RESEARCH REPORT SERIES no. 26-2012

HAILES ABBEY, STANWAY, GLOUCESTERSHIRE
HAILES ABBEY CULVERT EVALUATION ASSESSMENT REPORT

Andrew Lowerre

INTERVENTION AND ANALYSIS

ENGLISH HERITAGE

This report has been prepared for use on the internet and the images within it have been down-sampled to optimise downloading and printing speeds.

Please note that as a result of this down-sampling the images are not of the highest quality and some of the fine detail may be lost. Any person wishing to obtain a high resolution copy of this report should refer to the ordering information on the following page.

Research Report Series 26-2012

HAILES ABBEY
STANWAY
GLOUCESTERSHIRE

Hailes Abbey Culvert Evaluation Assessment Report

Compiled by Andrew Lowerre

NGR: SP 0503 3001

ISSN 2046-9799 (Print)
ISSN 2046-9802 (Online)

The Research Report Series incorporates reports by the expert teams within the Investigation & Analysis Division of the Heritage Protection Department of English Heritage, alongside contributions from other parts of the organisation. It replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series, the Architectural Investigation Report Series, and the Research Department Report Series.

Many of the Research Reports are of an interim nature and serve to make available the results of specialist investigations in advance of full publication. They are not usually subject to external refereeing, and their conclusions may sometimes have to be modified in the light of information not available at the time of the investigation. Where no final project report is available, readers must consult the author before citing these reports in any publication. Opinions expressed in Research Reports are those of the author(s) and are not necessarily those of English Heritage.

Requests for further hard copies, after the initial print run, can be made by emailing:
Res.reports@english-heritage.org.uk
or by writing to:
English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD
Please note that a charge will be made to cover printing and postage.

SUMMARY

Hailes Abbey, Gloucestershire, founded in 1245, was one of the last Cistercian houses to be established in England. To the south-east of the surviving claustral buildings is a large, rectangular area, thought to be a former pond. The nature of the 'pond' was unclear, as was the survival of any remains of the monastic culvert and associated structures in the area which are not currently exposed.

The discovery of part of a masonry-revetted dam and the sediments observed in a test pit demonstrate conclusively that the 'pond' was an artificial water body. Radiocarbon dates from near the bottom of the sediment sequence show that the pond was medieval in date. The pond probably dried out or silted up rapidly following the Dissolution and no longer existed by the late 16th century. Significant archaeological remains survive very near the surface immediately to the south-east of the standing remains of the abbey. The culvert does survive and continues further to the south-east, towards the pond.

It is recommended that any flood mitigation works at Hailes Abbey be preceded by controlled archaeological excavation to recover artefactual and environmental evidence and record any features that would be affected by those works.

CONTRIBUTORS

Polydora Baker, Kayt Brown, Gill Campbell, Greg Campbell, Chris Evans, Emily Forster, Damian Goodburn, Karla Graham, D A Higgins, John Meadows, Sarah Paynter, David Earle Robinson, Sandra Rowntree. Except where indicated, all illustrations are by Andrew Lowerre.

ACKNOWLEDGEMENTS

My thanks to all the colleagues involved in the successful completion of this project, both in the field and during the post-fieldwork assessment. Particular thanks are due to the fieldwork team, the Site Supervisor, Duncan Stirk, and the Finds/Environmental Supervisor, Foxy Demeanour, who was the holder of placement on the English Heritage Professional Placements in Conservation (EPPIC) scheme. I am also very grateful to all the specialists who carried out the assessments of particular types of material, and especially Gill Campbell, David Earle Robinson and Emily Forster for their work on interpreting the sediments from the pond and demonstrating the information they can reveal. Finally, thanks to Mel Barge, Inspector of Ancient Monuments, and Niall Morrissey, Technical Manager for Hailes Abbey, for their assistance throughout the course of the project.

ARCHIVE LOCATION

The project archive is currently held at Fort Cumberland. Upon completion, the project archive will be deposited with English Heritage West Territory Curatorial team.

