



**ARCHAEOLOGICAL
INPUT into MASTERPLAN**

**BRAYFORD CAMPUS, UNIVERSITY
of LINCOLN**

DECEMBER 2011

Planning • Heritage

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**Local Planning Authority:
LINCOLN CITY COUNCIL**

**Site centred at:
SK 970 710**

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Summary

The University of Lincoln has commissioned CgMs to advise on archaeological implications of their proposed Masterplan for development within the existing Brayford campus site. Although the overall Masterplan boundary extends to c. 12.93 ha, the actual area currently proposed for development is far more limited (c. 2.37 ha.) The centre of the site is located at National Grid Reference SK 970 710.

This current document has been prepared further to a meeting, on Wednesday 10th August, convened with Michael Jones, the City Archaeologist, James Rackham of The Environmental Archaeology Consultancy and Dan Clayton, Environmental and Sustainability Manager for the University. At that meeting it was agreed that there was little or no requirement for a formal desk-based assessment of the site and that all of the relevant, site specific background, was available from existing reports. The ability to rely upon previously issued reports by James Rackham was discussed and has been subsequently resolved, such that it is possible for the University to consult and use all previous archaeological reports produced in relation to works on site. A full bibliography of these works is included within James Rackham's palaeotopographical report and his palaeoenvironmental proposals included as appendices to this document.

The meeting proceeded to consider the desirability of completing all of the fieldwork required to comply with future planning obligations in one tranche in advance of development. Fieldwork has to date been carried out in piecemeal fashion within the University campus and there is a danger that if this continues work will be duplicated and the opportunity to make savings from economies of scale will be lost. In addition, from a strictly archaeological perspective, there are significant advantages to having one contractor carry out a scheme of work in an iterative fashion.

This document serves as a Heritage Statement to comply with the requirements of PPS5. It proposes a broad testpitting strategy that will provide substantive data to allow the University to make a proper assessment of the likely archaeological costs of future development and risks to programme. The testpitting programme will also produce significant data to inform future design. Should the University choose to proceed directly to a mitigation phase (to excavate archaeological deposits likely to be impacted by future development, as required and appropriate), the testpitting will allow that investigation to be targeted effectively. As stated above, included as appendices to this document are reports produced by James Rackham setting out both the palaeotopographical context of the site and a proposal for completing the palaeoenvironmental mitigation of the site, in order to obviate the need for this on any future development (other than assessment of specific features).

1.0 INTRODUCTION AND SCOPE OF STUDY

- 1.1 The University of Lincoln has commissioned CgMs to advise upon the archaeological issues raised by their proposed Masterplan for the future development of their 'Brayford Campus' site. The area within the current Masterplan boundary is c. 12.93 ha. located at c. 5 m AOD; however, only a relatively small fraction of that is subject to proposed development.
- 1.2 The proposed development area is bounded by the Brayford Pool and the Fosdyke Canal to the north, by the River Witham to the east (although it is possible that development may also be carried out to the east of Brayford Wharf East), by Brayford Way and the Ropewalk to the south (one building is proposed to the south of Campus Way and to the west of Brayford Way), and a number of buildings are proposed to the west of Brayford Way and to the north of Campus Way (see the Masterplan, Figure 2).
- 1.3 CgMs was initially approached by the University to prepare an archaeological desk-based assessment of the University Campus. However following discussions with all relevant parties (Dan Clayton for the University and Michael Jones for the City Council), it was agreed that there was already a good understanding of the baseline archaeological conditions on the site (a full bibliography is included within James Rackham's report 'The Palaeotopography of Lincoln University' appended to this document). It was therefore agreed that a meeting should be convened to determine an appropriate way forward and this was held at the University on 10th August, 2011, attended by Dan Clayton, James Rackham, Michael Jones and Simon Mortimer. At the meeting it was agreed that it would be possible to agree a scheme for archaeological mitigation that, once implemented (fieldwork and recording), would obviate the requirement for any further archaeological work within the site.
- 1.4 The first part of the mitigation scheme would involve a suite of boreholes targeting areas of the palaeoenvironmental sequence within the site known to exist but not yet fully assessed. A strategy for this is set out in Appendix 1 of this document. The second element of the scheme involves a programme of machine excavated testpits, to be excavated within areas of the site proposed for development. The primary aim of these testpits is to establish the presence/absence of horizons containing or likely to contain artefacts, features or deposits that might trigger a need for archaeological mitigation or design solutions (to avoid or minimise impacts).
- 1.5 A substantial part of the meeting above was focussed on how best to mitigate the development proposed within the University Campus, when the impacts are relatively poorly understood; i.e., designs are not fixed because the scheme is at Masterplan stage, and, second how to avoid some of the inevitable issues arising from piecemeal

investigation. Crucial to this discussion was the agreement that whilst the site has never been densely settled in the last 7000 years, largely because of its peripheral and wet location, it does contain known significant deposits (e.g. the Mesolithic surface excavated in advance of the University pond construction) and it also has the potential for significant Neolithic and Bronze Age remains including waterlogged wooden structures and ritual monuments.

- 1.6 All of the deposits containing prehistoric material are sealed below substantial amounts of natural silt and dumped material. It is notoriously difficult to evaluate for the sort of archaeology that might be present within the site, because of the 'needle-in-a-haystack' nature of exposing boats within former channels, etc., or trackways and bridges/crossings, or even barrows. Efforts are frequently further frustrated by the depth below current ground surface that such deposits may be found and the practical and Health and Safety issues raised by excavating deep trenches into wet and frequently unstable deposits. From a development point of view, however, it is critical to try to quantify and subsequently reduce or remove the risk that the time and cost spent excavating these structures can add to a development programme.
- 1.7 What this document sets out therefore is a summary assessment of the archaeological significance of the site. It outlines a strategy to complete the work required to obtain a comprehensive palaeoenvironmental understanding of the site (as set out by James Rackham, Appendix 1) such that this objective can be removed from all future work on the site. Finally it proposes a methodology to investigate areas within the site known to have a potential to contain dryland deposits to produce information that can be used to inform both future design and also to establish the need for and likely scope of any future archaeological mitigation. The methodology proposed uses machine excavated testpits to allow a rapid visual inspection of the stratigraphic sequence within the site to determine the potential for buried landsurfaces and to seek to recover artefacts.
- 1.8 It is almost inevitable that there will be changes to the proposed Masterplan subsequently to the preparation of this document. The Masterplan used as the basis for the discussions in the August meeting has already been superseded. The site has therefore been zoned such that the proposed evaluation/mitigation proposals relate to the landscape element and not to the development proposals. As a result it is hoped that this document will be useful for the long-term.
- 1.9 This document has been prepared by Simon Mortimer MA MIfA of CgMs Consulting and edited by Myk Flitcroft BA MIfA. A palaeoenvironmental strategy, prepared by James Rackham is included as Appendix 1 and his report 'The Palaeotopography of the Lincoln University Campus, Brayford, and Lincoln' is included as Appendix 2.

Geology and Topography

- 1.10 James Rackham's 'The Palaeotopography of the Lincoln University Campus, Brayford, and Lincoln' provides a detailed account of the existing and former topography within the site and its evolution through time, together with a contour model. This should be consulted for detailed information. In summary James Rackham's report establishes the following growth of wetland environment through prehistory:-

Late Mesolithic – marsh above 0.5 m OD

Neolithic – marsh over 1 m OD

Middle Bronze Age – peat formation above 1.5 m OD

Late Bronze Age – peat over former land surfaces at 2.2 m OD

1000 BC – peat forming at 2.8 m OD

All current evidence for in situ dry land archaeology is above the 2.5 m OD contour i.e. it is sealed by c. 2.5 m of prehistoric and more recent alluvial deposits and made ground.

