglian material.
(iii) Geological derivation of worked stone, for all periods.
(iv) Inter-disciplinary study of Medieval pottery functions.

Project 6: The River Regime

Intensive sampling programme in riverside and pool or bog deposits in vicinity of York to determine:

(i) Height/width of river 6000 BC to present.
(ii) Vegetation sequence.
(iii) Climatic variation.

Targeted sampling of Hungate area to determine and locate Roman hydraulic engineering and effluent.

Project 7: The Hinterland Survey

This is an enhancement of the Hinterland project presented in Technical Appendix.

(i) Establishment of a geographical information system.
(ii) Construction of visibility template.
(iii) Intensive survey of radial transects.
(iv) Pre-Roman to Medieval vegetation sequence in the immediate vicinity of York.
(v) Location and excavation of a Roman settlement nucleus.
(vi) Location and excavation of a (late) Roman villa.
(vii) Location and excavation of early Saxon or Anglian settlement in the vicinity of York.
(viii) Location and excavation of early Saxon cemeteries in the vicinity of York.
(ix) Investigation of Roman and Medieval refuse disposal pattern in the vicinity of York.

Project 8: Protection for the Future

(i) Research work on decay trajectories under 'benign' foundations (e.g. thin piling).
(ii) Instigation of administrative procedures for statutory protection of specified monuments or strata sets, e.g.

(a) the site of Mary Bishophill Junior above and below ground

(b) samples not less than 30 x 10 x 10 metres deep of anaerobic strata in Zones 3 and 6.

Project 9: Research Reviews

Overviews and reviews of research objectives and achievements should be prepared and published regularly to allow update and validation of this programme. The most important periods in this respect are Roman and Medieval.

TABLE 5.1 - SCOPE OF WORK FOR ARCHAEOLOGICAL SITE EVALUATION

Aim of evaluation To predict the extent, character and quality of archaeological deposits which survive on and under the areas to be developed.

The actual scope of work required will be decided after consideration of the characteristics of the particular site and the particular proposed development. The total work is sub-divided into three stages to suit the degree of knowledge required at different stages of consideration of the development.

Stage AE.1 (Database)

Abstract archaeological and geotechnical knowledge form YCC Database. Predict likely Archaeological Value (quality of deposit and status in archaeological research framework). Determine outline archaeological mitigation strategy in relation to proposed development.

Stage AE.2 (non-Destructive Evaluation)

More detailed information will normally be required to assist the correct mitigation strategy. A typical evaluation report would produce/cover:

(a) Plan of site at 1:100 showing encountered features.

(i) as currently existing

(ii) as may have existed previously (from documents pertaining to the site and its locale).

(b) Status of any standing structures.

(c) Position and depth of all cellars and basements.

(d) Schedule of any samples of deposits recorded as having been found on site or surrounding areas.

(e) Drawn (1:20) models (using plans and sections) of the predicted deposit with estimate of the potential for environmental sequence. Particulars to include:

(i) Depths of natural, Roman, Anglian, Anglo-Scandinavian and Medieval horizons.

(ii) Quality and value of deposits.

(iii) Water table.

(iv) Anaerobic deposits.

(v) Natural ground geotechnics.

Stage AE.3 (Sample Excavation)

In most cases Stages AE. 1 and 2 will not provide sufficient information to match the required level of confidence in the prediction. It will be necessary to carry out trial excavation or inspection of strata. The location(s) and depths of trial bores, pits or trenches will be agreed after consideration of the particular site characteristics and the data needed to be acquired. The archaeological excavation could often be carried out in conjunction with the geotechnical excavation if this is needed.

A form of excavation that can often be carried out conveniently and economically is to make sample exposure of the deposit behind existing cellar walls.

All archaeological evaluation excavations will be excavated using modern archaeological techniques. Excavations will be required to be carried out at given levels of data recovery. Where encountered, samples shall be taken as follows:

(a) Environmental samples of deposits suspected of being pre-Roman, Anglian or Medieval dark earth.
(b) Collection of samples of all Roman to Medieval industrial residues. At data acquisition level D.
(c) Collection of pottery assemblages, Roman to Medieval at data acquisition level D.
(d) Plan of alignment and position of any Roman structures, and positive or negative identifications of any late Roman structures.

5.6 Recommended Policy for Archaeological Management

The principles and agenda recommended in this report have been developed on the assumption that they could form the background to formulation of a policy for archaeology in York. The chief instrument of this policy is the adoption of a Research Framework for York.

5.6.1 Database

Detailed data on the archaeological assets of the city of York should be gathered, mapped and maintained by the City Council or its nominated agent.

As was intended, this study has provided the foundations of this database. However, the study and its maps have shown that there are many zones for which deposit prediction is based on very limited data. An active programme of investigation on the ground could usefully be initiated under Council auspices to fill these gaps (see Projects 1 and 3). Studies undertaken as part of Projects 1 and 3 will in time improve the quality and distribution of data.

5.6.2 Improvement of Research Base

Most of the projects listed above do not depend directly on development opportunities (Projects 3-9). They nevertheless improve knowledge of York's archaeological assets, and of its history in a very positive way, allowing a better basis for decision-making and reducing research pressure on the opportunities for intervention that arise through development. For these reasons these projects should be incorporated in a policy for archaeology to be adopted by York City Council.

Council support, through this policy, will make it easier for research managers to get money from public and private sponsors in order to get the work done.

5.6.3 Archaeological Response to Development

The response to development is discussed in detail in Sections 6 and 9. This section outlines the archaeological aspects of the recommended procedure.

The elements of the procedure are as follows:

(a) Every developer should be asked to submit an archaeological site evaluation with any planning application.

This site evaluation should be non-destructive as far as possible, should conform to a scope of work issued by the Council, and the scope of work should conform to the framework given above (Project 1) and detailed in Table 5.1. The information gathered by these evaluations over the years will itself satisfy much of the research agenda.

(b) The results of the site evaluation will determine the mitigation strategy required on any particular site. The problem will be to achieve a balance between:

(i) The destructive foundations required by the developer.
(ii) The need to increase knowledge through excavation.
(iii) The need to conserve deposits for future study.

Reconciliation of these pressures at the planning stage should be considerably easier with the assistance of the 'archaeology policy'.

5.6 Recommended Policy for Archaeological Management (Cont'd)

5.6.3 Archaeological Response to Development (Cont'd)

(c) The following principles should be incorporated in the policy:

(i) The priority is always to conserve deposits rather than destroy them through construction or excavation.

(ii) Preservation, rather than excavation, of all sites which do not fall within the current research framework is preferred.

(iii) The opportunity to investigate any site which falls within the current framework (Project 2) is preferred. This is in order to advance knowledge and convince the public that urban archaeology (and the consequent constraint on development) are worth supporting.

'Preservation' or 'Conservation' in principles (i) and (ii) above can be defined at two levels:

(1) Total Preservation which allows no further disturbance of the deposit. In this case, planning permission for any development involving new foundations would have to be refused. This action would have to be justified through site evaluation which indicated unique deposits for which no archaeological provision was currently available. Such deposits would automatically require scheduling and, unless existing foundations could be used for building, an alternative use would have to be found for the site. This option is not recommended in general but may be appropriate for very rare specific sites.

(2) Preservation Using 'Benign' Foundations In this case construction is permitted on specified foundations only which form part of an agreed mitigation strategy.

5.6.4 Formal Excavation Projects: Management

This policy will mean that predominantly non-destructive site evaluation will be routine and obligatory, but that the option of formal excavation will be the exception rather than the rule. Excavation may occur under principle (c) (iii) when deposit quality and research objectives coincide in sites where complete preservation of the deposit is undesirable or incompatible with the agreed development, or where the promotion of the city of York through a public excavation project is desirable. These will tend to be in large central areas. Such a project must conform to the demands of the Research Framework and conform also to an agreed scope of work with stated data acquisition levels. These demands will very rarely be met by simply extracting those deposits which are to be disturbed by foundations, since the majority of the research objectives require excavation over a large area (see Project 2).

5.6 Recommended Policy for Archaeological Management (Cont'd)

5.6.4 Formal Excavation Projects: Management (Cont'd)

Nevertheless, where a developer adopts a mitigation strategy which includes the option of a large excavation, the agreed operation may still be a compromise between total excavation on the one hand and total preservation on the other. For example, if a 3 metre deep deposit is Roman (from 3 to 2½ metres), early Medieval (2½ to 2 metres) and Medieval assets (2 to 1 metre), archaeological intervention may take the form of an area excavation down to a depth of 2 metres to report the Medieval residential/ industrial area, followed by a non-destructive mapping of the remaining deposits by electronic remote sensing, which would produce a plan of the larger Roman structures beneath. Such an approach might be adopted, for example, at the very important site of St Andrewgate (Site 30 in Zone 2). However, it should be noted that a compromise could jeopardise the research project if not programmed with the greatest care. For example, if only the latest parts of the deposit are recovered, it may be difficult to distinguish the residual fragments of material such as Roman ironwork and animal bone.

If such an approach was adopted, both parties, developers and archaeologists, would have to conform strictly to the agreement incorporated in the mitigation strategy, which would be invalidated by any penetration by either, in this case, below 2 metres.

The procedures set out in the report will result in few excavations, but when they do occur they will be on a large scale and may endure over several years.

5.6.5 Formal Excavation Projects: Funding

A modern scientific excavation requires considerable resources in time and money, which is why it should not be undertaken lightly or forced on the community as an emergency. The excavation of an area 20 x 20m and 4m deep, including wet deposits, can be expected to last 2-3 years (using average recovery levels) and cost about £1.5m, including publication.

It would be most unusual for a developer outside London to be able to bear this level of time/cost penalty. This is shown in Section 7.4.3.

It might be possible to share the cost of selected excavation, without inhibiting development in the city, by extracting a levy on all development, in order to provide a central research fund, redistributed to projects by the City Council. The feasibility of doing this is discussed in Section 7.5.7, and there are reservations.

The excavation programme proposed under Project 2 cannot therefore expect to rely solely on developer-funding. Nevertheless an excavation programme at this scale may be viable, when the following factors are taken into account:

The Time Penalty

(a) Using techniques described in Section 6, excavation can take place during or after construction, thus avoiding delays to the developer's realisation of his investment.

(b) Vacant sites, eligible under the archaeology policy can be excavated before any development is proposed. Owners of these sites might be encouraged to promote or allow excavation there, and thus free land in the city for eventual development without restraint.

5.6.5 Formal Excavation Projects: Funding (Cont'd)

The Cost Penalty

(c) Excavation under the archaeology policy will be contemplated only at sites of high national and international research interest. Such excavation projects will be much more attractive to potential sponsors such as academic trusts, English Heritage and the developer himself, than obligatory contributions to an emergency.

Such sponsorship is feasible, indeed normal in archaeology. Table 5.2 shows the recent budget for the Sutton Hoo Research Project which has been carried out in Suffolk from 1983, exclusively with private sector funding. (Suffolk County Council is an active partner in the project but does not contribute to the project funds). The current estimated total for the project is £1.2m (including publication). A sample of current sponsors is given in Table 5.3.

(d) The allowance of time means that costs can be spread. They need not be influenced through a sense of emergency, since, under the archaeology policy, the alternative is always preservation. And where there is to be preservation, development can still go ahead, using the techniques outlined in Section 6.

(e) As scientific techniques improve, the cost of excavation is unlikely to fall. But since the profession now operates on the basis of design competition, the costs are much easier to control. The level of expenditure will be determined, in advance, by the sponsors, the selected archaeological consortium and the curator (the City Council in this case) acting in concert. Further control can be exercised by subjecting excavation itself to planning procedures.

(f) The attention of curators, archaeological contractors and developers should be drawn to The Institute of Field Archaeologists Code of Approved Practice for the Regulation of Contractual Arrangements in Field Archaeology.

5.6.6 Management of Archaeology

For this approach to function successfully as an instrument for planned archaeological intervention, the archaeology plan and its research programme will need to be managed, updated and monitored in practice.

This will imply an alteration to the present structure of the local archaeological community. The Director of Development Services, through the City Archaeologist, should be responsible for Archaeological Policy and for management of the procedures outlined above. We suggest that an Archaeological Advisory Panel is established to advise the Director and to provide a mechanism for assessing the views of the archaeological community and periodically updating the archaeology programme.

The key role of such an advisory panel, or of the city archaeologist if acting alone, will be to ensure that archaeological contractors are issued with a scope of work and adhere to it, that records and finds are deposited expeditiously in a safe and accessible public archive in York and that publication to an agreed standard is a condition of contract, whether funded or not.

