An archaeological watching brief at The Gate House, 20 Causeway Lane, Cropston, Leicestershire SK 539 155

Mathew Morris

For: Mr A Chell Planning Application: 2005/1995/2

Checked by	
Signed:	.Date:
Name:	
Approved by	
Signed:	.Date:
Name:	

University of Leicester Archaeological Services

University Rd., Leicester, LE1 7RH Tel: (0116) 2522848 Fax: (0116) 2522614 www.le.ac.uk/ulas

CONTENTS

Summary	1
1. Introduction	
2. Geology	1
3. Archaeological Background	2
4. Archaeological Objectives	3
5. Methodology	3
6. Results	
7. Discussion	
8. Sources	6
9. Archive	
10. Acknowledgements	7
Appendix Design Specification	
FIGURES	
Figure 1: Location Plans with development area highlighted	2
Figure 2: Plan of development area showing location of footings and features	
Figure 3: General view of development area, looking south-east	5
Figure 4: Footing through large rubble filled pit, looking south-east	
Figure 5: The exposed footings of The Gate House's north-west corner	

An archaeological watching brief at The Gate House, 20 Causeway Lane, Cropston, Leicestershire (SK 539 155)

Mathew Morris

Summary

An archaeological watching brief was carried out The Gate House, 20 Causeway Lane, Cropston, Leicestershire (SK 539 155) on the 4th December 2007 by University of Leicester Archaeological Services. The work was carried out on behalf of Mr A Chell in advance of construction of a new extension to the existing house. The work involved observation of machine stripped surfaces and the excavation of foundation trenches of the new build for any indication of archaeological activity. The results of the investigation revealed the stone footings of the Grade II listed 16th/17th century timber building and a large rubble filled early modern pit. The site archive will be held by Leicestershire County Council Museum Services under the accession number X.A.239.2007.

1. Introduction

This document presents the results of an archaeological assessment carried out on land at The Gate House, 20 Causeway Lane, Cropston, Leicestershire (SK 539 155). The archaeological assessment was undertaken on behalf of Mr A Chell by University of Leicester Archaeological Services on 4th December 2007.

The proposed extension to the existing Grade II listed 16th/17th century timber building (Planning Application Number 2005/1995/2) was located against its southwest gable-end and directly impacted an area of ground approximately 144m². The new development fronted directly onto the south side of Causeway Lane at the southwest end of the village approximately 4.31miles north of Leicester (*figure 1*).

The watching brief was requested by Leicestershire County Council's Historic and Natural Environment Team in their capacity as archaeological advisors to Charnwood Borough Council, as specified in their *Brief for archaeological attendance for inspection and recording (a watching brief) at The Gate House, 20 Causeway Lane, Cropston, Leicestershire*, in accordance with Planning Policy Guidelines 16 (PPG16, Archaeology and planning), para.30.

2. Geology

The Ordnance Survey Geological Survey of Great Britain, Sheet 156 indicates that the underlying geology is likely to consist of superficial deposits of Middle Pleistocenian glaciofluvial sands and gravels capped with boulder clays to the north. These overlie deposits of Triassic mudstone belonging to the Mercia Mudstone Group. The site lies at a height of c.75m above Ordnance Datum on the south side rising to c.76m on the north.

1

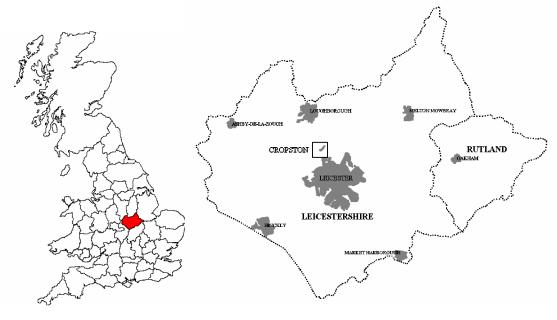




Figure 1: Location Plans with development area highlighted

Reproduced from Landranger[®] 129 Nottingham and Loughborough 1:50 000 OS map by permission of Ordnance Survey[®] on behalf of The Controller of Her Majesty's Stationery Office. © Crown copyright 1996. All rights reserved. Licence number AL 100029495.