2.0 AIMS AND OBJECTIVES

- 2.1 The principal objective of the archaeological trial investigation within the Masterplan site is to determine presence/absence, extent, location and character (including the degree of preservation and chronological range) of archaeological remains within unevaluated parts of the proposed development area. The results of the field evaluation will help to characterise and define the status of archaeological remains, if present, and determine the need for further archaeological work.
- 2.2 Once the nature and dating of any archaeology is known, the East Midlands Archaeological Research Framework and/or the Lincoln Archaeological Resource Assessment (LARA) will be used to determine appropriate research avenues.
- 2.3 The site has a known high potential for prehistoric archaeology. This is most likely to be located at or above the 2.5m OD contour (top of sand), prior to the development of the peat horizon. There is also potential for the occurrence of Romano-British activity; a buried soil of this date was recorded during the evaluation of the AMC Block at a height of 4 m AOD. Medieval features were also excavated within the University pond site and the potential exists for features of this date elsewhere within the site. The archaeology could include features, spreads, artefacts, imprints, deposits and structures cut into the sands or contemporary land surface as well as artefacts or structures within buried soils or within peat deposits. Where such archaeological activity is identified, there is also a potential for the survival of organic waterlogged materials in deposits.
- 2.4 Information will be gained on the location, extent, nature and date of any archaeological features or deposits that may be present. The integrity and state of preservation of any archaeological features or deposits that may be present will be detailed.

3.0 ASSESSMENT OF ARCHAEOLOGICAL SIGNIFICANCE

- 3.1 In order for the Masterplan to be of useful application in the long term, it has been necessary to identify areas of future development, instead of referring to specific structures or development proposals. The archaeological potential of each area or zone is assessed below.
- 3.2 Zone A is located at the north-western extent of the site in the vicinity of the former confluence of the River Till and Brayford Pool. The confluence of the water courses gives this zone an enhanced potential for prehistoric ritual activity, in particular for barrows. There is an additional potential for Roman and later revetment and other water related structures, including possibly boats. There is a research interest in determining the date of the Fosdyke Canal and any activity associated with its construction would be of local to regional significance. Although the potential for finding evidence for prehistoric ritual activity is relatively low, i.e., it is not extensive, where present, especially if waterlogged, remains are likely to be of at least regional importance.
- 3.3 Zone B is located to the south of the railway line, opposite Zone A. This zone is closest to the possible barrow location reported within James Rackham's Palaeotopographical report (Appendix 2, Figure 1, site 3). The location on the southern side of the River Till at or above the 2.5 m contour suggests an enhanced potential for buried landsurfaces dating from the Mesolithic potentially up to and including the Bronze Age. As with Zone A, although the potential for finding evidence for prehistoric ritual activity is relatively low i.e. it is not extensive. Where present, remains are likely to be of at least regional importance, especially if waterlogged.
- 3.4 Zone C is the area to the south and west of the current University pond. This zone has the same potential as Zone B for earlier prehistoric dryland deposits, including Mesolithic and Neolithic sites. Movement away from the rivers reduces the potential for finding barrows in this location, but it is close to the previous discovery of Mesolithic material (on a sand ridge within the University Pond). Deposits of *in situ* Mesolithic material are likely to be of regional importance. Depending upon their extent, nature and state of preservation deposits containing Neolithic and Bronze Age material are likely to be of local to regional importance.
- 3.5 Zone D. The Arts Box site. This area is immediately east of the School of Architecture, below which was a Bronze Age peat sequence. There is therefore some potential for evidence of early prehistoric activity within this zone, which is likely to be of local importance. The former pond that existed within this zone, prior to the construction of

the new pond to the north of Zone C, is likely to have removed any archaeologically significant deposits and should therefore be removed from the scope of any intrusive archaeological works.

- 3.6 Zone E. This area is immediately to the west of the Sparkhouse Studios. James Rackham has flagged up the need for further work in this area to investigate what is likely to be a post-medieval scour channel of the river, which is likely to be of local importance.

4.0 PROPOSED METHODOLOGY

4.1 The combined area likely to be impacted upon by the current Masterplan proposals amounts to c. 2 ha. broken down as follows:

Zone A – 7225m²

Zone B – 3000 m²

Zone C – 10500 m²

Zone D – 1425 m²

Zone E – 625m²

4.2 Each of the proposed development areas outlined above has been subject to some impact from the construction and use of the site as railway sidings in the nineteenth and twentieth centuries. There was a substantial Goods Yard within Zone B and there are a number of drains cut within the proposed Arts Box site. These impacts will need to be taken into account when preparing evaluation strategies. That said, given the results from previous phases of investigation within the site, it is clear that the amount of overburden (largely derived from the construction of the railway), sealing the earliest archaeological horizons has protected them from all but the deepest of modern intrusions.

4.3 The percentage sample investigated within the proposed development footprints will depend upon the decision that the University makes as to the ultimate aim of the work. The options are three-fold. Option A would be to do nothing in advance of individual planning applications for development within the site and then undertake evaluation and mitigation works as stipulated by the planning authority. Option B is to seek to characterise the archaeological resource present across the site, to establish the level above OD of any and all significant archaeological horizons and to seek to assess the potential mitigation costs/requirements for design solutions. Option C is to look towards a programme of archaeological evaluation as outlined in Option B and to follow this with a programme of mitigation, as required and informed by the evaluation results and probable development impacts. The advantages of the latter two options revolve around economies of scale and minimising and/or removing disruption to future construction programmes.

4.4 In determining the sample size for investigation, this should reflect the fieldwork aims as outlined in the options above. Any intrusive data from within the proposed development areas will be useful and clearly the greater the sample investigated the greater the reliability of the results. Given the relatively small size of the proposed development areas a sample size of 2.5% by area, with a contingency for a further

0.5% would be readily achievable and this would give some robust data to inform upon both future mitigation strategies/design solutions, and allow selected areas to be removed from the scope of future mitigation. To be clear, the sample size needs to be of sufficient density that where no significant archaeological features or deposits are exposed these areas can be excluded from the scope of any further archaeological mitigation. The proposed strategy requires the excavation (including the contingency) of the following number of testpits (each measuring 2 m by 2 m in plan) within the zones detailed below. There is clearly some flexibility for the samples to be adjusted, to take into account areas already destroyed by recent development.