Table 5.2 - SUTTON HOO RESEARCH PROJECT: TYPICAL STATEMENT OF EXPENDITURE

Expenditure	1988/9	1989/90
Director	-	-
Project Staff	52,582	48,222
Temporary site team July-September 1988/89	4,143	14,627
Specialist Costs	202	1,000
Computing	1,760	-
Equipment	1,395	1,200
Consumables and office relocation expenses	10,922	7,500
Fundraising and publicity	45	2,600
East Anglian Kingdom Survey	5,800	-
Illustration/typing	-	1,351
Machining	-	1,030
Annual Total	76,849	78,330

Table 5.3 - A SAMPLE OF SPONSORS TO THE SUTTON HOO PROJECT

1. The SOCIETY OF ANTIQUARIES OF LONDON
2. The BRITISH MUSEUM
3. The NATIONAL MARITIME MUSEUM
4. The BRITISH BROADCASTING CORPORATION
5. The SCARFE TRUST
6. The AURELIUS TRUST
7. TRINITY COLLEGE, Cambridge
8. GONVILLE and CAIUS COLLEGE, Cambridge
9. ST JOHN'S COLLEGE, Cambridge
10. The ESMEE FAIRBAIRN CHARITABLE TRUST
11. The WOLFSON FOUNDATION
12. The W.A. CADBURY CHARITABLE TRUST
13. The BRITISH ACADEMY
14. The NORWICH UNION INSURANCE GROUP
15. NATIONAL WESTMINSTER BANK (WOODBRIDGE)
16. The EAST ANGLIAN DAILY TIMES

Section 6

6. FOUNDATION/ARCHAEOLOGY INTERACTION

6.1 Aims of this Section

Whenever a site with archaeological deposits is to be developed, the aim should be to preserve the deposit. The objective of the designers should be to minimise the disturbances to the archaeological deposit by adopting suitable foundation solutions and structural form for the development. No unique solution exists or can be designed to cater for all situations. The most appropriate solution will very much depend on the type of development, the value and thickness of the archaeological deposit and the ground conditions. It is therefore important that for any development site the following aspects are assessed and correlated:

(a) Sub-soil Strata

(b) History of Recent Occupation

(c) Archaeological Remains

(d) Proposed Building and Foundations

This section will assess information about the soil strata and archaeological deposits in York for building purposes. The effect of recent history of the site on the deposits will also be discussed.

Different types of foundations will be briefly discussed highlighting their advantages and disadvantages. Procedures to avoid unsatisfactory practices on the site during foundation construction will be recommended.

From this we will make recommendations on a general procedure for resolving the dilemma of how to redevelop with minimal impact on archaeological resources which must be preserved. And conversely, how to provide for archaeological study with minimal impact on development.

Finally the strategy for dealing with archaeological sites will be discussed and methods be put forward to improve the opportunity for harmonious co-existence of archaeology and foundations for development.

A case study of an actual planning application is included to demonstrate the applicability of our recommendations.

6.2 General Ground Conditions in York

The 1 : 50,000 Geological Map Sheet No. 63 (1983) shows York to be generally covered by alluvium underlain in succession by warped lacustrine clay (bedded and laminated clays, with silt and sands), Glacial Tills (including sands and gravels) and Bunter Sandstone.

The records of specific soil investigations, made available by the City Council, have been studied. These have been stored on the Database package, the details of which are given in Appendix A.

6.2 **General Ground Conditions** (Cont'd)

Using this information the sequence of different strata and their load carrying capacity, in York, can be summarised as follows:

(a) **Made-up Ground**

This is the depth between present ground level and natural ground level. The stratum is created by man's building and demolishing activities. It follows that all archaeological remains lie in this made-up ground.

This ground is not suitable for carrying concentrated building foundation loads. This is due to its extreme variability of nature and consistency which results in the difficulty of predicting its behaviour under load in terms of support and settlement. Depth of made up ground varies 0-15m but is generally of the order of 3m.

(b) **Natural Soil**

Alluvium is generally underlying the made-up ground and consists of clayey silt becoming very soft to firm grey/brown sandy clay. This material is up to 10m thick in some areas and is absent in others. Alluvium is not normally suitable for medium rise frame buildings.

The Glacial Tills in York consist of boulder clay and large amounts of sand and gravel. The boulder clay varies in strength from firm to very stiff. The sands and gravels are generally medium dense. This material varies in thickness between 0.0m to 9.0m. Where present in sufficient thickness the Tills can be used for building foundation.

(c) **Sandstone**

The Bunter Sandstone consists largely of weak red and mottled sandstone. A zone of more compacted and coarser grained sandstones, with rounded pebbles scattered throughout, occurs in the midst of this thick series and is designated as the Bunter Pebble Beds. This stratum is capable of carrying high foundation loads. The stratum has been proved for a thickness of at least 55.0m and therefore other strata below the sandstone can be ignored in relation to building developments.

For the purposes of this study, York has been divided into 20 zones, see Figure 4.1. A summary of what is known of the archaeology and sub-soil succession in each of the zones is given in Tables 4.1 and 6.1 respectively. In general there is more knowledge of the soil than of the archaeological deposits. However, ground conditions for any site within a zone will be expected to vary from the general. In Table 6.1 we quote the ranges of the strata thicknesses. Figure 6.1 gives the estimated contours for rock head.

TABLE 6.1 - KNOWN GROUND CONDITIONS

ZONE		SOIL STRATA THICKNESS (m)		DEPTH BELOW GROUND		
		Made-up Ground	Natural Soft Ground	Natural Firm Ground	Sandstone	Water
1		2.5 - 4.5	1.5 - 5.0	*	6.0 - 9.0	2.0
2		1.5 - 5.5	0.0 - 5.5	1.4 - 14.8	15.0 - 20.0	0.4 - 10
3	**	2.0 - 5.0	0.0 - 6.0	0.0 - 7.0	16.0 - 23.0	0.5 - 4.0
4		0.0 - 8.0	0.0 - 7.0	0.5 - 9.0	18.0 - 20.0	2.5 - 5.5
5		3.0 - 4.0	*	6.0 - 9.0	16.0 - 26.0	0.5 - 7.5
6		2.0 - 7.5	0.5 - 10.0	2.0 - 7.0	17.0 - 20.0	4.0 - 6.0
7		3.0 - 4.0	*	0.5 - 13.0	15.0 - 18.0	0.5 - 7.5
8		0.0 - 8.0	0.0 - 4.0	0.5 - 13.0	15.0 - 18.0	2.5 - 4.5
9		1.5 - 9.0	0.0 - 12.0	0.0 - 8.0	17.0 - 26.0	0.5 - 4.0
10		1.0 - 13.5	0.0 - 11.0	0.0 - 4.0	12.0 - 20.0	3.0 - 7.0
11		1.0 - 6.5	0.0 - 5.0	0.0 - 7.0	14.0 - 25.0	2.0 - 4.0
12		2.0	0.5	6.5	19.0	5.4
13		2.0 - 6.0	0.5 - 10.0	0.5 - 5.0	18.0	1.0 - 5.0
14	**	0.0 - 8.0	0.0 - 10.0	0.5 - 9.0	16.0 - 23.0	2.0 - 6.0
15		1.5 - 6.5	0.0 - 4.5	1.0 - 10.0	15.0 - 20.0	2.0 - 6.0
16		0.0 - 3.5	3.5	0.5 - 3.5	15.0 - 20.0	1.0 - 9.0
17		0.5 - 1.5	0.0 - 13.0	1.0 - 6.0	15.0 - 21.0	2.0 - 7.5
18		2.5 - 4.5	1.5 - 5.0	*	6.0 - 9.0	2.0
19		2.5 - 4.5	1.5 - 5.0	*	6.0 - 9.0	2.0
20		2.5 - 4.5	1.5 - 5.0	*	6.0 - 9.0	2.0

* No Information

** Interpolated

6.3 Archaeological Deposits in York

The archaeological data collected during the study is stored in a computerised database and can be accessed in a similar manner to the soil data. Details are given in Appendix A. This data has been interpreted and presented in the form of contours in Section 4 of this report.

For archaeological purposes the human occupation of York is divided into four successive periods. In the best situation these layers will occupy discernably different horizons or layers within the total depth of made-up ground. As indicated in Table 6.1 this discernability or 'coherence' is one of the factors used in grading the potential archaeological value of zones.

The actual presence or thickness of each of these layers is not known sufficiently well to be taken advantage of in terms of foundations. For present purposes it has to be taken that any part of the made-up ground may contain archaeological deposit. The three category grading (E,1,2) has more relevance in that it should be used to assess whether archaeological considerations are likely to influence the desirability of development.

However, within the study area there are locations where the effect of development can be ignored because past activity has destroyed or at least greatly disturbed the deposit. Destroyed areas are identified in Section 4. Where a particular site has been occupied and disturbed by recent occupation then it is probably unlikely to contain useful archaeological deposit within say 1m of present ground level or even deeper if large industrial buildings have occupied the site or there is evidence of cellars. After proper evaluation of such sites, development may be able to proceed without being constrained by archaeology. But this would not be equally true of a shallow made-up ground site which has had no post-medieval development. The converse is also likely to be true. The greater the depth of made-up ground the more likely it is that more and better quality deposits exist.

It appears that present knowledge of the probable quality of deposits is too low to be taken advantage of in many cases except for sites with shallow made-up ground which have been previously developed. But for any particular development site it will be essential to have an Archaeological Site Evaluation and the recent history of the site. This study should form part of the investigation into the constraints on development. A brief study of the recent history has been carried out for each of the specific sites, and given in Appendix B. A more detailed investigation would be carried out as part of a site investigation prior to the development of these sites.

Except when it is accepted that a site has no archaeological value the development of the site will have to allow for the deposit to be either preserved or to be recorded by excavation. Preservation will require the building and its foundations to have minimal impact on the archaeological deposit. We will now discuss ways by which this can be achieved. We will start by describing the foundation types.

6.4. Foundation Types

The many forms of foundations used in building work may be divided, broadly, into shallow foundations, deep foundations and basement foundations.

6.4.1 Shallow Foundations

Shallow foundations are those which generally transfer the load to the soil at a level close to the existing ground level. They include the spread foundations; pads, strips and rafts. For present purposes we will consider shallow foundations to be no more than about 1m deep.

6.4. Foundation Types (Cont'd)

6.4.1 Shallow Foundations (Cont'd)

The in-situ sub-soil underlying the made-up ground will inevitably vary in strength and thickness of strata, therefore the choice of shallow foundations will depend on the structure and loads that need to be transferred to the ground.

To use shallow foundations requires the removal of the made-up ground and exposure of the load bearing sub-soil stratum. Including underground drains and contractor's working space this means that virtually the whole of the site to the approximate 1m depth will be either excavated or disturbed. Raft foundations would require the removal of all the made-up ground above raft level.

6.4.2 Deep Foundations

Piles are often used to transmit loads through soft soils or made-up ground to some deep underlying firm stratum. Piles are classified by reference to the way in which they transmit loads to the sub-soil or by the way in which they are placed.

End bearing piles are those that mainly transmit loads by the bearing of the toe of the piles on a firm strata and friction piles are those that mainly transmit loads by the friction of their surfaces on the surrounding strata. Piles may carry load both on end and by surface friction.

Displacement piles (generally known as driven piles) are those formed by driving precast concrete or steel piles into ground and those made by casting concrete in a hole formed by driving a casing through ground. Replacement piles (generally known as bored piles) are those formed by casting concrete in a hole previously bored or drilled in the soil.

The selection of appropriate pile type for a given job will depend on:

- Underlying soil conditions, including ground water levels.
- The nature and size of loads to be supported by the foundations.
- Properties of the pile materials and characteristics of installation equipment.
- Effect of environmental and economic constraints.

There are advantages and disadvantages in using different types of pile which need careful examination. The merits of each system can only be examined for a specific project. In the following some of the factors influencing the choice of each type of pile are outlined.

(a) <u>Displacement Piles</u>

As the piles are driven into the ground, the noise and vibrations can prove unacceptable in a built-up environment. The majority of the sites in this study area are sensitive to these factors and therefore any such restraint should be investigated prior to adoption of this type of foundation. The factors to be considered include:

- For sensitive sites the noise of pile driving can be reduced by an acoustic screen in the form of a steel boxframe, which surrounds the driven pile and drop hammer. However, this does not deal with the possible adverse effects of vibration.

6.4. Foundation Types (Cont'd)

6.4.2 Deep Foundations (Cont'd)

- Vibration levels can vary widely, depending on ground conditions and type of driving equipment used. Therefore the proximity of sensitive structures or of buildings in which excessive vibration might be unacceptable should be taken into account.

- During the driving of these piles, the soil is displaced. This can result in ground movement, which could cause damage to adjacent buildings. The extent of lateral or vertical displacement varies depending on the type of piles used and the ground conditions.

These piles are generally not suitable to be driven through made-up ground which contains large obstructions. Depending on the nature of the obstructions, these could cause structural damage to the piles and deviate them from their vertical line. In certain circumstances, however, robust driven piles capable of penetrating obstructions, without deviation or damage during installation, can be used.