3. Archaeological Background

The Leicestershire and Rutland Historic Environment Record (HER) showed that the development area lies within an area of archaeological interest, within Cropston's medieval and post-medieval settlement core. The Gate House itself is a Grade II listed building described as being a two-and-a-half storey house of the 16th/early 17th centuries constructed using granite and slate rubble, red brick and timber framing with a Swithland slate roof and granite and brick end stacks; with a gabled two storey wing and 20th century extension to the rear (Charnwood Borough Council; see Appendix 1). Roman occupation and a pottery kiln has also been recorded near by (HER Ref. No. MLE1045 and MLE1046).

4. Archaeological Objectives

The principle objectives of the watching brief were:

- To identify the presence or absence of any archaeological deposits.
- To establish the character, extent and date range for any archaeological deposits to be affected by the proposed ground works.
- To excavate and record any archaeological deposits to be affected by the ground works.
- To produce an archive and report of any results.

5. Methodology

The project required a professional archaeologist to supervise all stripping and groundwork likely to impact upon any archaeological remains.

The work involved the supervision and observation of excavation of foundation trenches by a JCB 3C mechanical excavator using a 1m wide toothed bucket on the back actor and a mini JCB using a 0.6m toothed bucket. Landscaping of the site prior to excavation of the footings was carried out by the mini JCB using a 1m ditching bucket.

All stripped areas and existing spoil heaps were visually inspected for features and finds.

All work followed the *Institute of Field Archaeologists (IFA) Code of Conduct* and adhered to their *Standard and Guidance for Archaeological Watching Briefs* and the *Guidelines for Archaeological Work in Leicestershire and Rutland (LMARS)*.

6. Results (*figure 2, 3, 4, and 5*)

The ground across the development area dropped down c.1m from the road level to the north of the property. This was lowered to match the ground level to the south of The Gate House with the footings for the new extension excavated a further 0.4-0.6m below this level (figure 4). This established a new ground level 1.15m below existing road level and 0.1m below ground level to the south of the property. Exposed within section beneath the road and removed from across the area in general were topsoil and subsoil deposits. These mirrored the slope down to the south and sealed natural sands. The topsoil appeared largely modern being a dark grey soil containing modern brick and root activity. It appeared to extend beneath the road to the north and continued beyond the development to the south and was up to 0.3m thick. The subsoil beneath this was mid-greenish brown silty sand containing scattered grit, charcoal and some slate; it was approximately 0.2m thick. The natural substratum across the development area was a very soft mid-reddish-pinkish orange sand with scattered small dark greyish brown silt inclusions. This was over 1.3m deep across the north of the site and continued beneath the depth of excavation.

The only feature of note revealed during landscaping and excavation within the development area was a large oval pit (*figure 5*), c.2.9m north-south by 1.3m eastwest and 1m deep, backfilled with mid-orangeish grey sandy silt and large quantities of building rubble (slate, red brick and granite fragments up to 700mm in diameter

3

and large granite blocks over 700mm in diameter). This pit was sealed beneath topsoil with its upper elements being c.1m beneath road level.

Forming the eastern edge of the development area was the western gable end of the timber building. The lowered ground level exposed the full depth of this structure's footing which was revealed to be constructed from random granite blocks (100-400mm in diameter) with some slate incorporated as levelling material. This footing extended 1m beneath the road surface, but just 0.5m beneath ground level to the south, with the upper 0.5m bonded with a pale yellowish white mortar. The extruding chimney stack was constructed on two courses of massive, crudely squared granite blocks laid to the same depth as the building's footing (*figure 6*).