Zone A – 54 testpits

Zone B – 22 testpits

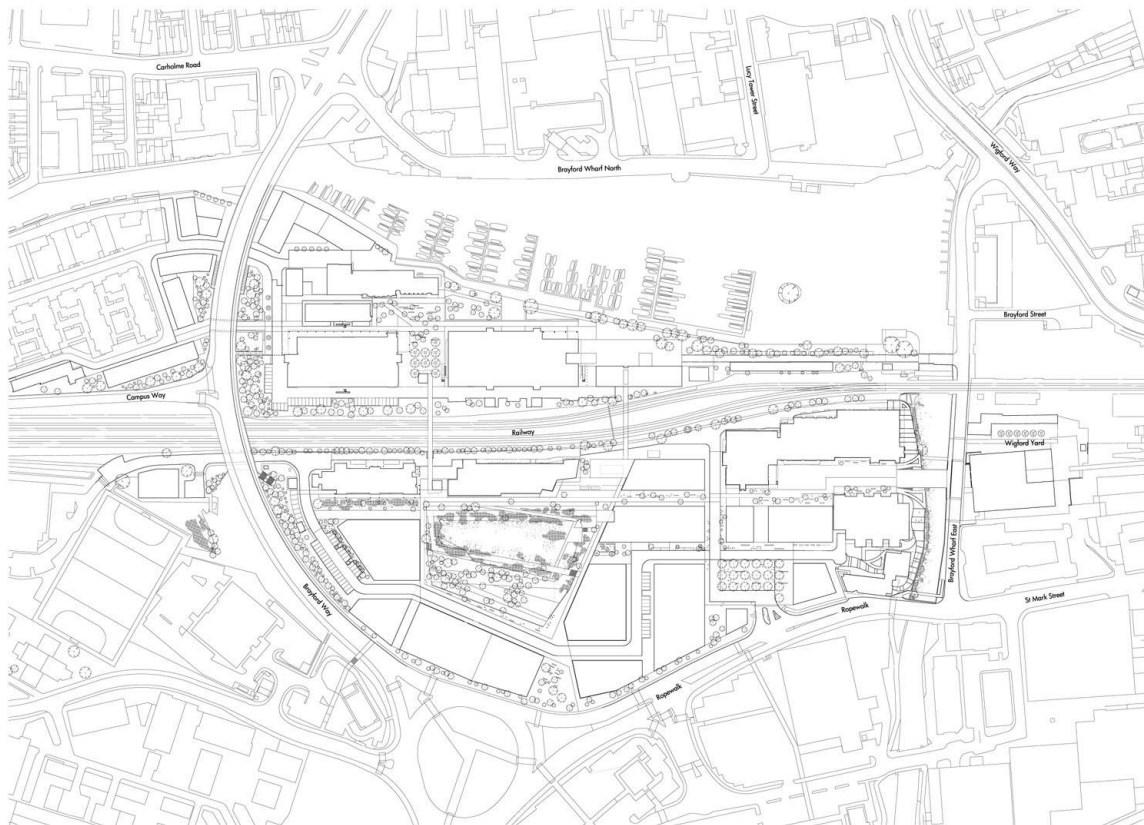
Zone C – 78 testpits

Zone D – 11 testpits

Zone E – 5 testpits

- 4.5 This document is intended to provide a strategic overview of the known archaeology within the site, the potential for further unknown archaeology and to outline various options to respond to that archaeological potential. It is not a detailed Method Statement for archaeological fieldwork and recording. Once the scope of work desired by the University has been resolved upon, an archaeological fieldwork contractor will be appointed. They will be an Institute of Field Archaeologist Registered Archaeological Organisation and they will also have demonstrable experience of carrying out this sort of exercise in fenland locations. It is hoped that the work can be co-ordinated with that of James Rackham and/or that James Rackham can be present during the excavation and recording of the testpits to allow consistency of recording with the wider Palaeoenvironmental programme detailed in Appendix B. In the event that it is not possible for James Rackham to be present during the testpit excavations it is essential that the results of this work are explicitly tied into his model developed for the site.
- 4.6 Once an archaeological fieldwork contractor has been appointed they will produce a detailed Method Statement for the work. They will be provided with current archaeological and service information for the relevant areas and will produce plans of the proposed testpit locations taking into account the known former land use and known constraints. This document or documents will be submitted to the LPA for approval prior to commencement of work on site.
- 4.7 Excavation of the archaeological testpits will be undertaken using a 360° mechanical excavator fitted with a c. 2 m wide ditching bucket. Excavation will be undertaken in a series of controlled spits, under the supervision of a suitably experienced archaeologist.

The most significant archaeological horizon is anticipated to be that sealed beneath the peat. The peat deposits themselves are more appropriately sampled during the proposed palaeoenvironmental coring programme. Where present any buried soil will be separated from the remaining arisings and a minimum of 90 litres of the soil will be sieved through an appropriately sized mesh to facilitate the recovery of artefacts, principally flint. Each testpit will be recorded as appropriate prior to backfilling. Testpits will be backfilled with the arisings loosely compacted. No specialist reinstatement will be undertaken. An illustrated report detailing the findings of the archaeological works will be prepared within 12 weeks of completion of work on site (dependant upon receipt of specialist reports), unless it is decided that there should be a programme of mitigation undertaken following on from the testpitting, in which case one report should be prepared upon completion of all site works to the satisfaction of the City Archaeologist.




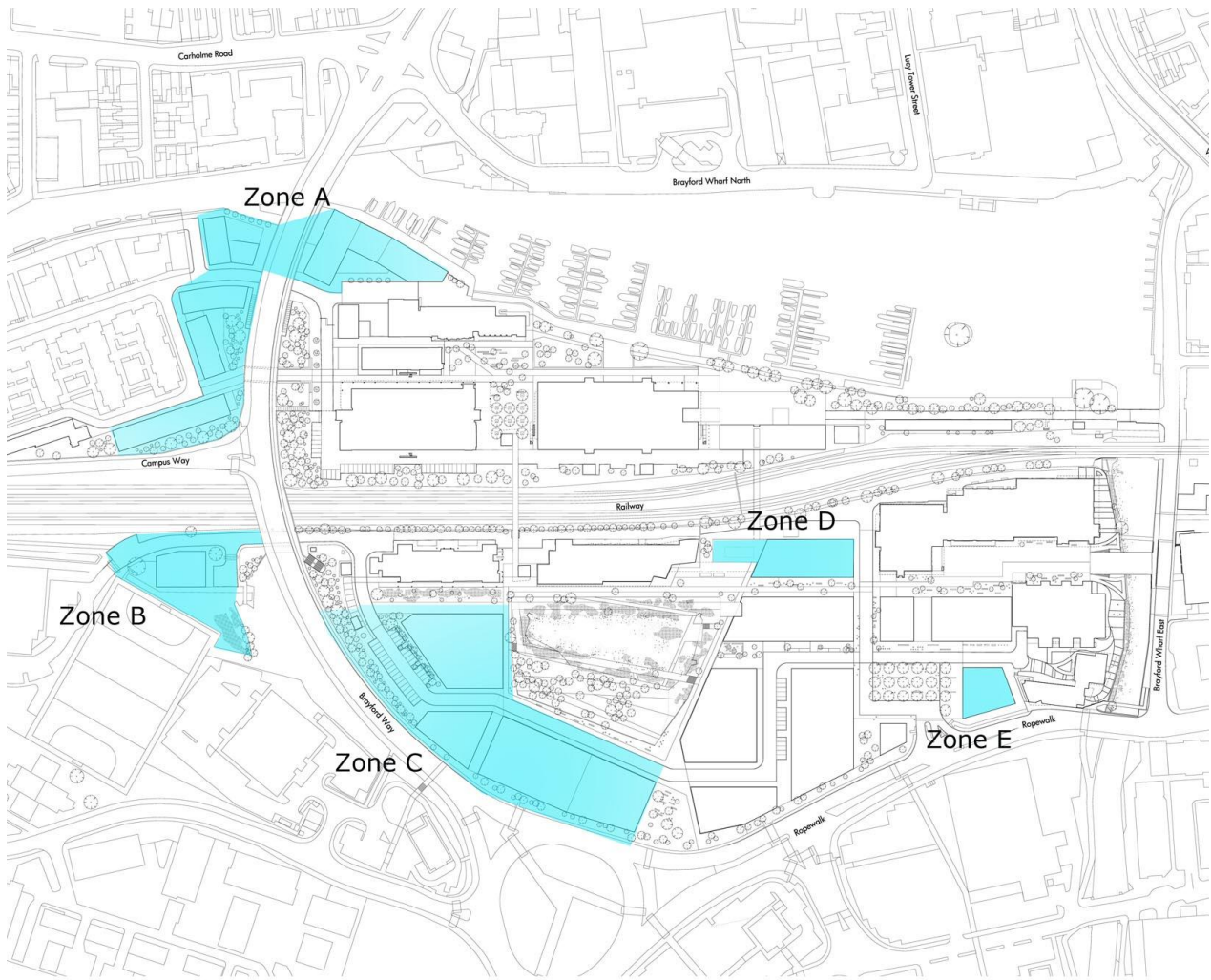
<p>Current Masterplan</p>		London Cheltenham Kettering Newark Birmingham www.cgms.co.uk
		Date printed: 29.09.11

Figure 1 Site location/current Masterplan




<p>Plan of archaeological zones</p>	 <p>London Cheltenham Kettering Newark Birmingham www.cgms.co.uk</p>	
	<p>Date printed: 29.09.11</p>	<p>Drawn by: SM Checked by: MF</p>

Figure 2 Plan showing archaeological zones referred to within this document




<p>Masterplan overlain onto 1967 Ordnance Survey map</p>		<p>London Cheltenham Kettering Newark Birmingham www.cgms.co.uk</p>
		<p>Date printed: 29.09.11</p>

FIGURE 3 Masterplan overlain onto 1967 Ordnance Survey plan

APPENDIX 1

Palaeoenvironmental proposals by James Rackham

Palaeoenvironmental Proposal for the University of Lincoln Brayford Campus

Introduction

The archaeological and palaeoenvironmental potential of the University campus has been broadly outlined in the analysis of the topography of this area of Lincoln City (Rackham 2009). Previous work funded by Lincoln University and adjacent landowners and developers has established that the deposits of the Brayford Pool and those of the Rivers Witham and Till where they flow into the Brayford include sediments spanning from the early Mesolithic right up until post-medieval times (Table 1). Unfortunately many of the projects that have identified and recovered deposit sequences from the University Campus did not receive funds for the post-excavation analysis:

1. University of Lincolnshire, Brayford South, Lincoln. University Phase V Sports Facility.
2. Lincoln University AMC Block
3. Lincoln University, Ruston Way and Pond development
4. Great Central Warehouse, Lincoln University Library
5. Ruston Way, Lincoln University, Accommodation blocks
6. Lincoln University Engine Shed and Performing Arts Building
7. Lincoln University Harbour Cafe site.
8. Lincoln Marina

Only two projects went forward to post-excavation analysis, a developer funded project on Ruston Way (LIWRD09) immediately west of the campus, conducted by M.L.Jarvis in 2009 and part of the palaeoenvironmental analysis (the pollen study) of the deposit sequence revealed during the excavation of the University Pond (LUNY06) in 2006, the latter unfortunately never paid for by the archaeological client. These two projects included the pollen analysis and reconstruction of the vegetational history of the area between the late Bronze Age and the medieval period, with the Ruston Way sequence of only thirteen samples from 50cm of deposit spanning from the early Iron Age to the Saxon period and the sequence of 25 samples from one metre of deposit at LUNY06 spanning over two thousand years from 1200 BC to AD 1300. This latter diagram was undertaken by a recent PhD graduate and the results could be considerably enhanced by a more experienced palynologist studying this period on a longer sequence of sediments.