(b) Replacement Piles

These piles are formed by boring or excavation techniques. When constructing in unstable or water bearing ground, borehole support in the form of either temporary or permanent steel casing is required. In certain circumstances, a bentonite suspension may be used instead of steel casing. There are three types of replacement piles: Cast in place, concrete injected (continuous flight auger) and partially preformed.

Using these piles may have the following advantages:

- There is minimal ground movement.
- Noise and vibration levels are generally acceptable.
- Spoil excavated from the pile bore can be inspected.
- Drilling tools can break up boulders or other obstructions which cannot be penetrated by any form of displacement piles. When using continuous flight auger piles, however, the ground has to be free from obstruction.
- Large diameter piles can be constructed compared with driven piles.

6.4.3 Basement Foundations

The important factor with basement foundations is that the ground has to be excavated for the depth of basement construction. A one storey basement may well require 4m depth of excavation. Beneath the basement the foundations may be either pad, raft or pile type.

By definition a basement will require at least part of the deposit to be recorded, not preserved.

For any excavation in the ground, the sides will have to be supported, especially in made-up ground such as that found in York. The supports could either be for temporary or permanent use or both. Ground water adds complications and normally requires some form of pumping.

These supports often take the form of sheet piles which are driven in the ground and used mainly for temporary support. For the permanent case diaphragm walls or walls formed by piles are used. The techniques and factors to consider are similar to those discussed in section 6.4.2. Basement construction is always complex. Archaeological considerations make it much more complex. See Section 6.7.

6.5 Building and Foundation in York

6.5.1 General

The buildings of previous generations were often founded in the shallower, more recent layers of impacted residues, while leaving older, Medieval or Roman levels untouched. This was possible mainly because of the relatively small scale of the buildings which meant that foundation loads were also small.

Much current development is of larger buildings requiring transfer of the building loads to lower more competent strata. The scale of foundation excavations depends on the scale and form of the development. Provision for deep basements often causes complications. The possible building types in York will be discussed in this section.

In York the relatively large depth to suitable bearing material and the high ground water table strongly influence the foundation choice. The other factors influencing foundation choice are the layout of the superstructure and whether basements are required. The different types of foundation will be described in this section with recommendation on how to ensure desirable working practices.

6.5.2 Building in York

In Table 6.2 we give six different types of buildings. Any other development is likely to have characteristics similar to one of these. The table also gives the characteristics which affect foundations. In the study area development is generally limited to three storeys above ground. This has the very desirable effect of limiting loads on, and therefore size of, foundations. It also means that stability can be achieved by columns, not walls.

With the exception of housing all normal structural support system and foundation types are discrete. This has advantages in terms of archaeological remains because a series of piles is likely to cause less damage than would footings or rafts.

TABLE 6.2 - TYPES AND CHARACTERISTICS OF DEVELOPMENT BUILDINGS

Type	Structural Support Grid	Minimum Structural Type	Normal Foundation Construction	Requirement for Basement
Housing	Cross-walls	3.5 linear	Strip footing	None
Offices	Columns	6 x 4	Pads or Piles	Car Parking, Lift Pits
Individual Shops	Columns	6 x 4	Pads or Piles	Can be avoided
Shopping Centre	Columns	12 x 6	Pads or Piles	Car Parking in City Centre None elsewhere
Institutional	Columns	6 x 6	Pads or Piles	Some often required
Industrial	Columns	12 x 6	Pads or Piles	Machine Pits, etc.

6.5.3 Foundation in York

Except where the made-up ground is shallow and there are no underlying soft soil conditions, the general sub-soil conditions in York are such that piles are the preferred foundation type. It is necessary to pass through the made-up ground and any soft natural ground. We note from our study of the available documents that piles have been used even for two storey housing. Piles occupy the minimum plan area so in principle there is no basic clash between the type of foundation appropriate for York sub-soil and the types that will be appropriate for York underground archaeology.

Ground floor slabs can be either suspended or supported by the ground to suit particular sites. Where the ground floor slab has to be suspended anyway because of the soil conditions it will influence the grid positions of the piles. Economically they would not exceed about 6m x 6m centres. It can be seen from Table 6.2 that this would suit the superstructure grid of many building types. Indeed, in order to minimise the load on individual piles, and therefore their size, it would be advantageous to choose smaller rather than larger superstructure grids. But the grid should not be so small as to cause loss of legibility in the archaeological deposit. The 6m x 6m grid is a reasonable balance.

The pile grid area is taken as 6m x 6m. As both grid area and pile size are proportional to the grid, the percentages affected will be similar for different grids in the same building.

6.5 Building and Foundation in York (Cont'd)

6.5.3 Foundation in York (Cont'd)

Basic column loads transferred to piles for a relevant range of grid sizes and building heights are shown in Figure 6.2. It can be seen that the largest column considered can be transferred to a single pile of 1050mm diameter. Therefore there is no need to use pile groups. The illustration in Figure 6.3 shows the effect a pile cap and piles in group can have on archaeological deposit compared with a single pile. Although the length of the single pile may be longer than that of piles in group, the relative disturbance it will cause is very much lower.

On buildings which may have widely spaced columns the piles under those columns would have to be correspondingly larger. The use of large spans does not require deep ground beams, the construction of which could damage or disturb archaeological deposits. The requirements for large spans should only apply to the structure above ground. The system below ground should have a smaller grid as illustrated in Figure 6.4.

In principle therefore we have the situation where a grid of piles of the order of 6m x 6m (or say 7.2m x 7.2m to suit a commonly adopted superstructure grid) is appropriate for economic support of both suspended slab and superstructure. It will also lead to an acceptably low destruction of deposit and deposit legibility. The exact dimensions would vary with a particular building but the general format would hold good. Not all piles would continue as columns in cases where a large superstructure grid is required.

6.5.4 Piles and Impact on Archaeological Deposits

Table 6.3 shows the volume of deposit effect by a range of pile diameters on a 6m x 6m grid. This shows that, even allowing a generous disturbance zone around each pile, the maximum loss of deposit for this pile grid is less than 5%. The maximum of 5% will only occur in exceptional circumstances and is unlikely for most buildings in York. The need for ground beams deeper than say 0.5m will also be extremely rare. In most cases the top 1.0m of the made-up ground has been disturbed by recent building activity and therefore the introduction of moderate size ground beams will have no effect on archaeological deposits. If archaeological deposits of high value do exist within the top 1.0m of the existing ground level, then, either the ground floor can be raised by the required amount, to avoid any damage to archaeology due to construction of ground beams, or the top metre will have to be archaeologically excavated.

By using single piles it is clear that construction of a building can go ahead with disturbance to archaeological deposit limited to 2% to 5% of the volume involved within the site boundary. This point can be illustrated by superimposing a 6m x 6m grid of 600mm diameter pile on the site plan at Coppergate, see Figure 6.5, which also clearly demonstrates that the pile pattern has a low impact on the legibility of the deposit. It will normally be much better to distribute the 2% to 5% impact across the site rather than concentrate it in one position. But the best distribution can be discussed and established for any particular site. We conclude that piles are the correct foundation type for York. But the process of piling can be destructive. We will discuss how this can be overcome in Section 6.6.

6.5 Building and Foundation in York (Cont'd)

TABLE 6.3 - MINIMUM SITE AREA AFFECTED BY PILES OF DIFFERENT DIAMETER

Pile Diameter (mm)	Allowable load (kN)	Cross Sectional Area (m^2)	% of Grid Area occupied by pile 6m x 6m	% of Grid Area occupied by pile plus 50%
450	1300	0.16	0.5	0.75
600	2300	0.28	0.8	1.2
750	3600	0.44	1.2	1.8
900	5250	0.64	1.8	2.7
1050	7100	0.87	2.4	3.6
1200	9300	1.13	3.1	4.7

6.5.5 Basements

Basements present a problem. They cannot be created without digging out part, sometimes, all of the made-up ground, and with it, the archaeological deposit. As indicated in Table 6.3 many developments may be expected to want to incorporate basements. And sometimes part basement situations are created by the lie of the land.

So, if basements are to be permitted some preservation by record (archaeological excavation) will be necessary. Alternatively, basements will have to be forbidden or designed out of the development.

Although it would be possible to design out the basement requirements, it would always have a cost penalty, both in reducing the development value and in making it more costly to construct the permitted scheme. In some cases it may be possible to alleviate this by other planning concessions such as allowing another storey above ground level, but the urban design implications would need to be considered.

In Section 6.7 we will make proposals on how to accommodate basements and ensure that the archaeological requirements are satisfied. In Section 6.8 we show how to do this in an actual site case study.

6.6 Piling and Archaeology

6.6.1 Potential Effects on Archaeological Deposit

From the discussion presented in this section so far, it is apparent that pile foundations are the preferred and often the only foundation solution to be used in York. Furthermore, that bored piles are the type suitable for most circumstances.

6.6.1 Potential Effects on Archaeological Deposit (Cont'd)

Theoretically the only destruction to an archaeological deposit occurs within the cross sectional area of the pile and any deposits surrounding this area are untouched. However, this is not the case in practice and the archaeological community are generally wary of piling operations and contractors on sites with archaeological remains. They believe, and at times rightly so, that piling operations cause untold damage to archaeological remains surrounding the pile locations. Such damage comes about because of poorly planned operations. Damage occurs because of poorly protected ground surface, and because of crude ways of dealing with buried obstructions.

The exact location of obstructions and for that matter any archaeological remains are not known prior to the commencement of piling. When an obstruction is encountered on a non-archaeological site it needs to be removed. One way of tackling it would be to move the piling rig away from the pile location and attempt to remove the obstruction. This is generally done by machine and results in a large cone of excavation down to the obstruction, see Figure 6.6.

It is clear that this will cause extensive damage to any archaeological remains which may exist and are intended to be preserved. This usually happens because the piling operation was not thought through or planned properly. The need to maintain programme means that as soon as an obstruction has been hit, it is removed as soon as possible and therefore results in considerable destruction.

If an inappropriate piling system has been adopted, say continuous flight auger piles, then if there is any obstruction where the pile is being bored, it can only be removed by excavation. Alternatively, the pile has to be moved to another location. This option could prove successful if the new pile location is free from obstructions. But depending on the loading system extra piles may have to be introduced to balance the eccentricity.

Also, the newly positioned pile could hit another obstruction in which case it has to be moved again. In fact this could happen to the majority of the piles. This could result in delays and consequent increase in cost of development. Even worse it would destroy the deposit as an archaeological resource. The right piling system must therefore be adopted.

6.6.2 Appropriate Piling Techniques

A buried obstruction could be categorised as follows:

(a) Modern reinforced concrete slab or large pad at a horizon below ground level, covering all or part of the site. Large obstruction.

(b) Any manmade or man placed object contained within the made-up ground. Maybe small or large.

A good knowledge of the type of made ground would have been obtained by the pre-contract detailed geotechnical desk study and subsequent site investigation.

In the case of obstructions described in (a) these can easily be identified and there are unlikely to be any archaeological remains above the slab. The ground over the slab can therefore be removed. Holes can be made into the slab at pile locations and then the area backfilled before the piling rig arrives. Adopting this approach will avoid excess damage to remains below the slab. Naturally, if there are such remains, then it would be best to remove the whole slab before backfilling and piling.

6.6 Piling and Archaeology (Cont'd)

6.6.2 Appropriate Piling Techniques (Cont'd)

The obstructions described in (b) above are more relevant to sites where archaeological remains may exist, and are to be piled.

As previously discussed, it is proposed that the piles should go through the archaeological deposits, but the damage caused should be restricted to the cross sectional area of the pile. Any damage to the remains in the area surrounding the pile should be avoided.

It has been pointed out that continuous flight auger piles should not be used where there are likely obstructions in the ground, especially those at depth. The solution to (b) is to use a piling system that will enable the damage to be restricted to the area occupied by the pile.

The most suitable pile types are bored cast-insitu piles. These are either bored by percussion method or by augering. In both these cases permanent or temporary casing should be used within the made-up ground to support the sides of the bore.

When obstructions are encountered these can be broken through, enabling the casing to advance. The breaking could often be done by using chisels. Alternatively, the contractor could be asked to core through the obstruction using a core barrel. This could only be done if the holes are being constructed by augering. Again the choice of equipment will depend on the type of obstruction present in the ground. If the obstruction was a Roman wall it would suffer less damage if it was cored through rather than chiselled. So would a medieval timber structure. Coring is clearly preferable to chiselling but is of course more expensive and may not be feasible on restricted sites where the required machine cannot access.

What is outlined above is typical. Depending on type of ground and archaeological remains, problems would vary but there are always solutions which can be adopted. The best solution is a matter of good engineering and this can only be achieved if the problem is properly defined and understood.

On an archaeological site any 'obstruction' has to be regarded as a potential archaeological remain and preserved except for the core of the piles itself. Thus the piling method has to provide the facility for coring through all obstructions.