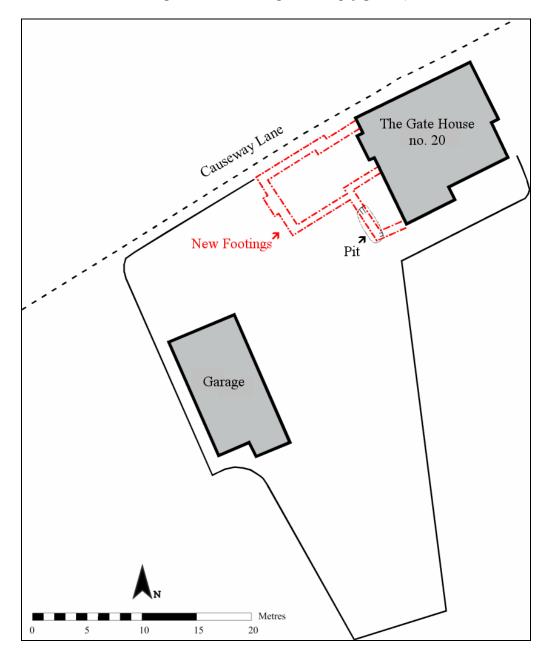


Figure 2: Plan of development area showing location of footings and features
Figure adapted from image provided by client.

4



Figure 3: General view of development area, looking south-east, showing exposed footings. The pit was located within the footings on the right of the picture.



Figure 4: Footing through large rubble filled pit exposed within southern half of the development, looking south-east.

2008-003.doc X.A.239.2007 5



Figure 5: The exposed footings of The Gate House's north-west corner. Road level is represented by the top of the section on the left of the image, the footings for the extruding chimney stack can be observed on the right.

7. Discussion

No features of archaeological significance were exposed during the ground-works. The large pit exposed near the building's south-west corner contained deomolition rubble and a two sherds of early modern/Victorian pottery (one dark brown glazed sherd and one willow patterned c.1750-1900 – not retained). The absence of more domestic wares and the high percentage of demolition material suggest it was not a refuse pit. Rather, the extremely soft, wet nature of the underlying sands suggests this rubble may have been a deliberate attempt to stabilise an unstable area, possibly caused by the removal of an earlier unidentifiable structure. The exposed wall footing revealed a sizeable sub-surface plinth for the timber-framed building and its substantial nature was again possibly due to the extremely soft nature of the underlying sand.

8. Sources

Charnwood Borough Council - *Historic and Listed Buildings of Cropston* www.charnwood.gov.uk/environment/cropston.html (accessed 10/12/07)

9. Archive

The site archive consists of eight digital photographs and a watching brief recording form. The archive will be held by Leicestershire County Council Museum Services under the accession number X.A.239.2007

6

10. Acknowledgements

Thanks to Mr Andrew Chell for his co-operation and assistance on site. Fieldwork was undertaken by Mathew Morris. The project was managed by Patrick Clay.

Mathew Morris ULAS University of Leicester University Road Leicester LE1 7RH

Tel: 0116 252 2848 Fax: 0116 252 2614 Email: mlm9@le.ac.uk

10/12/2007

2008-003.doc X.A.239.2007

7

Appendix 1 Listed building description



© Mr Brian R. Screaton

Location: THE GATE HOUSE, 20 CAUSEWAY LANE (south side) THURCASTON AND CROPSTON, CHARNWOOD, LEICESTERSHIRE

Photographer: Mr Brian R. Screaton Date Photographed: 04 June 2003 Date listed: 01 June 1966 Date of last amendment: 01 June 1966 Grade II

THURCASTON CAUSEWAY LANE SK 51 SE4/115(South Side) CROPSTON1.6.66No.20 (The Gate House)II