The results of over a decade of development have established that the Campus and surrounding area holds a regionally important palaeoenvironmental sequence that can throw considerable light of the long term vegetational and landscape history of the area throughout the post-glacial era. Perhaps even more significantly this sequence should allow a good assessment of the impact of the pre-Roman human population in the region and the subsequent development of Lincoln City on the local landscape, in terms of woodland clearances, heathland development, rising groundwater, expansion of agriculture, increasing aerial pollution (a pattern recognizable in the LUNY06 pollen diagram (Wheeler 2009)), the timing of the arrival of certain crops, such as rye and hemp, and the introduction of new species, such as walnut and spruce, and plantations. To have such an extensive sequence on one site so close to a city centre is unusual, not to say unique, for cities in Britain.

The following proposal is to undertake a study of the palaeoenvironmental history of the Brayford Campus site and its surrounding area and the impact of urban development on the landscape, such that this aspect of the archaeological and palaeoenvironmental history of the

site need not be addressed again, piecemeal, as the university proceeds with its building programme.

Current situation

Auger surveys, generally transects, or single cores or test pits have been undertaken on eleven sites on the Campus and immediately adjacent areas. These have included five boreholes running east-west adjacent to the Library (Rackham 2005), mostly heavily disturbed but with early mesolithic sediments at the base (5m depth) in the borehole closest to the river wall. A series of nine boreholes running east-west south of the Engine Shed and Performing Arts buildings (Rackham 2008a) which produced 1.5m of peats and organic river or lake edge silts of middle Bronze Age to Middle Iron Age date. A series of eight boreholes across the Marina carpark (Rackham 2008b) from NNW to SSE which sampled the sediments on the edge of the Brayford Pool and on the north side of the mouth of the River Till. The dated horizons in core BH5a from this series show three metres of organic sediments of late Neolithic through to the post-Roman period. A single core taken adjacent to the Café produced 1.8m of organic muds and peats spanning the period from the late Bronze Age to the twelfth century AD, while the one metre of peat and silts taken from the University Pond (LUNY06 – Wheeler 2009) produced a sequence also from the late Bronze Age to the medieval period. The peats and silty peats sampled in three cores from the Phase V Sports facility project (Rackham 2001) show sediments built up between the late Mesolithic and the medieval period (2.5m of deposit), the middle Bronze Age to the Roman period (approx. 1.5m of deposit), and the early Neolithic to the middle Saxon period (4m of deposit). A monolith sequence from one of the AMC Block test pits produced 0.92m of organic sediments deposited between the late Bronze Age and the 1st century AD (Rackham *et al* 2003). The Ruston Way project in 2004 (RUS04 – Rackham 2004) showed a landscape becoming waterlogged in the late Bronze Age with up to 0.5m of organic sediments above, while the 2009 test pit at the west end of Ruston Way (Rackham and Scaife 2010) produced an old land-surface that became waterlogged in the early Iron Age and built up peats until the late Saxon period.

Although most of these cores were retained they are now of such an age that they are no longer suitable for detailed analysis, due to deterioration through drying out and oxidation, and new cores will need to be obtained to study the palaeoenvironmental history of the University site. Clearly access to the original core sites is no longer possible so a new series of boreholes should be undertaken in those areas of the Campus awaiting development and sited to try and ensure a comprehensive chronological coverage from the early Mesolithic to the post-medieval period.

Natural organic deposits of the earliest period, the Mesolithic, has been found adjacent to the river wall by the Library and north of the all weather pitch on the Sports Facility. Contemporary archaeological evidence has been excavated in the University pond (Rylatt and Field in press). Neolithic sediments are recorded at the latter location, at the extreme west of the sports facility adjacent to the wildlife pond, and at the base of the sequence beneath the Marina carpark. Bronze Age deposits, particularly late Bronze Age occur across a large extent of the Campus and can be expected in most locations, although probably not under the University Green. Roman and Saxon deposits are similarly fairly extensive and can be expected across much of the campus where undisturbed sediments occur, while a Roman landsurface was recorded in a Test Pit at the west end of the AMC Building (Rackham *et al* 2003). Medieval peats have been recorded at the Café site, north of the all weather pitch and in the University pond (LUNY06) sequence, while late medieval and post-medieval deposits

are reflected in the alluvial clays across parts of the site and the buried turf horizon sealed by post-medieval dumping when the site is first developed and the ground level raised.

The topographic survey (Rackham 2009) has alluded to the rising water level and the advance of the developing peats onto progressively higher land around the Brayford Pool and the river margins. The earliest deposits are therefore likely to be present where the organic sediments are deepest, as long as they have remained undisturbed by river channel movement or human activity, and some of the most recent sediments might be expected in the upper fills of former channels of the rivers Till and Witham; for instance 1.6m of well preserved organic mud survive above the dated Roman sediments in BH5a on the Marina site, suggesting that these sediments must have extended into the medieval period. Except in these channel areas the late medieval and post-medieval sediments are alluvial clays that seal the organic sediments, but should nevertheless contain well preserved pollen since many of the deposits are generally not oxidised.

Several of the unstudied sequences are considerably better than the two studied ones. The most information can be gained from sediments that built up more quickly such that one metre representing two thousand years is likely to be less informative than two metres representing two thousand years. The four metre sequence in one of the cores from the Sport Phase V development and the three metre sequence from the Marina site are both examples of longer sequences where a more detailed story, unaffected by preservational problems, is likely to be possible.

Field strategy

Rather than the piecemeal approach that has so far attended the palaeoenvironmental studies on developments of the University Campus site it is proposed that a borehole survey based largely on two transects across the campus would permit the recovery of a series of deposits that should allow the study of most, if not all, of the post-glacial vegetational and landscape history of the University site. It should provide for the recovery of cores from each borehole, and be targeted at those areas that previous work has suggested will be productive of sediments of the whole chronological range, as well as being broadly focused on the future building plots,.

A total of twenty boreholes is provisionally recommended to address the palaeo-environmental history of the site and additionally inform on the depth of post-glacial sediments and made ground dumps overlying the glacial sands in each of the major proposed building plots (see Fig. 1). The location of several of the boreholes is designed to obtain long organic sediment sequences that should include the early, Mesolithic and Neolithic, parts of the sequence, and also the latest. The number of cores proposed is to ensure that we have the highest chance of obtaining as much of the post-glacial sequence as possible as well as contributing information that will influence the decisions on the archaeological evaluation methods for some of the building plots. The precise location of each borehole will be dependent upon any underground services in the immediate area. Each of these boreholes will be taken to a depth of between 3 and 6m and stopped when glacial sands are recovered in the basal core sample. The cores will be collected in 1m length 100mm diameter transparent sleeves for the whole depth of each borehole to ensure the recovery of an adequate sample of sediment from all levels cored. This will necessitate the boreholes being cased to prevent contamination of each subsequent core and remove the need to reduce the sample core size progressively with depth. In order to undertake the coring with the greatest efficiency and least likelihood of individual failure (coring can be unpredictable and can sometimes fail to

recover a complete and intact sequence) a Rotary Unimog mounted rig is recommended. This rig will also allow the drilling out of any hardcore and landfill which might otherwise prevent or slow down the coring.

Because the cores are being removed off site intact the drilling will leave a hole of approximately five inches diameter for the full depth of the borehole which will need to be filled with bentonite (inert dried clay pellets which swell and seal the boreholes when they take up water). Where boreholes are undertaken through tarmac the filled core will be capped with new tarmac, where the boreholes are located on grass, the turf will be removed prior to drilling and replaced after filling the borehole.