The overall objective is to limit and contain any damage to the archaeological remains within the cross-sectional area of the pile. This can be achieved if the main contractor and the specialist contractor have been made aware of all requirements. Prior to the start of the contract a detailed method statement should be prepared by the piling contractor and submitted, for approval, to the engineer. This should be part of the mitigation strategy. Piling problems should not arise when the requirements are properly specified and the contract properly supervised.

6.6.3 Re-Use of Piles in Future Re-Development

Another issue which needs to be considered is the re-use of foundations by subsequent developments. We have promoted the concept that an appropriate piled foundation can be regarded as preservation since only a very small percentage of the volume of deposit is lost and that the opportunity for excavation and research is still available in the future. Clearly this would not be the case if each subsequent cycle of redevelopment was based on a new set of piled foundations.

6.6 Piling and Archaeology (Cont'd)

6.6.3 Re-Use of Piles in Future Re-Development (Cont'd)

It should be possible to avoid this. Obviously the same set of piles will have to be used. In order to accommodate a different coincidence of columns and piles the original piles should each be designed to carry the maximum load from the maximum superstructure grid.

One of the main reasons why old foundations are not used when sites are redeveloped is because ground information, and more importantly design assumptions made at the time of construction are not available to today's engineers. Obviously if the databank and the York City Urban Evaluation (Project 1) are created and updated as recommended then this problem will not arise in York in the future. The re-development and archaeological mitigation strategy undertaken for each site will be well documented and recorded.

6.7 Archaeological Mitigation Strategies

6.7.1 Archaeological Requirements

As discussed in Section 6.3 there are in York only two types of site archaeologically speaking:

(a) Shallow made-up ground, previously occupied.

(b) All other sites.

Sites (a) will have shallow deposits which are highly disturbed by recent occupation; they are expected to have poor archaeological deposit. Subject to confirmation by the particular site evaluation such sites can be developed freely to whatever grids and foundation types are required from the development point of view.

On all other sites there will be archaeological deposit of variable quality and value. If the particular site appraised confirms this then there are only three archaeological options:

(i) Preservation in-situ.

(ii) If archaeological value is high then investigation by full archaeological excavation for research purposes is appropriate.

(iii) A combination of (i) and (ii).

The form of building development has to provide for whichever of these options is agreed to be adopted as part of the mitigation study.

6.7.2 Constructional Provisions for Archaeological Requirements

The various options and requirements of 6.7.1 (b) can be met by the adoption of the appropriate Archaeological Mitigation Strategy (MS). Seven alternative strategies are available and are illustrated in the accompanying Figures 6.7 - 6.11 inclusive. They are:

(a) <u>Disturbed Deposit of no Archaeological Value</u>

Archaeological Mitigation Strategy 1 (MS.1)

6.7 Archaeological Mitigation Strategies (Cont'd)

6.7.2 Constructional Provisions for Archaeological Requirements (Cont'd)

MS.1 The development can be designed without any archaeological constraint (Figure 6.7). It can also be constructed by normal methods except that an archaeological contractor be allowed to monitor the excavation operation to record unexpected discoveries without, in most cases, holding up construction work.

(b) Deposit Preserved Insitu

MS.2 With no facility for archaeological excavation or basements during the life of the development (Figure 6.8). Superstructure can be to the developers grid but ground floor construction must be such as will transfer loads to an approximate 6-7m grid of piles through the deposit to be preserved.

MS.3 With facility for archaeological excavation and basements during life of building (Figure 6.9). Superstructure grid to relate to approximate 6-7m pile and pile beam grid. Ground floor removable.

(c) Deposit Excavated and Recorded

MS.4 During construction and early life of building (Figure 6.10). Griding as MS.2. Excavation and construction sequenced to allow working space under ground floor slab.

MS.5 Prior to construction. Development design and construction delayed but otherwise unconstrained.

(d) Deposit Part Excavated and/or Part Preserved

MS.6 Part excavated and recorded by MS.4 or MS.5 but with part of deposit preserved within development.

MS.7 Combination of two of MS.1-6.

The most likely case when this would be employed is on a sloping site where a part basement is almost unavoidable and will require some archaeological excavation (MS.5). But removing deposits below the part basement can be dealt with by one of MS.2, 3 or 4. See Figure 6.11 and case study 6.8.

Another potential use is illustrated in Figure 6.12. In this case (housing in St Andrewgate) the upper part of the deposit is of little archaeological value but the lower part is of high archaeological value. The upper part can be excavated as in MS.1. It can then be replaced by a layer of crushed stone which can be used to support the housing and spread its load over the weak deposit below. This is a modified version of MS.2. Removal of the low archaeological value layer would also allow non-destructive examination (radar) of the lower deposit before the stone raft is placed.

6.7.3 Excavations, Basements and Groundwater

In the various archaeological mitigation strategies, basements are generally only possible where at least some archaeological excavation and preservation by record is carried out.

6.7 Archaeological Mitigation Strategies (Cont'd)

6.7.3 Excavations, Basements and Groundwater (Cont'd)

The two basic constructional difficulties with excavation are the upholding of the surrounding ground, and dealing with groundwater. Where basements have to be constructed inside the excavation there is the added difficulty of inserting the permanent structure. And on archaeological sites, any supports or other devices inserted into the ground must cause minimal destruction and/or damage to the deposit. The ideal solution would be a thin, knife-like wall which could slice through the deposit and create an impenetrable barrier to soil and water. The nearest practical form of this is sheet piling. Unfortunately this is not sufficiently knife like and cannot cut through large obstructions. If the archaeological and geotechnical studies indicate that sheet piling should penetrate, then it will probably be the best medium.

On many sites sheet piling will not be feasible. In those cases the least impact will be achieved by king post and plank construction. Where this has to penetrate below the water table then some form of de-watering will be required. Well-points are likely to be best for general application. Chemical or other forms of consolidation may be effective as long as they do not affect the deposit, or its later excavation. Depending on the nature and importance of the deposits, retaining structures formed by piles may also be used.

In general the deposits in York are above groundwater. But within the fortress (Zone 1) and along the river where the archaeological values are high, much of the deposit can be below groundwater. And of course there is the added hazard of flooding which affects both temporary and permanent construction. For these reasons deep basements will not normally be adopted along the river. Excavation below a single basement depth is only likely to be carried out for archaeological purposes, as discussed in Section 6.8. Elsewhere basements to greater depths can be excavated and built (subject to the Archaeological Mitigation Strategy).

6.7.4 Mitigation Studies

Selection of the appropriate Archaeological Mitigation Strategy for the particular site will depend on its:

(a) Development value
(b) Deposit quality and archaeological value
(c) Physical and planning constraints
(d) Geotechnical constraints
(e) Funding and resources available for archaeological investigation.

Preliminary studies will be required on all these subjects. Only outline knowledge is required for initial thinking about the viability of a proposed development. But, as proposals firm up then more detailed knowledge will be needed.

The needs of preliminary considerations in relation to archaeology and foundations will be largely met by the Database which we propose be held and updated by York City Council. But a planning application will require an Archaeological Mitigation Strategy which is supported by an adequate evaluation of the particular site.

A scope of work for archaeological site evaluation is tabulated in Table 5.1. The purpose of the evaluation is:

> 'to predict the extent, character and quality of archaeological deposits which survive on and under the area to be developed.'

6.7 Archaeological Mitigation Strategies (Cont'd)

6.7.4 Mitigation Studies (Cont'd)

The standard scope of work is phased so that information can be gained progressively, and as required. After the Database phase, the next stage of evaluation covers information that can be obtained easily by visual study of the site and its present building occupancy, plus desk study of historical documents relating to the site. Where new building is intended, the third stage involving physical inspection of the archaeological deposits will normally be required, since the appropriate foundations cannot be designed without first hand knowledge of the deposit to be affected. Neither can an archaeological excavation be mounted without this information. A result of the third stage sample archaeological excavation will be to confirm where archaeological deposits are absent or illegible, in which case foundations can be laid there without restraint. In other cases it will be constrained by the appropriate Archaeological Mitigation Strategy.

The geotechnical site excavation required for the assessment of foundations and work in and on the ground, follow a similar three stage pattern: database, visual and desk study, borehole or pit investigation. At each stage the aim is to predict (to the degree of probability required) the type of foundations, basements, groundwater control, ground upholding, construction methods etc. which will be required in relation to the proposed development. It will make sense to undertake the assessment of the geotechnical and archaeological constraints together.

The extent and cost of each of these evaluations will be geared to the degrees to which the nature and cost of development is governed by ground and archaeological considerations. And to the viability and funding of the development/archaeological preservation.

All these factors are covered in our case study of the proposed development of an actual site.

6.8 Case Study

In November 1989 a planning application was made in respect of Specific Site No. 26, Ouse Bridge, Queens Staithe. This was not referred to us at the time. In the summer of 1990 our attention was drawn to certain aspects of the design of the proposal. We suggested that we be asked to use the application as a case study.

This case study was carried out and proved very valuable in that it allowed all of our proposals and recommendations to be tested and illustrated in relation to a real proposal on a real site.

Although there was extensive pre-application discussion on the design and massing of the building, our recommended procedures for archaeological excavation and mitigation strategies were not then in place. The design was attractive and the City Council's Planning Committee approved the scheme subject to the developers meeting the cost of an archaeological specification to be prepared by the Council's recently appointed Principal Archaeologist. Foundations were to be such as would minimise damage to archaeological deposits.

However, the developer's architect offered no mitigation by means of building and foundation design. YCC viewed the proposed construction as being substantially destructive of the whole archaeological deposit. Their specification therefore had to be MS.5 (record by excavation). The estimated cost of excavation was too high for funding by the development. Reduction in the specification still worked out at 2-4 times the band of expenditure that we consider the development could reasonably be expected to afford (£100,000 -£200,000).

6.8 Case Study (Cont'd)

Our case study showed how each of strategies MS.2-5 inclusive could be applied. We discuss their relative suitabilities and conclude that an MS.7 strategy (MS.2 below, and MS.5 above basement level) is the most appropriate. After discussion with York City Council we put forward a combined enhanced archaeological evaluation and limited archaeological excavation as probably both affordable (in normal development times) and capable of revealing much valuable archaeological data. In the opposite case of no funding being available we show how MS.2 can be applied - no basement but no extra cost. For both strategies we made suggestions on how the building design and foundations can be adjusted to reduce the archaeological destruction from 6.7% to 2.5%.

Overall the case study proved invaluable in demonstrating that, by following the main study recommendations, the developer could have had the development he wanted (or a better one) and the archaeologists discovered much of what they want to know (with the rest preserved). That is not the position they presently occupy nor are likely to without adopting the study recommendations.

6.9 Summary of Procedural Recommendations

We recommend that York City Council adopt and advertise 'The General Principles for Development and Archaeology in York' as listed in Section 9. We will describe later how we recommend these principles be applied to the overall development/planning approval process. In relation to archaeology and foundations we recommend the following:

(a) York City Council set up and maintain the database containing all known information on the archaeological resource and the archaeological research framework for knowledge extension. Inter alia the database will also summarise information on the sub-soil and geotechnical aspects of the archaeological zone.

(b) At the earliest possible date a site developer should discuss site characteristics with York City Council Principal Archaeologist who will make database information available. This search is similar to any of the other searches that a developer would make before proceeding far with his ideas. It forms the first stage of archaeological evaluation (AE.1). The aim of the search is to determine the information on deposit quality and archaeological value of the site from the database. From this the York City Council archaeologist can advise the developer on the probable archaeological mitigation strategy which York would require him to adopt. The York City Council archaeologist should also advise developers on the extent of the remaining archaeological evaluation likely to be required.

At this stage the main question is whether the archaeological deposit on the site has any archaeological value. Archaeological stages AE.2 and AE.3 should be aimed at locating the deposits on site and assessing their quality, with a view to matching the developer's requirements to the archaeological deposits actually present. Evaluation should be carried out as early as possible in the developers programme, as it may allow development to proceed free of archaeology, or with minimal monitoring (MS.1)

(c) If it is decided that the site does have high archaeological value then an early decision is required on whether MS.5 (excavation prior to construction) will be desirable or feasible. If it is then the development can be designed free of archaeological constraint (other than possible delay).

6.9 Summary of Procedural Recommendations (Cont'd)

(d) If archaeological excavation of an extant deposit before construction is not desirable, feasible or necessary, then the basic foundations will normally be required to be single piles on a moderate grid. The next question to arise will be what level to locate the lowest level of development: be it ground floor or basement.

If no basement is required during the life of this development an early decision is required using the evaluation on whether to excavate the upper levels archaeologically or raise the ground floor of the proposed building.

In the event of the developer wanting to adopt foundations other than gridded piles then the evaluation will also be geared to determining the distribution of the foundations so as to keep destruction of the deposits below the 5% maximum.