THURCASTON CAUSEWAY LANE SK 51 SE 4/115 (South Side) CROPSTON 1.6.66 No.20 (The Gate House) II House of C16/early C17. Granite and slate rubble stone, red brick and timber framing with Swithland slate roof and end stacks, that to right projecting with double flue above. Ground floor of stone with upper part timber framed in 2 bays. Square panels filled with stone or brick nogging, some of latter in herringbone pattern. Central buttress. 2½ storeys of 3 casements: 3-light, 1-light, 3-light over 4-light, 1-light, 3-light. On left end a door with overlight and a 1-light casement with 2-light casement over and in gable where also tie beam truss with collar. On mostly rendered right end a fixed light window with 1-light casement over and 2-light in gable. C20 extension to right. Gabled 2 storey wing to rear with truncated stack and other extensions.

8

From www.imagesofengland.org.uk

UNIVERSITY OF LEICESTER ARCHAEOLOGICAL SERVICES

Design Specification for Archaeological Works

Site: The Gate House, 20, Causeway Lane, Cropston, Leicestershire

NGR: SK 539 155 Client: Mr A Chell P.A 2005/1995/2

Planning Authority: Charnwood Borough Council

1. Introduction

1.1 Definition and scope of the specification

In accordance with Planning Policy Guidance Note (PPG16, Archaeology and Planning), para.30, and the condition placed on planning permission, this specification constitutes a 'written scheme of archaeological investigation' which ULAS intends to implement on behalf of the Client in mitigation of any damage which may be caused to buried or standing archaeological remains from the development. It addresses the requirements of *A Brief for an archaeological attendance for inspection and recording (a watching brief) at The Gate House 20, Causeway Lane Cropston, Leicestershire* produced by Leicestershire County Council, Historic and Natural Environment Team as archaeological advisors to the planning authority (23.10.2007 hereinafter the 'Brief')

- 1.2 The definition of archaeological watching brief, taken from the Institute of Field Archaeologists Standards and Guidance: for Archaeological Watching Briefs (IFA S&G: AWB) is a formal programme of observation and investigation conducted during any operation carried out for non-archaeological reasons. This will be within a specified area or site on land, inter-tidal zone or underwater, where there is a possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive.
- 1.3 The purpose of a watching brief, as laid down in the IFA S&G AWB is:

to allow, within the resources available, the preservation by record of archaeological deposits, the presence and nature of which could not be established (or established with sufficient accuracy) in advance of development or other potentially disruptive works.

to provide an opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological find has been made for which the resources allocated to the watching brief itself are not sufficient to support treatment.

1.4 This document provides a scheme of works for an 'intensive watching brief' as defined by the IFA:

Archaeological supervision, attendance and recording during topsoil stripping and groundworks likely to disturb archaeological remains, if present.

2. Archaeological Objectives

The main objectives, within the resources available, are

- To identify the presence/absence of any archaeological deposits.
- To establish the character, extent and date range for any archaeological deposits to be affected by the proposed ground works.
- To excavate and record any archaeological deposits to be affected by the ground works.
- To produce an archive and report of any results.

3. Background

- 3.1 The Leicestershire and Rutland Historic Environments Record (HER) shows that the application site lies in an area of archaeological interest, inside the medieval and post-medieval historic settlement core of the village. The listed building is a Grade II listed, timber framed, 16th/17th century structure. The works may reveal below ground remains associated with the building or other occupation in the area. Roman occupation and a pottery kiln are recorded close by (SMR Ref. No. MLE1045 & MLE1046).
- 3.2 The proposal involves the excavation of footings, landscaping and the introduction of services, etc., consequently, there is a likelihood that any buried archaeological remains will be affected by the development.

4. Methodology

4.1 General Methodology and Standards

- 4.1.1 All work will follow the Institute of Field Archaeologists (IFA) Code of Conduct and adhere to their *Standard and Guidance for Archaeological Watching Briefs*.
- 4.1.2 Staffing (as far as is possible), Recording systems, Health and Safety provisions and Insurance details are included below.
- 4.1.3 Internal monitoring procedures will be undertaken including visits to the site by the project manager. These will ensure that project targets are met and professional standards are maintained. Provision will be made for external monitoring meetings with the Senior Planning Archaeologist of the Historic and Natural Environment Team, Leicestershire County Council, the planning authority and the Client, if required.