Each borehole will be surveyed in using a GPS.

Initial reporting

The cores will need to be split, logged, assessed and radiocarbon dated before any sediments are selected for detailed palaeoenvironmental study.

Stage 1

An approximate total of 75-80m of core is anticipated from the 20 boreholes. These will be split, cleaned, photographed and logged, and two linear sections reconstructed, east-west and north-south, to illustrate the deposit sequences across the campus. These results will be related to existing borehole data and radiocarbon dated deposits and individual cores selected for radiocarbon dating to establish which cores will afford the greatest chronological range of natural post-glacial deposits across the site. An assessment report will detail the results of this work, which cores have been selected for dating, and the horizons sampled for dating.

Stage 2

Upon receipt of the radiocarbon dating results, the assessment report will be revised and recommendations made as to which sequences of deposits from which cores should be taken to full post-excavation palaeoenvironmental analysis. A revised cost estimate for the detailed study of the selected cores will be made at this stage.

Post-excavation analysis

The palaeoenvironmental analyses will be targeted at those cores that contain as much of the post-glacial environmental history of the site as possible.

The primary objectives are threefold:

1. A radiocarbon dated sequence of sediments for as great a proportion of the post-glacial as possible, up to and including the post-medieval alluvial clays on the site.
2. A vegetational history of the site and local region deriving from the pollen analysis of the whole selected sequence.
3. An interpretation of the depositional environment of the deposits, the local landscape history, including the development of the Brayford Pool and the history of the Rivers Till and Witham at this location based upon a consideration of the sediments themselves and the plant and invertebrate macrofossils contained within them.

The methods of analysis may include radiocarbon dating, pollen analysis, microcharcoal concentrations (carbonaceous particles), sedimentary descriptions, loss on ignition, plant macrofossil analysis, insect analysis, molluscan analysis, wood identification.

The results from the analyses will be used to interpret the impact of man on the landscape from the earliest times, particularly with reference to the mesolithic activity already identified on the Campus, and the later prehistory of the area and the development of the historic city. The pattern of evidence for forest clearance and microcharcoal in the sediments should reflect the extent of local settlement activity at different times and the aerial pollution history of the developing urban area. The results may also allow some interpretation of the climate history. The final report will also address and expand the analysis of the topographic history of the site up to the post-medieval period.

Implications

If this work is undertaken then it can be assumed that no intrusive archaeological evaluation or fieldwork will be required for the proposed buildings east of the present University Green, although a watching brief should be implemented on any deep excavations because of the possibility of prehistoric waterside timber structures, boats or early prehistoric activity on the deeply buried palaeosol. This would not be required on excavations no deeper than 1.5-2m and is likely to only be relevant to larger groundworks for structures such as lift pits or significant service trenches. Only the proposed building adjacent to the Sparkhouse Studios and the River Witham may require some evaluation work since the boreholes south of the Library (Rackham 2005) showed early post-medieval material occurring to depths of up to 5m below modern ground level suggesting a possible dock or perhaps the post-medieval scour channel of the Witham. The former is certainly likely to have structural remains defining the dock at relatively shallow depth and their absence would suggest these deposits reflected the old channel.

Although this palaeoenvironmental project would not fulfill all of the archaeological requirements for the future building plans on the campus it would mean that no further palaeoenvironmental work, other than that specifically associated with any cultural remains found, would be required on any of the proposed building plots.

Bibliography and sources for the Radiocarbon dates

- Carrot, J. Hall, A. Issitt, M. Lancaster, S., Kenward, H. and Milles, A. 1994 Evaluation of biological remains from deposits at the University for Lincolnshire site, Brayford, Lincoln (Site code UCL94), EAU report 94/21. In Wragg 1994
- Jones, M.J., Stocker, D. and Vince, A. 2003. *The City by the pool*. Oxbow Books
- Rackham, D.J. 1998 Brayford Wharf East, Borehole Investigation. The Environmental Archaeology Consultancy. Unpublished report for the CLAU
- Rackham, D.J. 1999 University of Lincolnshire, Brayford South, Lincoln. University Phase III Accommodation. Unpublished report for the CLAU
- Rackham, D.J. 2001 Brayford North, Lincoln – LBN00. Evaluation of the sedimentary sequence. Unpublished report for John Samuels Archaeological Consultants
- Rackham, D.J. 2001. University of Lincolnshire, Brayford South, Lincoln. University Phase V Sports Facility. Assessment of the borehole investigations. Unpublished report for the CLAU.
- Rackham, D.J. 2004 Ruston Way, Lincoln. Auger Survey. Unpublished report for PCA, Lincoln.
- Rackham, D.J. 2005 Great Central Warehouse, Lincoln University Library. Report on the Auger Survey and palaeo-environmental work. Unpublished report for LAS
- Rackham, D.J. 2006. Lincoln University Harbour Cafe site. Unpublished report for LAS.

- Rackham, D.J. 2008a. Lincoln University Engine Shed and Performing Arts Building. Auger Survey Report. Unpublished report for LAS.
- Rackham, D.J. 2008b. Lincoln Marina. Auger Survey. Unpublished report for LAS.
- Rackham, D.J. 2009 The Palaeotopography of the Lincoln University Campus, Brayford, Lincoln. Unpublished report for the University of Lincoln
- Rackham, D. J., Scaife, R.G. and Gale, R. 2003 Lincoln University AMC Block Environmental Archaeology Assessment. Unpublished report for CLAU.
- Rackham, D.J., Tyers, I. and Wheeler, J. 2008 Lincoln University Palaeoenvironmental Report, University Pond. Unpublished report.
- Scaife, R.G. and Rackham, D.J. 2010 Ruston Way, Lincoln – LIWRD09. Unpublished post-excavation report for M.L.Jarvis
- Rylatt, J. and Field, N. in press Lincoln University: Excavation of the delph pond. In D.J.Rackham and J.Williams (eds) *Ebb and flow. The Archaeology, environment and History of the River Witham*. Witham Valley Archaeology Research Committee.
- Wheeler, J. 2009 Palynological assessment of a monolith sequence from Lincoln University (site code: LUNY06). Unpublished report for the Environmental Archaeology Consultancy
- Wragg, K. 1994 Site of Proposed University College of Lincolnshire, Brayford South, Lincoln; Archaeological recording. CLAU Archaeological Report No. 106