(e) If a basement is required at the outset and the archaeological destruction of the deposit is justified under the archaeology plan, then the time and cost of an archaeological excavation will be incurred whether by MS.4 (during construction) or MS.5 (prior to construction). The nature of the excavation must be specified and associated funding shown to be available.

(f) The next alternative is whether to provide facilities for excavation during the life of the development. Such excavation could be needed by either:

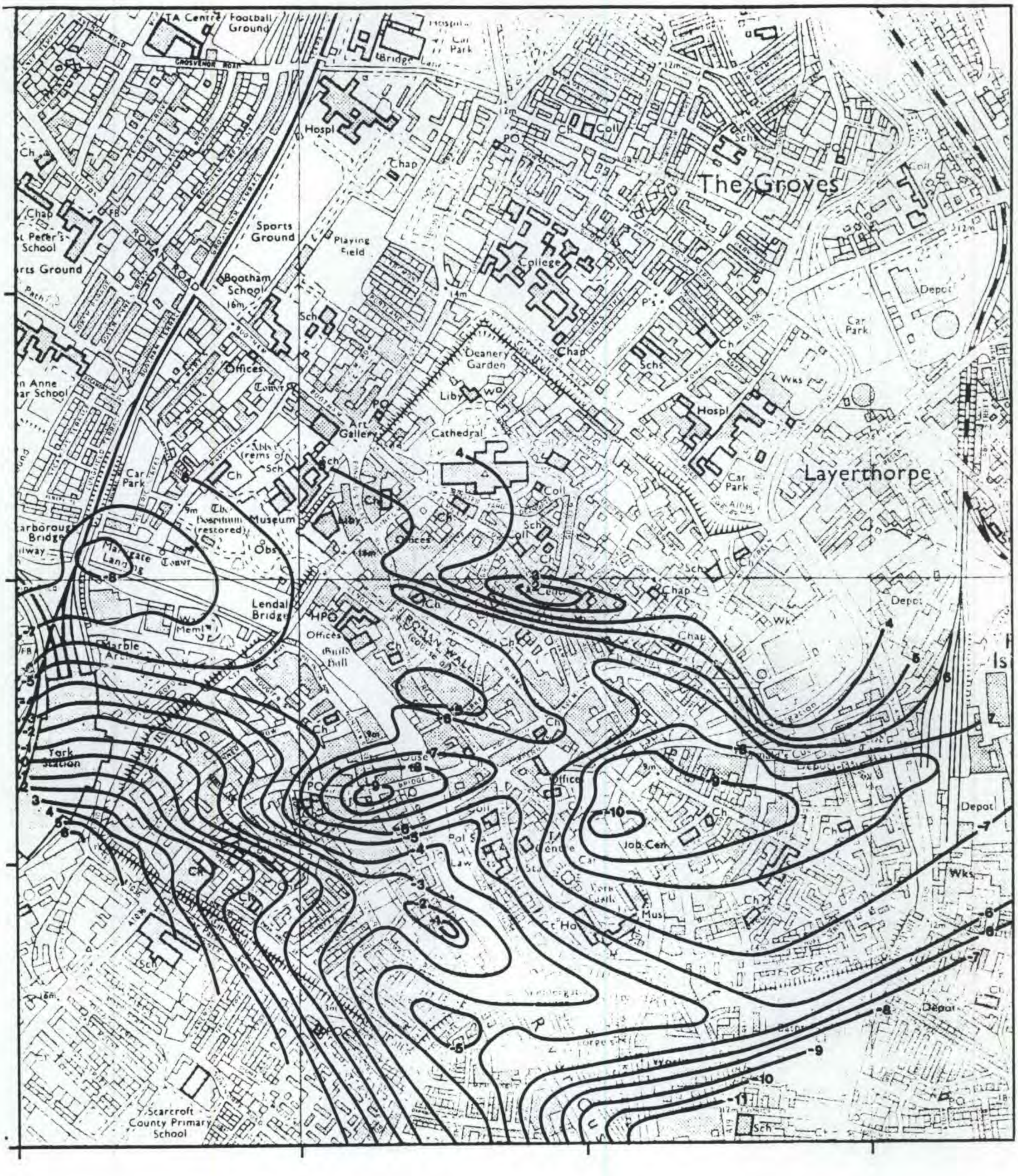
(i) the archaeological community wanting to fund an investigation

or

(ii) the developer wanting to insert basements and being willing to fund the associated dig.

Again, the evaluation would be used to define the nature of the archaeological investigation.

Adopting a procedure which is staged and geared in this way should ensure that the building design/construction will match the Archaeological Mitigation Strategy, that the AE is no more extensive than needed, and that all costs will be kept to the minimum.



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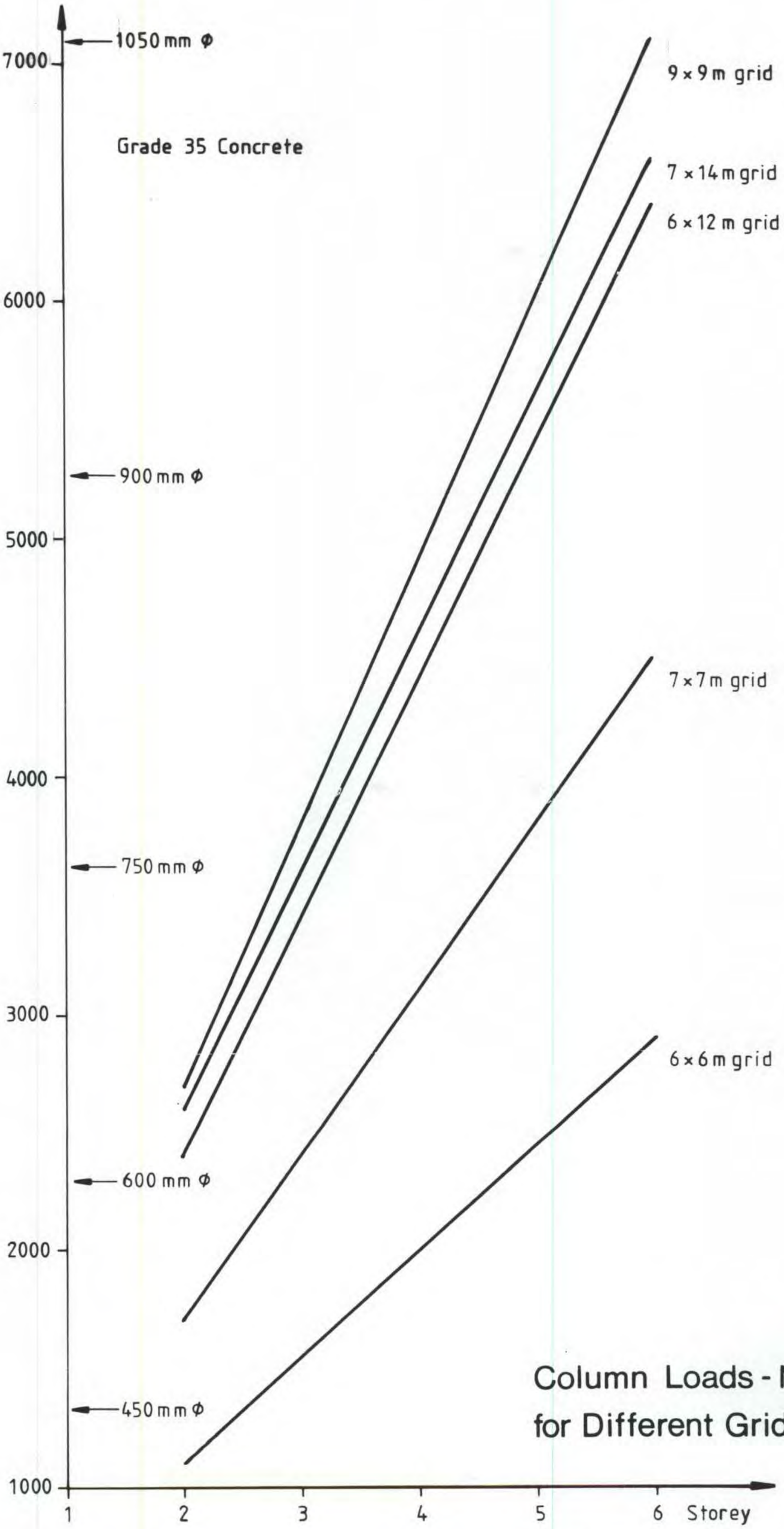
Rockhead Contours

ARUP

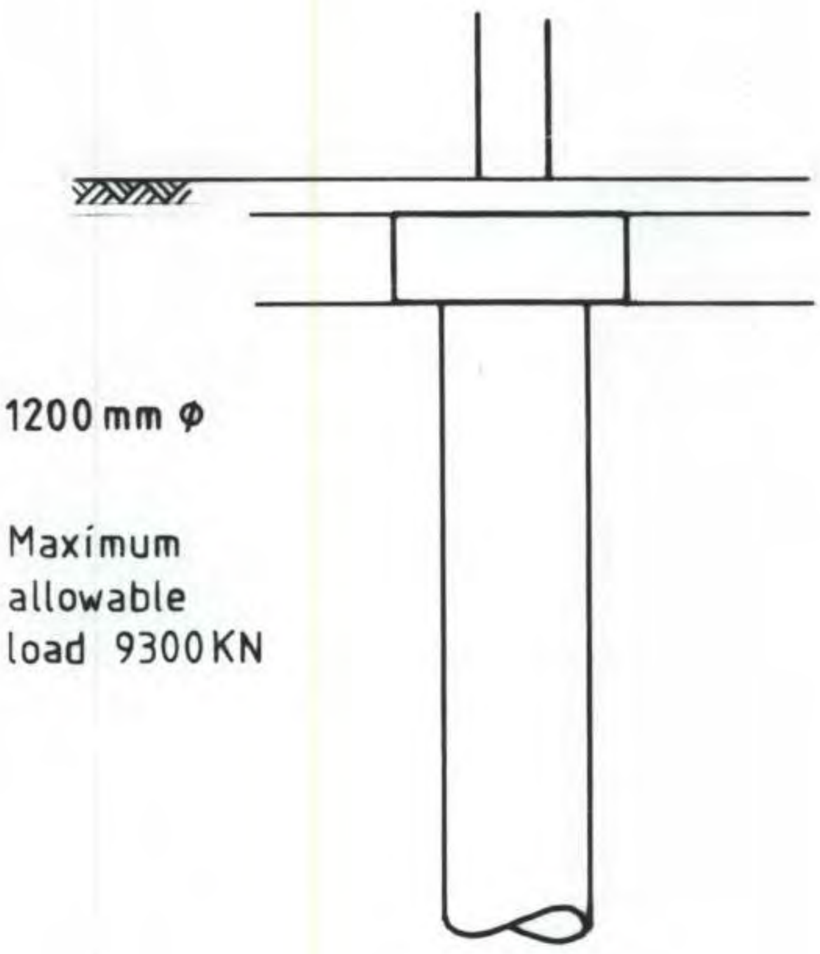
FIGURE 6·1



Column Loads - No. of Floors
for Different Grid Sizes

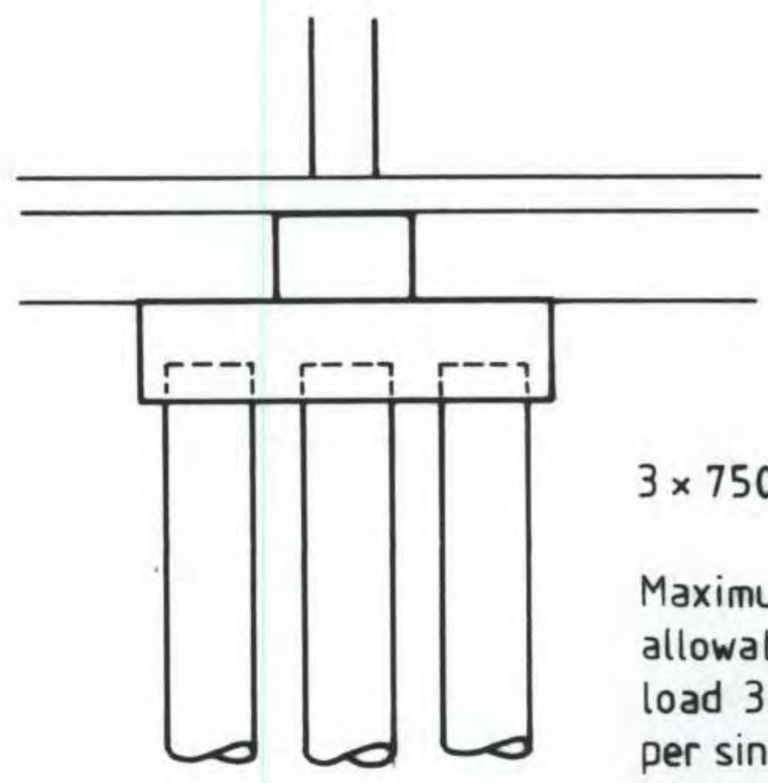
ARUP

FIGURE 6·2



1200 mm φ

Maximum
allowable
load 9300 KN

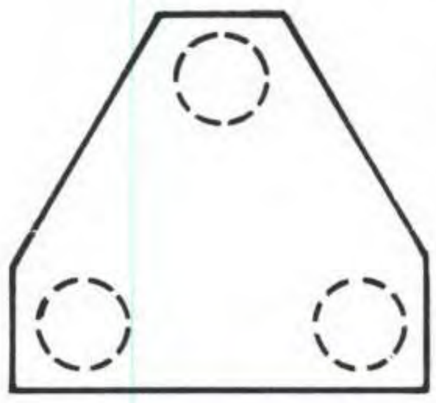


3 × 750 mm φ

Maximum
allowable
load 3600 KN
per single pile.
As a group
would carry
~ 9500 KN.