4.2 Watching brief methodology

- 4.2.1 The archaeologist will be present during all groundworks that have the potential to affect any surviving archaeological deposits within the development area. The commencement of groundworks and subsequent timetable of works has been agreed between the Client, the Client's contractor and ULAS.
- 4.2.2 The archaeologist will supervise and observe any topsoil stripping and the excavation of foundation trenches and drains, by the Client's contractors, in order to obtain an adequate record of any archaeological deposits or finds disturbed or exposed by groundworks associated with the development.
- 4.2.3 The archaeologist will cooperate at all times with the contractors to ensure that there are no unnecessary delays to the work. However, if any archaeological deposits are seen to be present, the archaeologist will have the power to temporarily halt the works in order to define and record areas of archaeological interest.
- 4.2.4 Any archaeological deposits encountered will be recorded and excavated using standard ULAS procedures (see section 5 below).
- 4.2.5 In the event that unforeseen archaeological discoveries are made during the development, ULAS shall have the power to halt any ground works and shall inform the site agent/project manager and the Senior Planning Archaeologist, and prepare a written statement with plan detailing the archaeological evidence. Following assessment of the archaeological remains by the Senior Planning Archaeologist, ULAS shall, if required, implement on behalf of the Client a contingency scheme for salvage excavation of affected archaeological features.

4.3. Environmental Sampling

4.3.1 If significant archaeological features are subject to excavation, the sampling strategy will include the following if practicable, within the scope of the project and with the allocated resources:

A range of features to represent all feature types, areas and phases will be selected on a judgmental basis. The criteria for selection will be that deposits are datable, well sealed and with little intrusive or residual material.

Any buried soils or well-sealed deposits with concentrations of carbonised material present will be intensively sampled taking a known proportion of the deposit.

Spot samples will be taken where concentrations of environmental remains are located.

Waterlogged remains, if present, will be sampled for pollen, plant macrofossils, insect remains and radiocarbon dating provided that they are uncontaminated and datable. Consultation with the specialist will be undertaken.

4.4 Recording Systems

- 4.4.1 The ULAS recording manual will be used as a guide for all recording.
- 4.4.2 Individual descriptions of any observed archaeological strata and features exposed by the works will be entered onto pro-forma recording sheets.
- 4.4.3 A site location plan based on the current Ordnance Survey 1:1250 map (reproduced with the permission of the Controller of HMSO) will be prepared. This will be supplemented by a plan at appropriate scale, which will show the location of the investigation area in relation to the OS or site grid, as appropriate.
- 4.4.4 A record of the full extent in plan of all archaeological deposits encountered will be made. Sections including the half-sections of individual layers of features will be drawn as necessary, typically at a scale of 1:10. Relative levels of archaeological deposits will be taken across the site area.
- 4.4.5 A photographic record of the investigations will be prepared illustrating in both detail and general context the principal features and finds discovered. The photographic record will also include 'working shots' to illustrate more generally the nature of the archaeological operation mounted.
- 4.4.6 As a minimum, the watching archaeologist will record the location and depths of any areas of groundworks, including descriptions and depths of all principal strata disturbed, even if no archaeological features are present.