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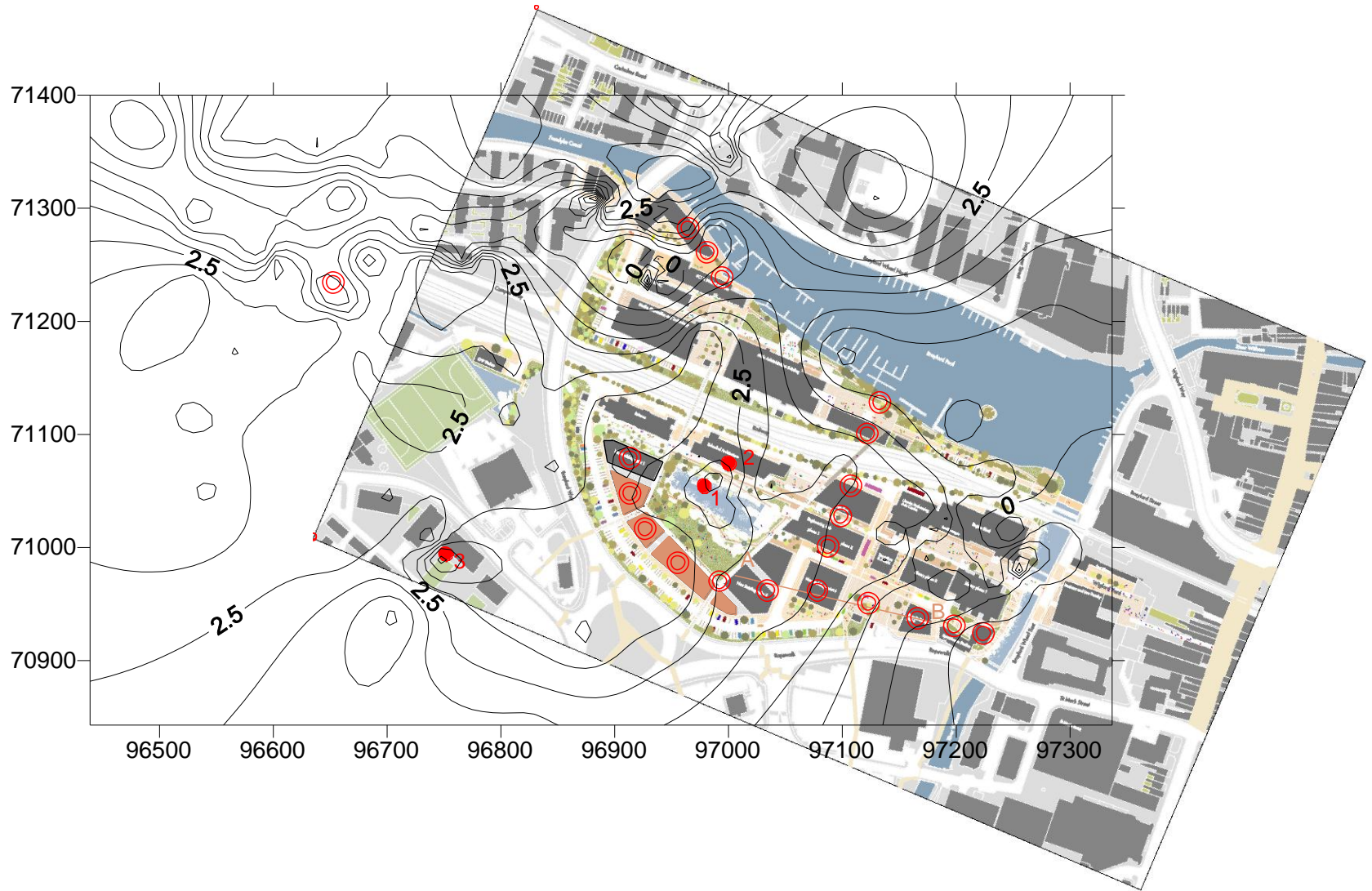
Revised 15th December 2011

Table 1: Radiocarbon dates from the University of Lincoln Brayford Campus and adjacent areas, arranged in chronological order.

Lab No.	Site		material	C14 measure	Approx. Height OD *		Calibrated date at 95% confidence
Beta-204135	Great Central Warehouse	BH1	Peat	8020±60	0.04m ch.		BC 7030-6660
Beta-204195	LinsUNIV	BH1	Peat	7970±60			BC 7070-6680
Beta-155290	Lincoln Univ. Ph. V	BH2	Peat	7420±40	0.7m OD sand		BC 6390 - 6220
	Lincoln Univ. Eval.	TP 33	Peat	4800±50	Between 1.74-2.14m OD		BC 3698 - 3382
Beta-155292	Lincoln Univ. Ph. V	BH3	Peat	4650±100	1.1m OD sand		BC 3650 -3090
Beta-222895	University pond	6	Hazelnut	4020±40	3.25m OD dry		BC 2620-2460
Beta-222896	University pond	8	Hazelnut	4010±40	3.25m OD dry		BC 2600-2460
Beta-244197	Marina	BH5a /500	Wood	3820±40	0.29m OD ch.		BC 2450-2140
Beta-155288	Lincoln Univ. Ph. V	BH1	Peat	3170±40	1.57m OD sand		BC 1520 - BC 1390
	Lincoln Univ. Eval.	TP 33	Peat	3100±60	Between 2.14 and 4.14m OD		BC 1515 - 1223
Beta-244184	Engine Shed	BH3	Wood	3150±40	1.0m OD ch.		BC 1500-1380, 1330-1330
Beta-157534	Brayford North	BH2	Peat	3020±60	0.85-0.95m OD silt		BC 1410 to 1060
Beta-217901	Café	4/0-5	Wood	3010±40	0.76m OD ch.		BC 1390-1120
Beta-244194	University Pond	2/34-36	Twig	2930±40	2.28m OD sand		BC 1270-1010
Beta-171899	Lincoln Univ. Ph. 6	5-10	Wood	2920±40	2.29m OD sand		BC 1200 - 940
Beta-244193	University pond	2/16-19	Wood	2850±40	2.46m OD marsh		BC 1120-910
Beta-217903	Café	6/49-51	Wood	2780±40	0.22m OD ch.		BC 1010-830
Beta-196800	Ruston Way	TP25	Peat	2740±60	2.81-2.91m sand		BC 1010-800
Beta-244186	Engine Shed	BH8	Wood	2730±40	1.89m OD sand		BC 970-960, 940-810
SUERC30060	Ruston Way		Peat	2695±40			BC 920-790
Beta-196799	Ruston Way	TP11	Peat	2590±40	3.02-3.12m sand		BC 820-770
Beta-244185	Engine Shed	BH4	Wood	2580±40	1.8m OD ch.		BC 810-750, 680-670, 610-600
Beta-244196	Marina	BH5a /400	Gyttja	2020±40	1.28m OD ch.		BC 150-140, BC 110-AD 60
Beta-171900	Lincoln Univ. Ph. 6	75-80	sediment	1960±60	3.01m OD marsh		BC 80 - AD 150
Beta-155287	Lincoln Univ. Ph. V	BH1	Peat	1980±40	2.6m OD marsh		BC 50 - AD 100
Beta-244192	University pond	1/22-24	Peat	1920±40	2.9m OD marsh		AD 10-140
Beta-155291	Lincoln Univ. Ph. V	BH3	Peat	1270±60	3.03m OD marsh		AD 650 - 890
Beta-157533	Brayford North	BH2	Peat	1260±60	2.22-2.32m OD marsh		AD 660 to 900
SUERC30059	Ruston Way		Peat	1140±40			AD 770-990
Beta-217902	Cafe	3a	Org sed.	780±40	1.8m OD ch.		AD 1190-1290
Beta-155289	Lincoln Univ. Ph. V	BH2	Peat	730±60	2.7m OD marsh		AD 1200 - 1320 and AD 1350 - 1390
Beta-244191	University pond	1/0-5	Peat	620±40	3.14m OD marsh		AD 1280-1410

* The entry after the height in the OD column refers to the deposits underlying the dated horizon, or whether the sediments lay within a channel. Only dates that have 'sand' in this column are likely to reflect a contemporary surface level for the date!

Figure 1. University Plan with contour plot of underlying sands superimposed and suggested locations of boreholes for sample cores (double circles)



APPENDIX 2

Palaeotopographical survey report by James Rackham

The Palaeotopography of the Lincoln University Campus, Brayford, Lincoln

Introduction

Archaeological investigations across the campus of Lincoln University, in advance of the construction programme, have in general been fairly limited. Most interventions have involved auger surveys, small test pits or evaluation trenches. Archaeological findings in these interventions have also been fairly limited, with occasional features along Ruston Way, a buried soil with abundant Roman pottery fragments beneath the AMC building (Fig. 1, 2), and most recently a Mesolithic site (Fig. 1, 1) in the university pond. Despite this relative lack of physical archaeological remains most archaeological monitoring has revealed an extensive palaeoenvironmental record of organic sediments and peats that extends back into the Mesolithic period and indicates that the Brayford Pool is an ancient feature, having existed, in some form or other, for several thousand years (French and Rackham 2003). A further result of the auger surveys and geotechnical investigations was the discovery of the former course of the River Till (Fig 1; French and Rackham 2003), a channel that appears to have become redundant and slowly infilled after the construction of the Fosdyke Navigation.

The discovery of a Mesolithic site on a low sand ridge in the university pond (Fig. 1; Rylatt and Field, in press) has however raised the probability of archaeology occurring on the as yet undeveloped areas of the campus. The geotechnical and borehole data have therefore been re-evaluated in order to determine where this probability is highest in order to inform the archaeological assessment of the future development areas.

Methods

The initial topographic survey of the site was produced by the author in 2001 (French and Rackham 2003). Since then additional data has become available and the image revised. It is unfortunate that a considerable number of the geotechnical boreholes that were conducted during the initial site investigation work in the early 1990's and subsequently have no modern ground surface levels recorded. This has meant that they could not be utilised in this analysis, because although the depth of the deposits recorded is noted in the logs, without the surface height of the borehole the data is useless. A total of some 300 test pits and boreholes have been undertaken across the University site, and logs are available for all of them, and for most their location can be obtained from maps and plans, although few have records of their OS grid coordinates. Accurate or approximate (to the nearest 0.1-0.2m) surface levels were obtained for 166 of these, which form the basis of the palaeotopographic reconstruction. Few data were obtained for the area north of the Brayford Pool, so in this area the model should be viewed as incomplete, and probably inaccurate.