ELEVATION

SCALE 1 : 100



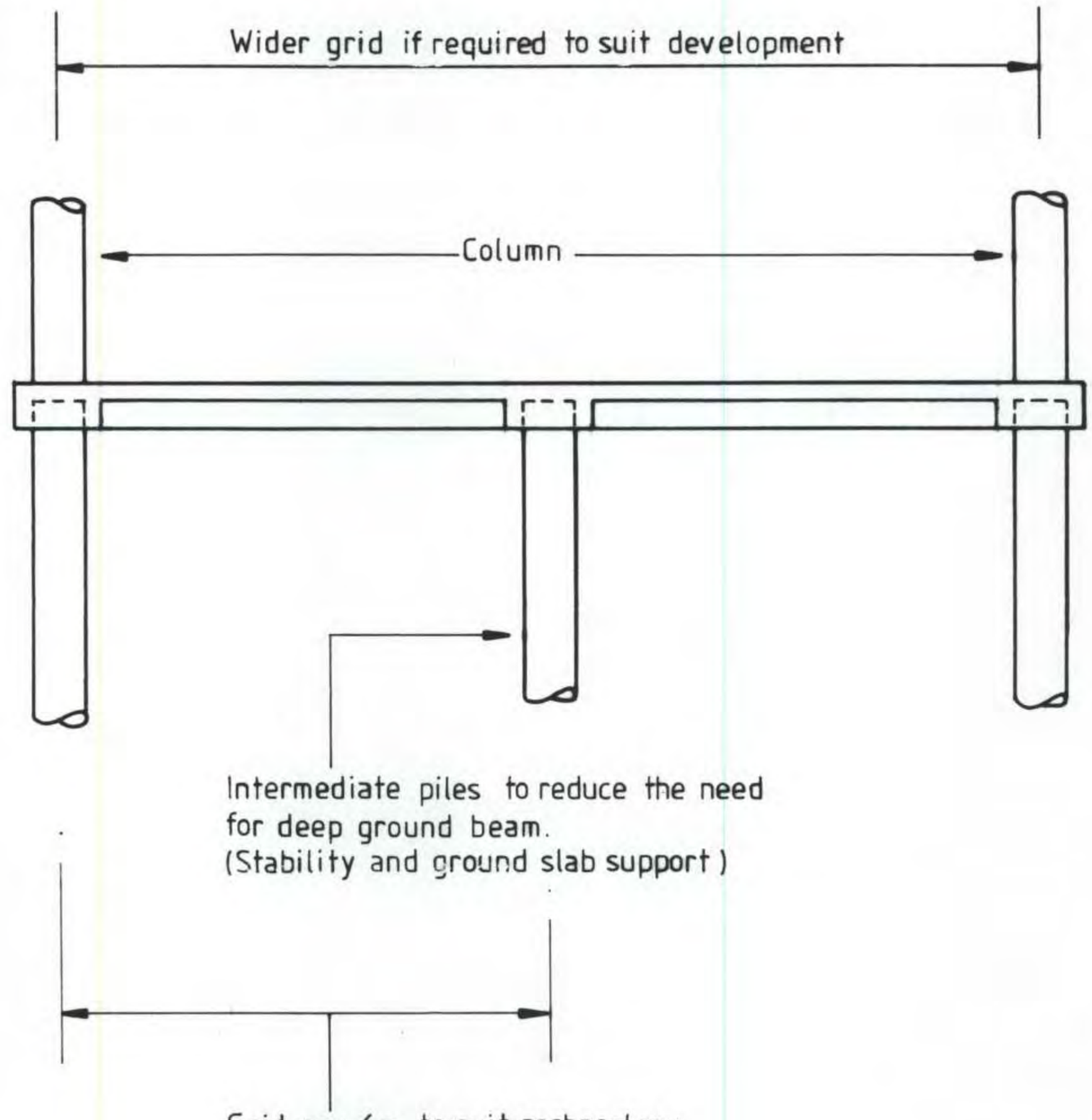
PLAN

SCALE 1:100

Effect of Pile Groups on
Archaeogical Deposits

ARUP

FIGURE 6·3



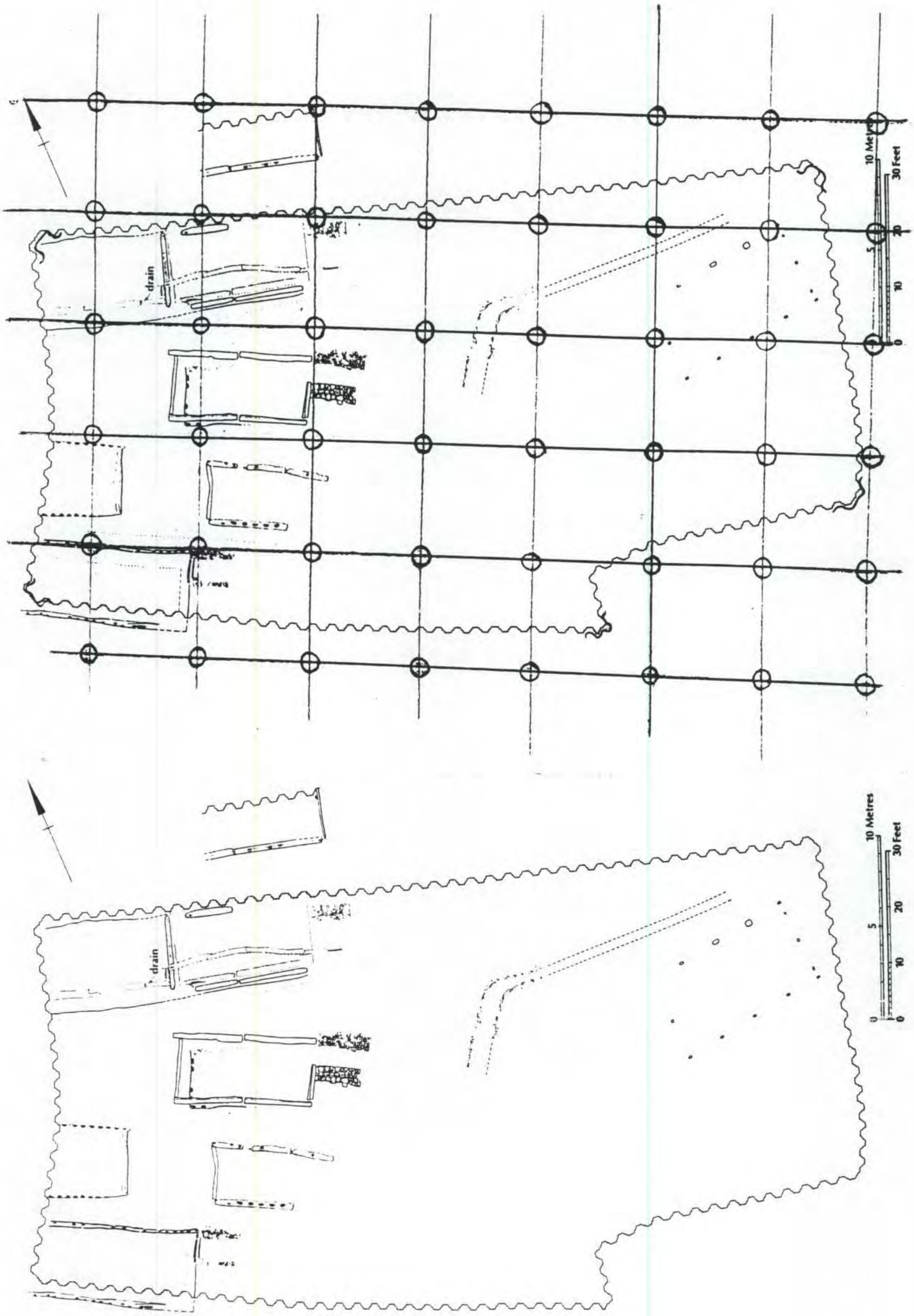
ELEVATION

SCALE 1:100

Different Grid Sizes for Substructure and Superstructure

ARUP

FIGURE 6·4



KEY

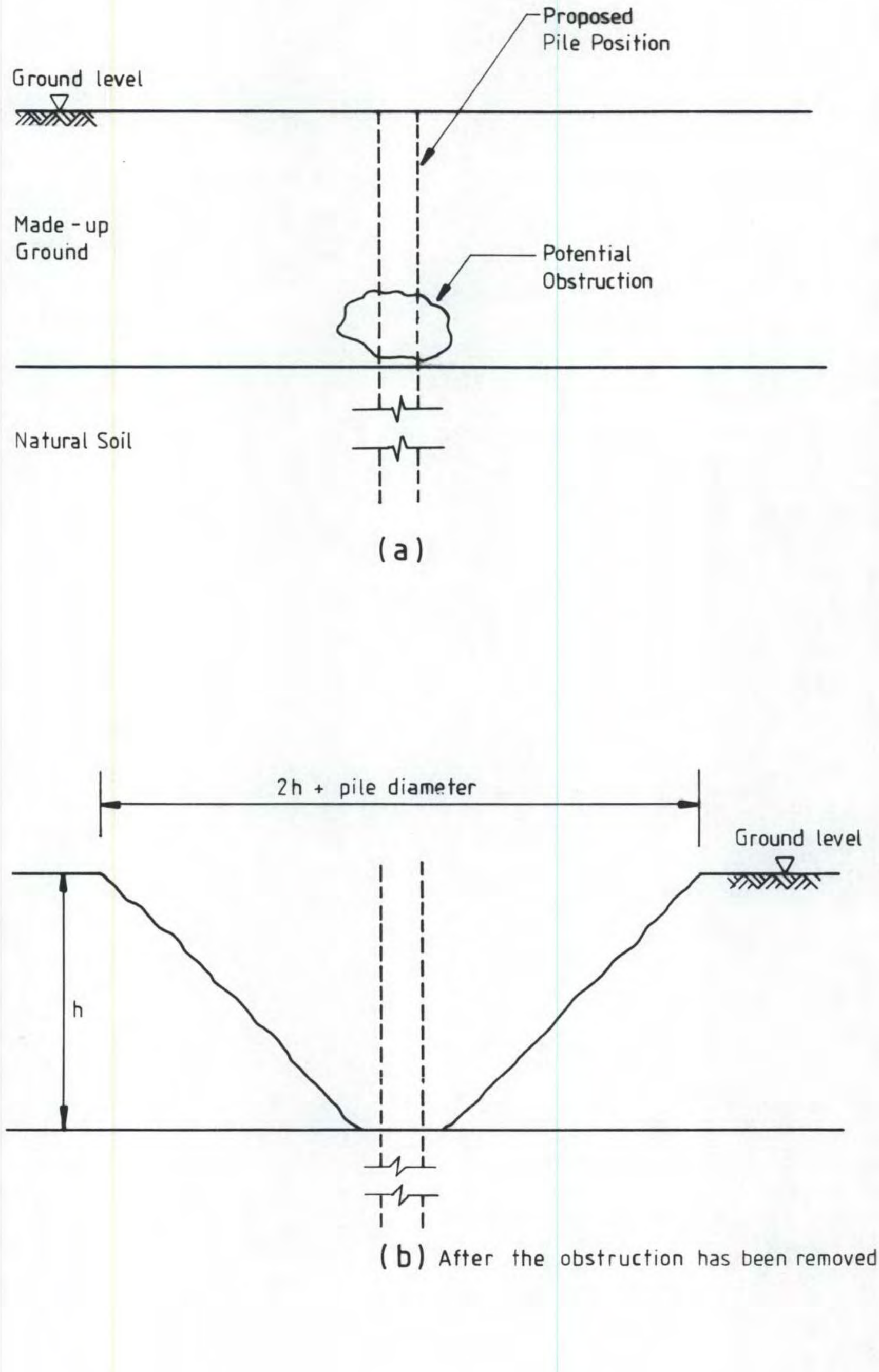
⊕ 600 mm diameter piles at 6·0 m grid

COPPERGATE - YORK

Minimal Impact of Piles on Archaeology.