5. Finds and Samples

- 5.1 The IFA Guidelines for Finds Work will be adhered to.
- All antiquities, valuables, objects or remains of archaeological interest, other than articles declared by Coroner's Inquest to be subject to the Treasure Act, discovered in or under the Site during the carrying out of the project by ULAS or during works carried out on the Site by the Client shall be deemed to be the property of ULAS provided that ULAS after due examination of the said Archaeological Discoveries shall transfer ownership of all Archaeological Discoveries unconditionally to Leicestershire Museums for storage in perpetuity.
- 5.3 An accession number will be obtained for the watching brief which will be used to identify all records and finds from the site.
- 5.4 All identified finds and artefacts are to be retained, although certain classes of building material will, in some circumstances, be discarded after recording with the approval of the Senior Planning Archaeologist. The IFA Guidelines for Finds Work will be adhered to.
- All finds and samples will be treated in a proper manner. Where appropriate they will be cleaned, marked and receive remedial conservation in accordance with recognised best-practice. This will include the site code number, finds number and context number. Bulk finds will be bagged in clear self sealing plastic bags, again marked with site code, finds and context numbers and boxed by material in standard storage boxes (340mm x 270mm x 195mm). All materials will be fully labelled, catalogued and stored in appropriate containers.

6. Report and Archive

- 6.1 The full report in A4 format will usually follow within four weeks of the completion of the fieldwork and copies will be dispatched to the Client (2 copies), Senior Planning Archaeologist/Leicestershire SMR (2 copies) and Rutland County Council Planning Officer (1 copy).
- 6.2 The report will include:-
 - Summary
 - The aims and methods adopted in the course of the watching brief.
 - The nature, location, extent, date, significance and quality of any structural, artefactual and environmental material uncovered.
 - Appropriate illustrative material including maps, plans, sections, drawings and photographs.
 - The location and size of the archive.
- 6.3 A full copy of the archive as defined in *The Guidelines For The Preparation Of Excavation Archives For Long-Term Storage* (UKIC 1990), and *Standards In The Museum: Care Of*

Archaeological Collections (MGC 1992) and Guidelines for the Preparation of Site Archives and Assessments for all Finds (other than fired clay objects) (Roman Finds Group and Finds Research Group AD 700-1700 1993) will usually be presented to within six months of the completion of fieldwork. This archive will include all written, drawn and photographic records relating directly to the investigations undertaken.

7 Publication and Dissemination of Results

7.1 A summary of the work will be submitted to the *Transactions of the Leicestershire Archaeological and Historical Society* for publication. A larger report will be submitted for inclusion if the results of the archaeological works warrant it.

8. Acknowledgement and Publicity

- 8.1 ULAS shall acknowledge the contribution of the Client in any displays, broadcasts or publications relating to the site or in which the report may be included.
- 8.2 ULAS and the Client shall each ensure that a senior employee shall be responsible for dealing with any enquiries received from press, television and any other broadcasting media and members of the public. All enquiries made to ULAS shall be directed to the Client for comment. The Senior Planning Archaeologist will also be consulted when dealing with such enquiries.

9. Copyright

9.1 The copyright of all original finished documents shall remain vested in ULAS and ULAS will be entitled as of right to publish any material in any form produced as a result of its investigations.

10. Timetable/Staffing

- One member of ULAS staff will be present on the site during groundworks. An initial start date for the works is to be agreed.
- 10.2 The report will normally be completed within eight weeks of the completion of fieldwork.

11. Health and Safety

11.1 ULAS is covered by and adheres to the University of Leicester Archaeological Services Health and Safety Policy and Health and Safety manual with appropriate risks assessments for all archaeological work. A draft Health and Safety statement for this project is attached as Appendix 1. The relevant Health and Safety Executive guidelines will be adhered to as appropriate. The HSE has determined that archaeological investigations are exempt from CDM regulations.

A Risks assessment form will be completed prior to work commencing on-site, and updated as necessary during the site works.

It is assumed that the locations of all services on the site are already known to the Client, and that this information will be made known to the attending archaeologist.

12. Insurance

All employees, consultants and volunteers are covered by the University of Leicester public liability insurance, £20m cover with St. Paul Travellers (policy no. UCPOP3651237). Professional indemnity insurance is with Lloyds Underwriters 50% and Brit Insurance 50%, £10m cover (policy no. PUNIO3605). Employer's Liability Insurance is with St. Paul Travellers, cover £10m (policy no. UCPOP3651237).