The underlying geology across the site is fluvio-glacial sands, so that, in all the boreholes selected for inclusion in the study, the Ordnance Datum was calculated for the upper surface of these sands and taken to reflect the approximate postglacial ground surface or channel floor prior to the build up of organic and silt rich sediments. The data have been processed using 'Surfer', a piece of software designed, among other things, to produce contour plots. Figure 1 presents the contour plot based upon the upper surface of the underlying sands for the 166 boreholes with surface height data. This image represents an approximate model for the underlying ancient ground surface (palaeosol), prior to the deposition of later sediments, and the floor and banks of the river channels and pool. The Fosdyke, Ropewalk, Brayford Way and university pond are mapped to help locate the topographic model.

Results

During the history of the site the water table has gradually risen, largely due to both changes in sea level and ponding back, probably partly caused by the extensive development of marshes, bogs and their associated peats in the lower Witham below the Lincoln Gap. This has resulted in a build up of organic silts in the former channels of the Rivers Witham and Till, and the formation of peripheral marshes along the margins of these rivers and the Brayford Pool, which have developed into peats and slowly expanded the areas of wet ground and marsh around the Brayford Pool. Subsequently late medieval and post-medieval drainage, and 19th century ground raising (through extensive dumping and deposition of clays and sands) raised the ground level sufficiently above the watertable to prevent the continued formation of peat.

The OD height for all the radiocarbon dated deposits has been included in Table 1. Of these, the samples deriving from channels and 'marsh' deposits give no clue to the actual surface level of the marsh, due to drying out and shrinkage, or the contemporary water level of the channels. However where the date has been obtained from organic sediments (peats or silts) immediately overlying the fluvio-glacial sands they do give an indication of when the palaeosol or contemporary land surface first became waterlogged or inundated. Eight of the radiocarbon dates have been obtained from deposits immediately overlying sands (see Table 1). These data suggest that already by the late Mesolithic (*c.* 6000 BC) the marsh deposits had crept over ground above 0.5m OD and by the Neolithic (*c.* 3500 BC) the water table had risen to such an extent that ground above 1.0m OD had become waterlogged. By the middle Bronze Age (*c.* 1400 BC) sands at 1.5m OD were being covered by peats. There appears to be a remarkable increase in peat growth and rising water-tables over the next millennium. By the later Bronze Age peats were forming over previously dry land surfaces at 2.2m OD and by 1000BC this had risen to 2.8m OD. At Ruston Way peat that had formed over sands at just over 3.0m OD has been dated to BC 820-770 suggesting that this landscape beneath the University had become almost completely covered by marsh at the start of the Iron Age. The fact that a buried soil horizon of Roman date was recorded during the evaluation of the AMC Block at a height of approximately 4.0m OD indicates that at least by the Roman period the area was accessible and used for agriculture and a drier climate at the end of the 1st millennium BC may have caused dessication and shrinkage of the upper peats around the Brayford.

These dates suggest that in terms of the topographic model (Fig. 1) the land below the 2m contour around the Brayford was probably already covered by peats in the late Bronze Age. By the early Iron Age (700-800 BC) the peats had extended over the 3.0m contour. The period of drying at the end of the 1st millennium BC may then have led to drying out of the marshes and peat shrinkage, allowing the area to be cultivated.

Most of the archaeology might be expected to lie on the dry ground, although sites such as Star Carr (Milner 2007) illustrate that the lake edge environment was also important and artefactual and environmental debris from Mesolithic and later occupation could occur in the peats developing along the margins of the rivers and pool. The *in situ* dry land archaeology so far recorded on the University site lies above the 2.5m contour of the ancient ground surface. This is Mesolithic (Fig. 1 site 1) and Roman (fig. 1 site 2), but two late Neolithic radiocarbon dates on charred hazelnut shell from the University Pond site (site 1) also suggest some occupation at this date. This evidence is grouped on the eastern side of a small plateau of sands that rises above 3.0m OD. An unexpectedly high record for sands in a borehole on the south western corner of this plateau (a single record with sand a metre higher than

elsewhere - Fig. 1, site 3) might suggest a barrow at this location, but unfortunately no archaeological work has been undertaken in this area.

The banks and levees of the River Witham have been favoured locations for barrows, and this plateau between the confluence of two rivers may have been a suitable location. Two other boreholes on this plateau record sands at a slightly higher level, including one on the University Green, and the latter may warrant investigation during any development works.

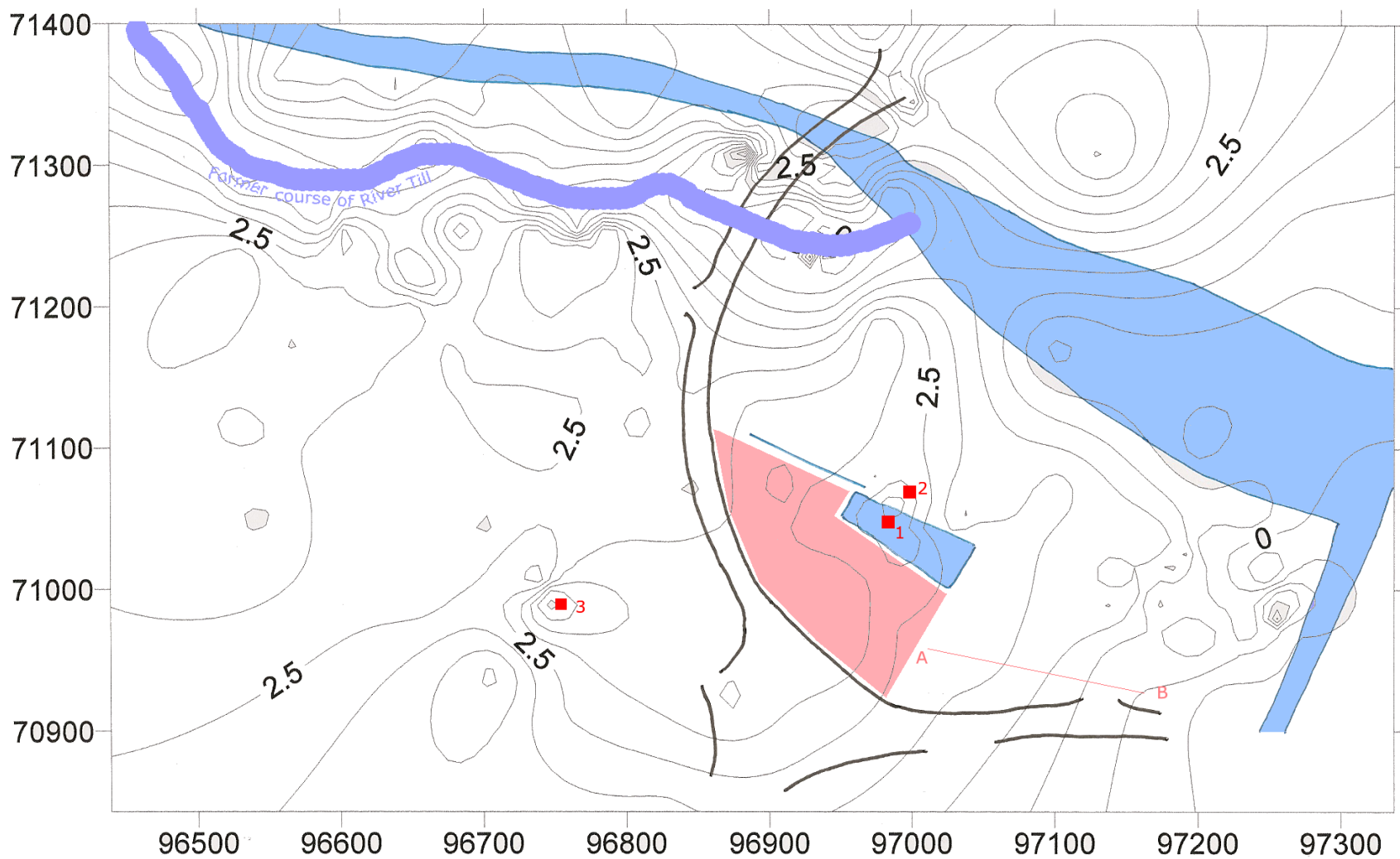
One of the most important archaeological studies on the university site relates to the environmental archaeology. Deposits within the Brayford Campus have yielded radiocarbon dates on peats and silts from 7000 BC to AD 1400, an eight thousand year environmental history of Lincoln! This includes deposits contemporary with the Iron Age activity beneath Wigford, and the development of the Roman and medieval cities (Jones *et al* 2003). On the north side of the Brayford the deposits at Brayford Wharf North (Carlyle and Atkins 2009) show the direct sequence from the organic pool margin deposits to reclamation and occupation in the 10th century AD.