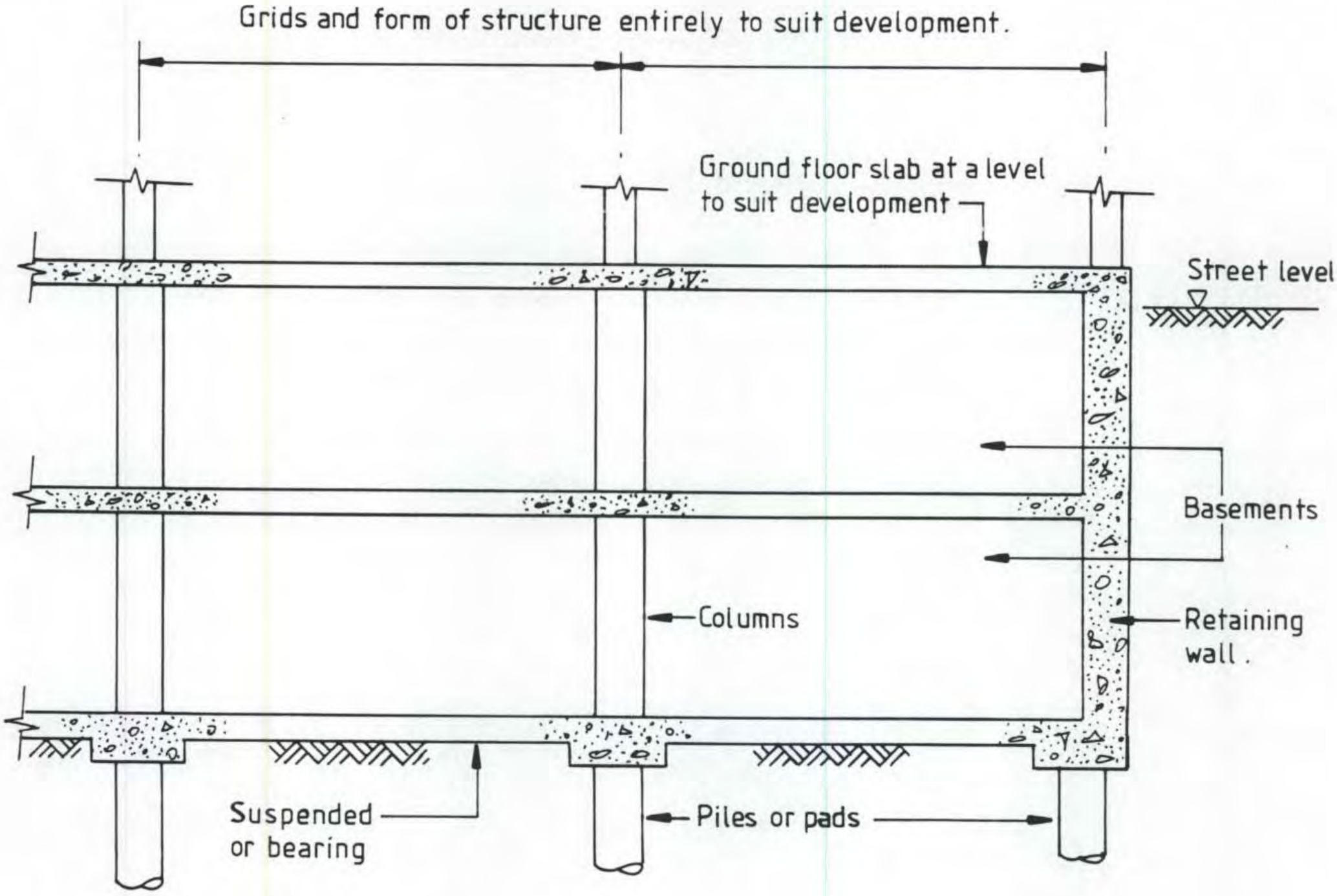
ARUP

FIGURE 6·5



Potential Damage to Deposit
due to Removal of Obstruction

ARUP FIGURE 6·6



- Archaeological input is only the monitoring of material excavated by normal constructional methods and programme.

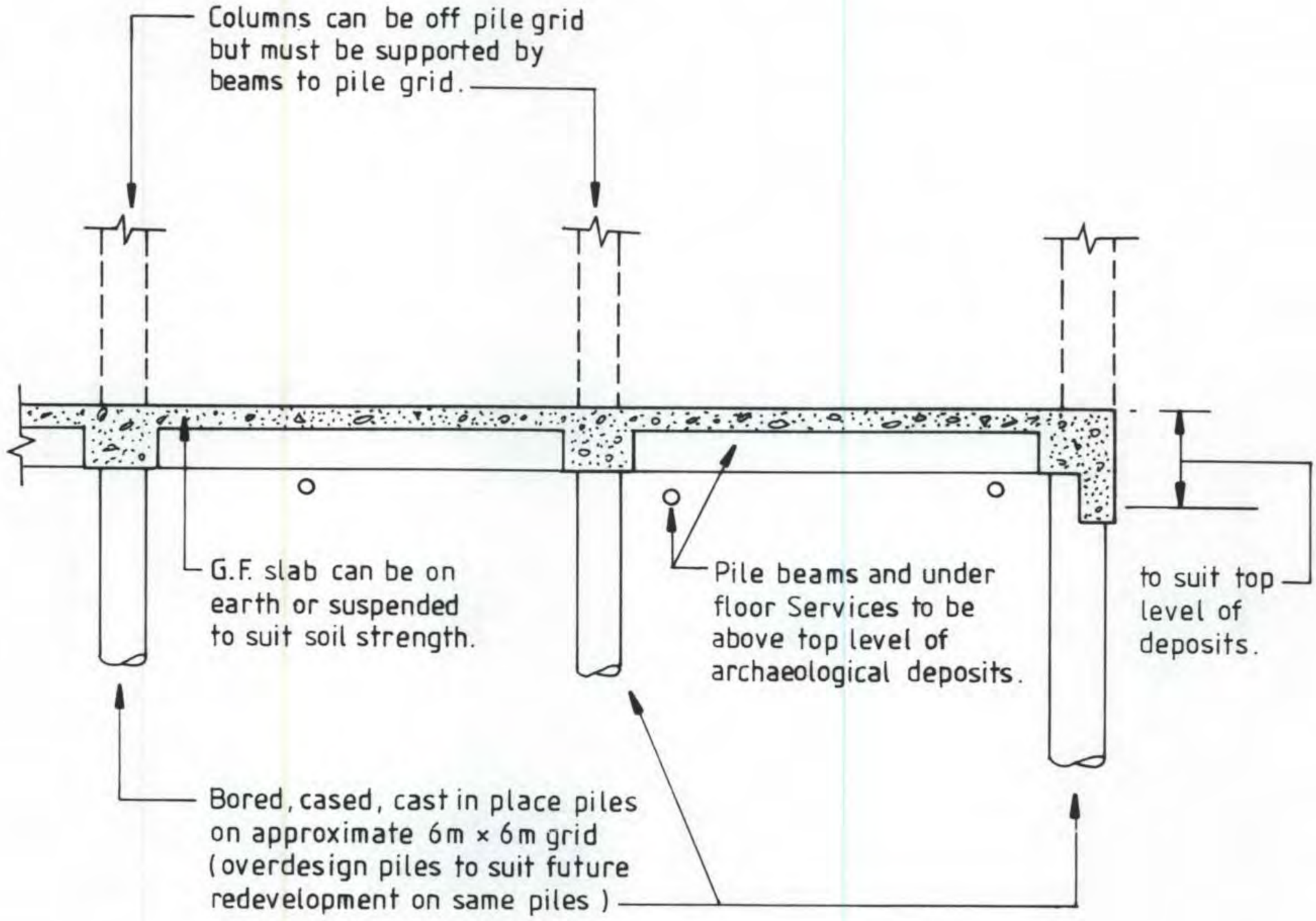
- If no basement required then shallow footings or rafts may be feasible depending on depth of made-up ground. Otherwise deep foundation will be used.

- Archaeological evaluation only required to confirm negligable archaeological value of site.

Mitigation Strategy MS.1.
Case When Archaeological Deposits are of Either Nil or Minimal Value.

ARUP

FIGURE 6·7



Archaeological Evaluation Required to Establish:

(a) Archaeological value of top level of deposits

(b) Nature of archaeological excavation required if top level has value but is agreed to be excavated

(c) Lowest level of construction permission without (partial) archaeological excavation

(d) Legibility characteristics of deposit if 5% maximum destruction is other then well distributed across site. Including local concentrations such as lift pits.

Mitigation Strategy MS.2.
Archaeology Preserved
but
no Facility for Excavation
During Life of Development.

ARUP

FIGURE 6·8

Column can be off pile grid if required but must be on beams joining the piles. (Piles overdesigned to cater for alternative superstructure grid in succesive developments.)

Beams joining pile tops

Pre-cast concrete floor channels.

Street level

Main Services run along sides of beams.

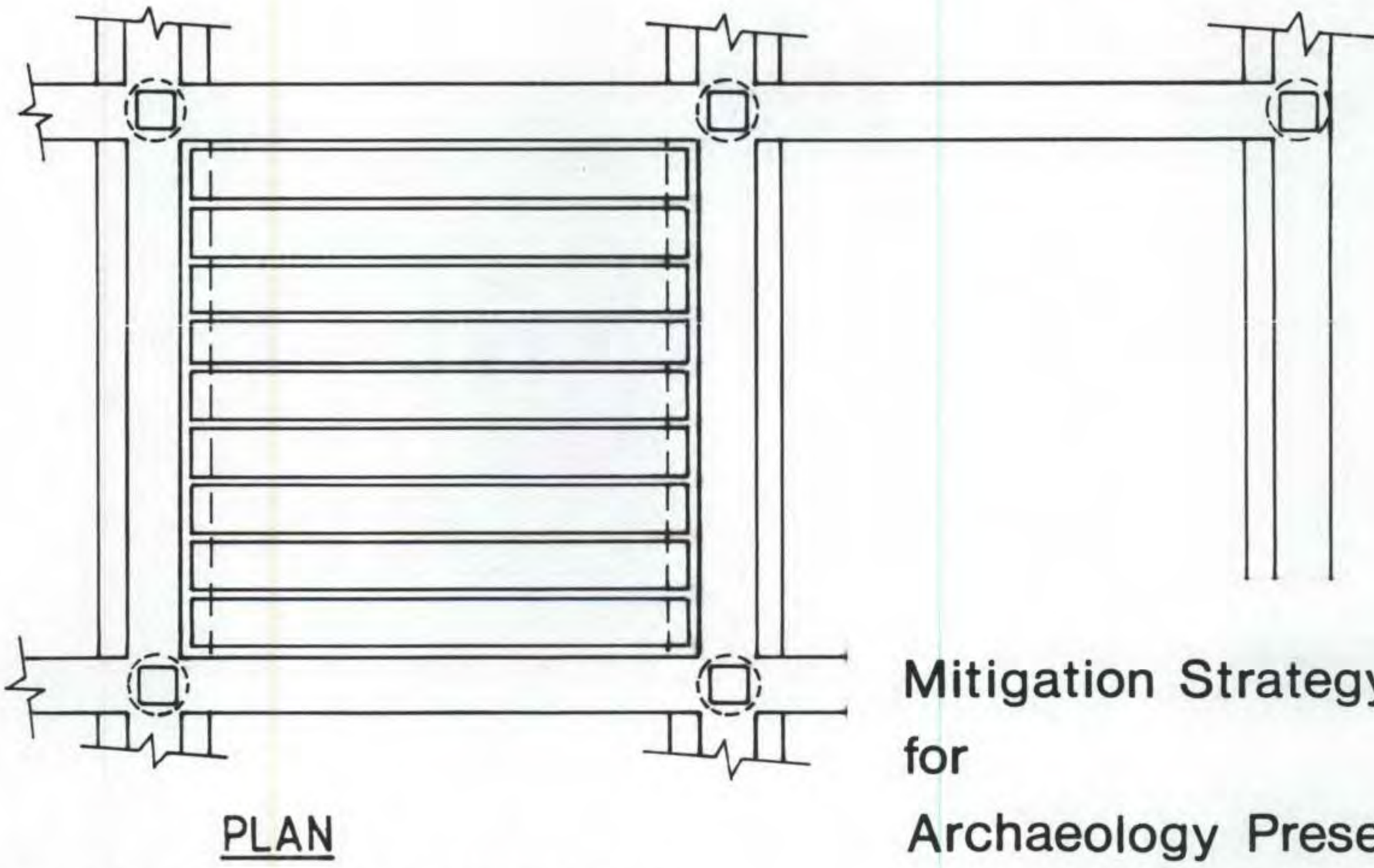
Bored, cased piles at approximately 6·0 m square grid.