13. Monitoring arrangements

- Unlimited access to monitor the project will be available to both the Client and his representatives and Senior Planning Archaeologist subject to the health and safety requirements of the site.
- 13.2 All monitoring shall be carried out in accordance with the IFA *Standard and Guidance for Archaeological Watching Briefs*.
- 13.3 Internal monitoring will be carried out by the ULAS project manager.

Bibliography

MAP 2, The management of archaeological projects 2nd edition English Heritage 1991

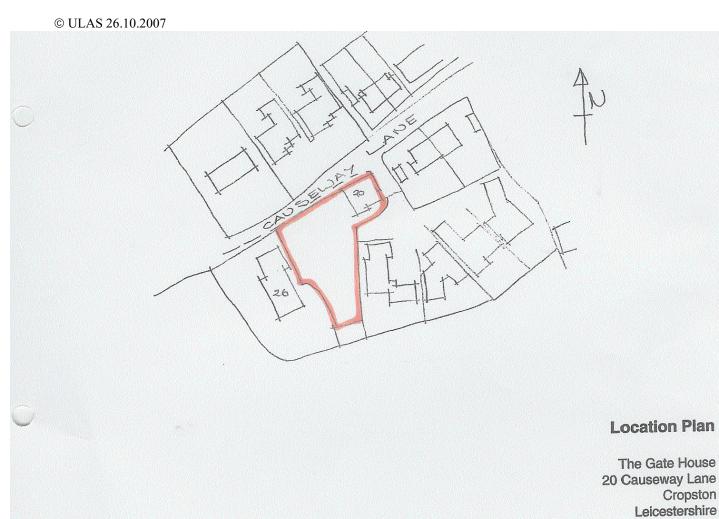
MGC 1992, Standards in the Museum Care of Archaeological Collections 1992 (Museums and Galleries Commission)

RFG/FRG 1993, Guidelines for the preparation of site archives (Roman Finds Group and Finds Research Group AD 700-1700 1993)

SMA 1993, Selection, retention and Dispersal of Archaeological Collections. Guidelines for use in England, Wales and Northern Ireland 1993 (Society of Museum Archaeologists)

Patrick Clay Director ULAS University of Leicester University Road Leicester LE1 7RH

Tel:0116 252 2848 Fax: 0116 252 2614 Email: pnc3@le.ac.uk



Scale: 1:1250 (approx.)

Figure 1: Site location plan indicating site area (plan supplied by developer)