The early deposits are preserved at some depth in the former channels and channel margins of the Rivers Witham and Till, and along the edges of the Brayford Pool. The latest deposits, those of post-Roman date, have not survived well across the marsh areas because they have dried out and been lost during the drainage over the last two hundred years, although the sequence of organic deposits in the University Pond extended into the medieval period, where the medieval and post-medieval deposits had been sealed beneath clays and dumps of 19th century date. So far the only detailed study of this environmental sequence has been on the deposits from the University Pond (Rackham *et al* in press), where a depth of 1m of organic silts and peats represents a period of some two and a half thousand years, extending back into the late Bronze Age. To discover deposits of earlier date samples need to be collected from deposits below the 2m contour of the ancient topography model, and the most recent periods may survive in areas that were low lying in the post-medieval period when the site was reclaimed for industrial use and the railways.

Archaeological potential of development areas

The university green to the south of the Science and Architecture buildings, and Harrison House, is available for development. The eastern part of this area has an ancient topography below 2.5m OD and drops towards the ancient course of the River Witham to the east. Although a Mesolithic date has been recorded at the base of the sequence beneath the Library (Rackham 2005) this area had been severely truncated by recent (post-medieval) activity, possibly the digging of a dock or scour by the Witham channel. However a more extended palaeoenvironmental sequence than those so far studied (Rackham, Scaife and Gale 2003; Rackham *et al* in press) might be expected in the area west of Sparkhouse Studios, before the underlying topography rises up to the 2.5m contour. If any development is intended in this area it is best evaluated by conducting a series of auger holes along a transect from Sparkhouse Studios to the university green (A-B on Fig. 1), up to the approximate line of the 2.5m contour or just above.

Figure 1. Topographic model of the fluvioglacial sand surface beneath holocene organic sediments and later dumping beneath the Lincoln University Brayford Campus.



The whole of the western area of the green and the existing carpark area bordering it has an ancient topography that lies above the 2.5m contour and may therefore have some surviving dry land archaeology beneath the prehistoric and more recent sediments and overburden. With a present day ground surface at approximately 5m OD most of the deposits that are likely to be significant (except for possible barrows) lie at a depth of 1.5 to 2m. If development can be undertaken with a minimal impact on deposits below 1.5m then, apart from limited mitigation work, archaeological investigation may not be required. To improve the accuracy of the topographic model in this area and establish a more accurate assessment of the depth of the overburden it may be appropriate to lay out a grid across the proposed development areas and undertake mechanical augering to review the deposits in this area and potentially identify any palaeosol (ancient land surface) or archaeological deposits, or the existence of any barrows. This survey would inform any proposed evaluation trenches in those areas under threat from proposed building where the construction will impact upon deposits deeper than 1.5m.

Bibliography

- Carlyle, S. and Atkins, R. 2009 *Medieval land reclamation at Brayford Pool, Lincoln. Archaeological excavation at the Brayford Centre 2000*. BAR British Series 498.
- Carrot, J. Hall, A. Issitt, M. Lancaster, S., Kenward, H. and Milles, A. 1994 Evaluation of biological remains from deposits at the University for Lincolnshire site, Brayford, Lincoln (Site code UCL94), EAU report 94/21. In Wragg 1994
- French, C. and Rackham, D.J. 2003 Palaeoenvironmental Research Design for the Witham Valley. In S.Catney and D.Start (eds) *Time and Tide The Archaeology of the Witham Valley*. Witham Valley Archaeology Research Committee.
- Jones, M.J., Stocker, D. and Vince, A.2003. *The City by the pool*. Oxbow Books
- Milner, N. 2007 Fading Star. *British Archaeology*, October 2007, 10-14
- Rackham, D.J. 1998 Brayford Wharf East, Borehole Investigation. The Environmental Archaeology Consultancy. Unpublished report for the CLAU
- Rackham, D.J. 1999 University of Lincolnshire, Brayford South, Lincoln. University Phase III Accommodation. Unpublished report for the CLAU
- Rackham, D.J. 2001 Brayford North, Lincoln – LBN00. Evaluation of the sedimentary sequence. Unpublished report for John Samuels Archaeological Consultants
- Rackham, D.J. 2001. University of Lincolnshire, Brayford South, Lincoln. University Phase V Sports Facility. Assessment of the borehole investigations. Unpublished report for the CLAU.
- Rackham, D.J. 2004 Ruston Way, Lincoln. Auger Survey. Unpublished report for PCA, Lincoln.
- Rackham, D.J. 2005 Great Central Warehouse, Lincoln University Library. Report on the Auger Survey and palaeo-environmental work. Unpublished report for LAS
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- Rackham, D.J. 2008a. Lincoln University Engine Shed and Performing Arts Building. Auger Survey Report. Unpublished report for LAS.
- Rackham, D.J. 2008b. Lincoln Marina. Auger Survey. Unpublished report for LAS.
- Rackham, D. J., Scaife, R.G. and Gale, R. 2003 Lincoln University AMC Block Environmental Archaeology Assessment. Unpublished report for CLAU.
- Rackham, D.J., Scaife, R., Tyers, I. and Wheeler, J. in press The Brayford Pool, topography and environmental history, recent work. In D.J.Rackham and J.Williams (eds) *Ebb*

and flow. The Archaeology, environment and History of the River Witham. Witham Valley Archaeology Research Committee.

Rylatt, J. and Field, N. in press Lincoln University: Excavation of the delph pond. In D.J.Rackham and J.Williams (eds) *Ebb and flow. The Archaeology, environment and History of the River Witham.* Witham Valley Archaeology Research Committee.

Wragg, K. 1994 Site of Proposed University College of Lincolnshire, Brayford South, Lincoln; Archaeological recording. CLAU Archaeological Report No. 106

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30 October 2009

Revised December 2011

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	Lincoln Univ. Eval.	TP 33	Peat	4800±50	Between 1.74-2.14m OD	BC 3698 - 3382
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Beta-222896	University pond	8	Hazelnut	4010±40	3.25m OD dry	BC 2600-2460
Beta-244197	Marina	BH5a /500	Wood	3820±40	0.29m OD ch.	BC 2450-2140
Beta-155288	Lincoln Univ. Ph. 3	BH1	Peat	3170±40	1.57m OD sand	BC 1520 - BC 1390
	Lincoln Univ. Eval.	TP 33	Peat	3100±60	Between 2.14 and 4.14m OD	BC 1515 - 1223
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Beta-157534	Brayford North	BH2	Peat	3020±60	0.85-0.95m OD silt	BC 1410 to 1060
Beta-217901	Café	4/0-5	Wood	3010±40	0.76m OD ch.	BC 1390-1120
Beta-244194	University Pond	2/34-36	Twig	2930±40	2.28m OD sand	BC 1270-1010
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Beta-244193	University pond	2/16-19	Wood	2850±40	2.46m OD marsh	BC 1120-910
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Beta-244186	Engine Shed	BH8	Wood	2730±40	1.89m OD sand	BC 970-960, 940-810
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Beta-244196	Marina	BH5a /400	Gyttja	2020±40	1.28m OD ch.	BC 150-140, BC 110-AD 60
Beta-171900	Lincoln Univ. Ph. 6	75-80	sediment	1960±60	3.01m OD marsh	BC 80 – AD 150
Beta-155287	Lincoln Univ. Ph. 3	BH1	Peat	1980±40	2.6m OD marsh	BC 50 - AD 100
Beta-244192	University pond	1/22-24	Peat	1920±40	2.9m OD marsh	AD 10-140
Beta-155291	Lincoln Univ. Ph. 3	BH3	Peat	1270±60	3.03m OD marsh	AD 650 – 890
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