Retaining wall of steel planks fixed to king post piles as and when excavation carried out. Steel plates concreted in after excavation. For excavation of internal bays ground will be excavated to slope. King piles at half grid centres.

Wherever possible sheet piles or contiguous bored piles should be used instead of king posts / planks but ground/archaeological conditions will have to be suitable.

If the top metre of the made-up ground has no archaeological value then the ground floor slab as shown. Otherwise the ground floor slab level may have to be raised above street level to avoid damaging archaeological remains. (See evaluation notes on MS.2. for various alternatives).

SECTION



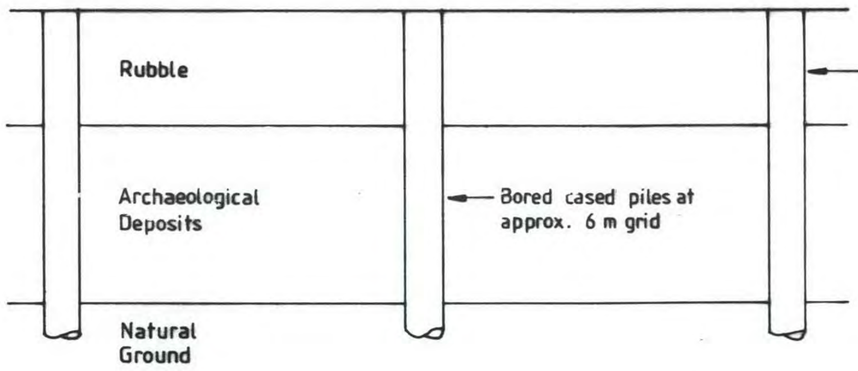
PLAN

- No archaeological involvement during construction.
- The ground can be excavated later by removing the slabs (bay by bay or in multiple bays as available). Access vertically via removed pre-cast concrete floor channels.
  Basement can be provided by means similar to Fig. 6.11
- Archaeological evaluation as MS.2. plus nature of archaeological excavation likely to be required.

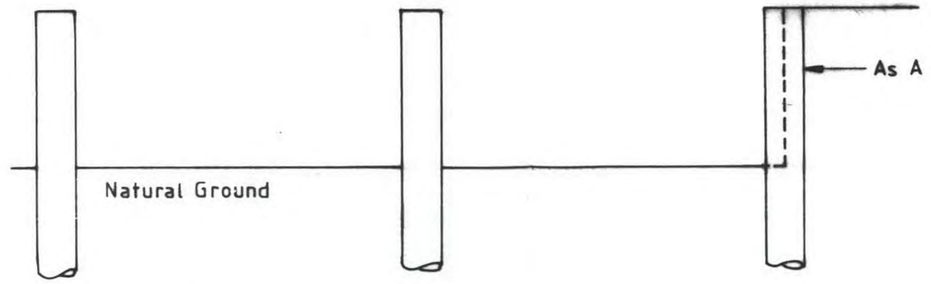
Mitigation Strategy MS.3. for Archaeology Preserved with Facility for Excavation During Life of Development.

ARUP

FIGURE 6·9

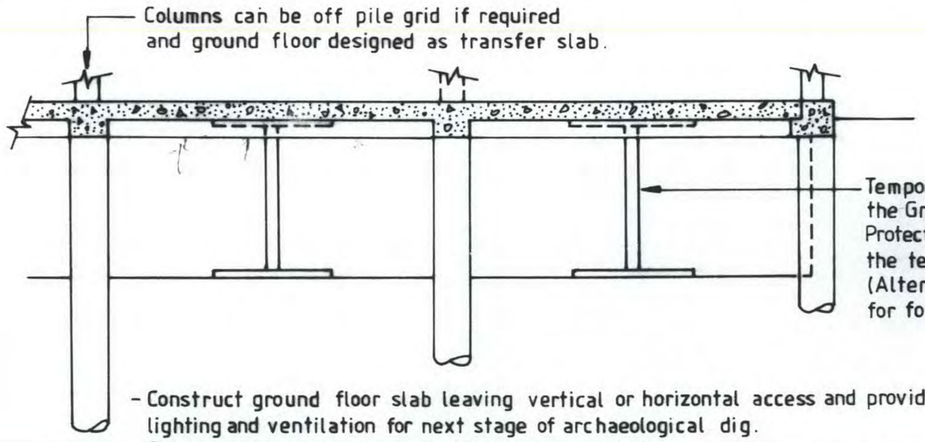


A. Construct Piles and Retaining Structures from Ground Level.



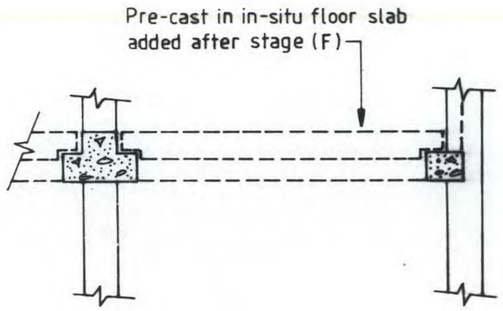
B. Excavate Down to Depth Agreed as Having no Archaeological Value
Then Allow Archaeologist to Continue Excavating Down to Approximately Either

(i) 2·0 m below soffit of Ground Floor Slab (minimum headroom for next stage of dig)
or (ii) 3·0 (+) m below soffit of Ground Floor Slab (to allow construction of 1st basement slab or pile bracing)



- Construct ground floor slab leaving vertical or horizontal access and providing lighting and ventilation for next stage of archaeological dig. Superstructure can now be built above ground floor.

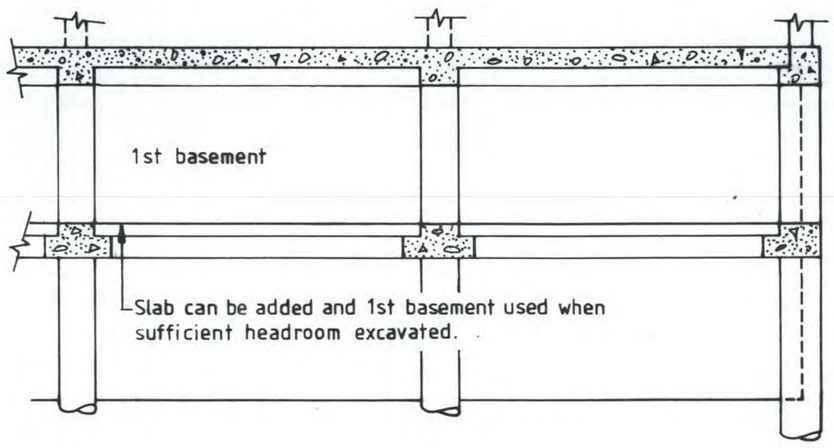
C. Construct Ground Floor Slab Following Option B (i)



- Cast beams joining the piles
- Construct ground floor slab as C (but probably using pile beams for temporary support)

D. Construct Ground Floor Slab and 1st Basement Floor Beams (or Pile Braces) Following Option B (i)

E. If Option B(i) and C is Followed then Excavate Further 1·0 (+) m and Construct 1st Basement Beams as D



F. Complete Archaeological Dig.

G. If necessary extend (non archaeological) excavation to depth of 2nd basement.

H. Construct 2 nd basement or pile bearing system , as D , if 3rd basement required.

I. Excavate for 3rd basement if required.

J. Repeat H and I if further basements required.

K. Construct bottom level of construction (bottom basement slab).

Archaeological Excavation Required to Determine :

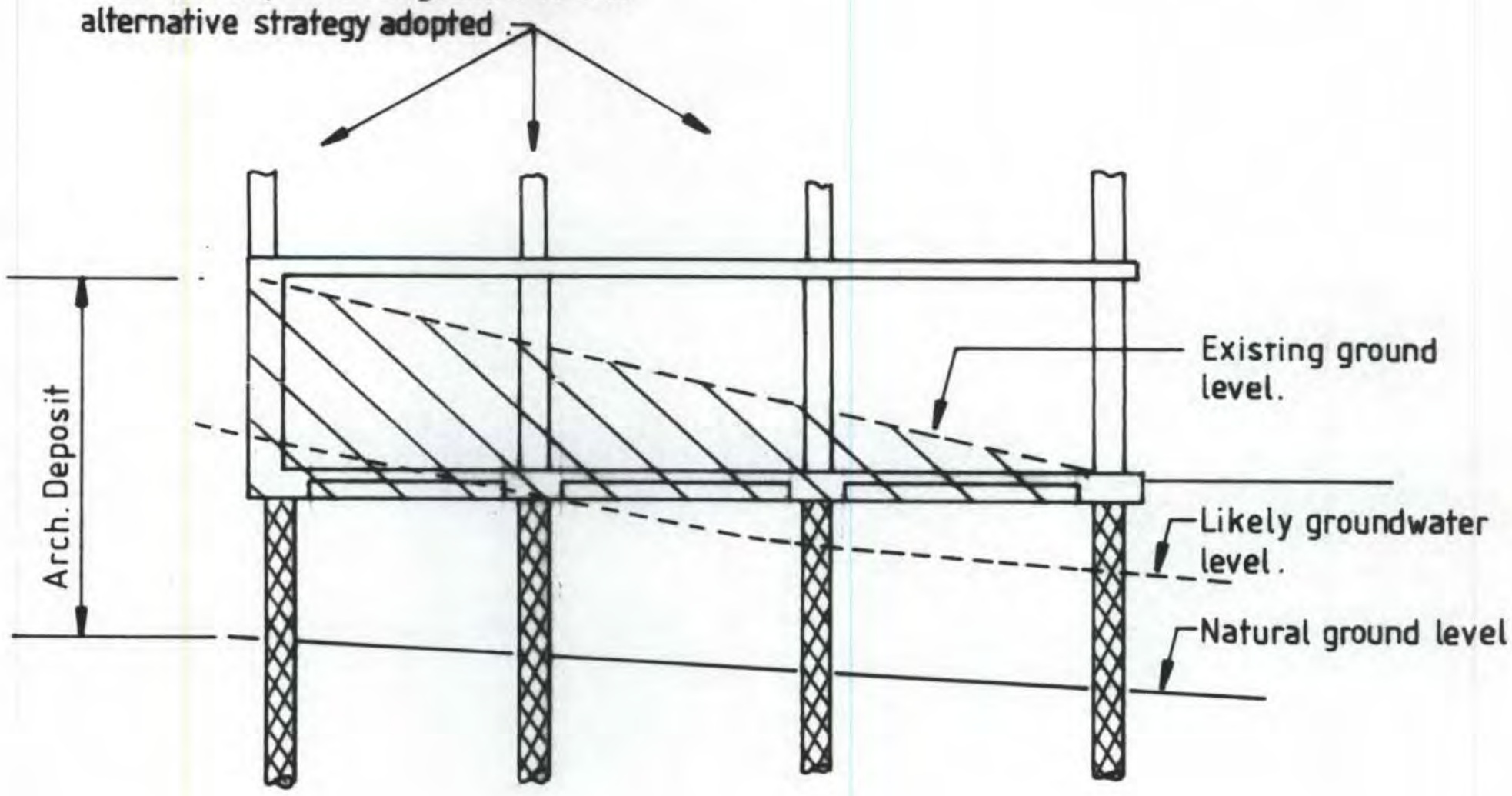
(a) Depth of no archaeological value.

(b) Legibility characteristics if 5% destruction has local concentrations.

(c) Nature of archaeological excavation required.

Mitigation Strategy MS.4.
Archaeology Recorded
with
Excavation During Construction
& Early Life of Development.

ARUP FIGURE 6·10



Deposit which will be destroyed by excavation of semi - basement.
This exceeds 5% and will require preservation by record from archaeological dig prior to development (MS.5)
This dig may be of the total area or only of a sample trench.
Extent of dig to be determined by archaeological evaluation prior to submission of planning application.

Deposit destroyed by piling not to exceed 5% of deposit below basement.
Method probably as MS.2 becouse groundwater / flooding problem likely to mean that MS.3 , 4 , 5 are not viable. But they are options.

Alternative approach - depending on archaeological value of deposit it may be possible to accept a partial excavation of the deposit below basement. This could be combined with partial or full dig of deposit above basement. This is a partial MS.5.

Alternative AMS - basement not allowed. Mitigate by adopting pile grid with (MS.3) or without (MS.2) a removable ground floor slab.

Extent of archaeological evaluation will depend on AMS to be adopted (e.g. the no-basement alternation would probably not require sample excavation)

Mitigation Strategy MS. 7.
Adoption of Partial MS.2-6 or Combination of Two of MS.2-6.
Example of Semi-Basement in Side-Long Ground.

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FIGURE 6·11