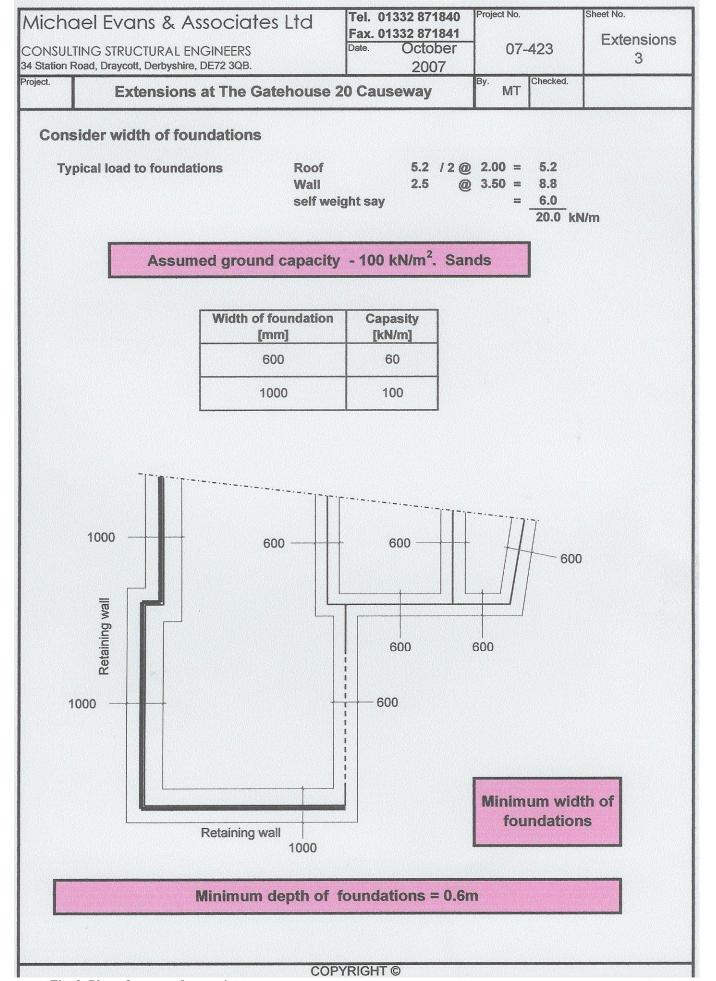


Fig. 2 Plan of proposed extension

Draft Project Health and Safety Policy Statement

Site: The Gate House, 20, Causeway Lane, Cropston, Leicestershire

NGR: SK 539 155 Client: Mr A Chell P.A 2005/1995/2

Planning Authority: Charnwood Borough Council

1.Nature of the work

1.1 This statement is for archaeological excavation. It will be revised following the commencement of operations when the extent of risks can be assessed in full.

1.2 The work will involve overburden stripping by hymac 360 or similar during daylight hours and recording of any underlying archaeological deposits revealed. Overall depth is likely to be c. 1.0-1.2m. Following stripping the exposed deposits will be examined with hand tools (shovels, trowels etc) and archaeological features will be excavated. All work will adhere to the University of Leicester Health and Safety Policy and follow the guidance in the ULAS Health and safety and the Standing Committee of Archaeological Unit Managers manuals, together with the following relevant Health and Safety guidelines, including the following.

HSE Construction Information Sheet CS8 Safety in excavations.

HSE Industry Advisory leaflet IND (G)143 (L): Getting to grips with manual handling.

HSE Industry Advisory leaflet IND (G)145 (L): Watch Your back.

CIRIA R97 Trenching practice.

CIRIA TN95 Proprietary Trench Support Systems.

HSE Guidance Note HS(G) 47 Avoiding danger to underground services. HSE Guidance Note GS7 Accidents to children on construction sites

1.3 The Health and Safety policy on site will be reassessed during the evaluation .All work will adhere to the company's health and safety policy.

2 Risks Assessment

2.1 Working within an excavation.

Precautions. No work will be undertaken beneath section faces deeper than 1.2m. Loose spoil heaps will not be walked on. Protective footwear will be worn at all times. A member of staff qualified in First Aid will be present at all times. First aid kit, vehicle and mobile phone to be kept on site in case of emergency.

2.2 Working with plant.

Precautions. Hard hats, protective footwear and hazard jackets will be worn at all times. No examination of the area of stripping will take place until machines have vacated area. Observation of machines will be maintained during hand excavation.

2.3 Working within areas prone to waterlogging.

Protective clothing will be worn at all times and precautions taken to prevent contact with stagnant water which may carry Weils disease or similar.

2.4 Working with chemicals.

If chemicals are used to conserve or help lift archaeological material these will only be used by qualified personnel with protective clothing (i.e a trained conservator) and will be removed from site immediately after use.

2.5 Other risks

Precautions. If there is any suspicion of unforeseen hazards being encountered e.g chemical contaminants, unexploded bombs, hazardous gases work will cease immediately. The client and relevant public authorities will be informed immediately.

No other constraints are recognised over the nature of the soil, water, type of excavation, proximity of structures, sources of vibration and contamination.

08.08.2007

16