DATE OF EXCAVATION

August-September 2006

CONTACT DETAILS

English Heritage, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth, PO4 9LD.
Andrew Lowerre Tel: 02392 856765 Email: andrew.lowerre@english-heritage.org.uk

CONTENTS

LIST OF TABLES

LIST OF FIGURES

BACKGROUND

Site location and description

Hailes Abbey is located at SP 0503 3001, in the north-western foothills of the Gloucestershire Cotswolds. It lies in a secluded position off the B4632 between Cheltenham and Broadway, and approximately 2.5km north-east of the small market town of Winchcombe (see Figure 1). The site is adjacent to a tributary of the River Isbourne on the lower slopes of a north-west facing coomb.

The underlying solid geology is Lower Lias clay (British Geological Survey 2001). The drift geology in the immediate area of the abbey is of the Denchworth association, made up of slowly permeable but seasonally waterlogged clayey soils with similar fine loamy over clayey soils, occasionally mixed with some slowly permeable calcareous clayey soils. On the higher ground around the abbey, the soil is of the Oxpasture association: a fine loamy clay soil giving way to brash calcareous soils on the Cotswold Hills. To the north-west of the abbey, toward the River Isbourne, the soils are well-drained fine loams overlying river terrace gravels (Soil Survey of England and Wales 1983).

Historical background

A Cistercian religious house dedicated to St Mary, Hailes Abbey was founded by Richard, Earl of Cornwall in 1245, with the first monks arriving from its mother house at Beaulieu Abbey (Hampshire) the following year. Hailes was one of the last Cistercian houses to be founded in England. The abbey church was rebuilt by 1277 following the receipt of a phial of the 'blood of Christ,' which made the abbey a great centre of pilgrimage. At this time Hailes was one of the richest houses of the Cistercian order in England. Following the Dissolution, the abbey was sold to a dealer in monastic properties, soon after which the church was demolished. In the later 16th and 17th centuries, much of the west range and the abbot's lodging became the home of the Tracy family, and it was at this time that landscaping altered the appearance of much of the area of the precinct. The Tracys moved on in 1729 and the buildings were converted into two farms. The monument was donated to the National Trust in 1939, and since 1950 has been a guardianship site in the care of English Heritage and its predecessor bodies.

The monument

The extant remains of the abbey, which are Listed Grade I, show that it followed a typical Cistercian layout. The valley in which the abbey lies was provided with an ample water supply in the form of a number of streams, which the monks utilised to feed the fishponds and the monastic buildings. A head of water was created by damming a stream further up

the valley; this was enlarged in the mid-nineteenth century to create a supply of water for the local railway station at Toddington to the north-west.

At the south-east corner of the standing remains lies the monks' latrine, flushed by a substantial, stone-built culvert. The culvert runs from south-east to north-west under the abbey. From the latrine to its outflow to the north-west of the monument, the culvert is open; it is blocked by gabions at the south-east corner of latrine. It is not clear how far and in what direction the culvert runs further to the south-east. To the east and west of the monument, earthwork and geophysical surveys have indicated the presence of a variety of features relating to the monastic precinct beyond the claustral ranges and to probable post-Dissolution landscaping (see Coad 1993; Brown 2006; David 1981; Elk 2006).

To the south-east of the site is a large rectangular silted up area, thought to be an old pond through which a small stream flows from the dam and into the culvert. The rectangular 'pond' is very wet, though the stream appears to follow a well established course through it.

The dating of the rectangular 'pond' is unclear: recent analytical earthwork survey suggested that the 'pond' may postdate other landscape features, ie, medieval fishponds and seventeenth century garden features (see Brown 2006). The results of coring undertaken in 2006 suggested the rectangular area may not have been a man-made pond, but rather a marshy area adjacent to the slow-moving stream which fed the monastic culvert (see Swindle and Green 2006).

The rectangular 'pond' area is not depicted on the earliest OS 1:2500 map of the area around the abbey, first published 1884. A rectangular depression with a roughly oval extension off its south-west corner is shown on the next OS 1:2500 map, published in 1902. This depression, labelled 'Fish Pond,' generally corresponds to the current, fenced-off rectangular 'pond' area . The same feature is shown on the OS 1:2500 map published in 1923.

Comparison of the current ground level with the contours shown on the 1976 topographic survey of the site suggests that the area between the exposed culvert and the rectangular 'pond' area to its south-east may have been re-landscaped. The level of the ground surface appears to have been raised, possibly by the deposition of spoil and/or rubble from excavation and consolidation works elsewhere on the site

Previous research

Previous work on the site has consisted of documentary research, excavation at the turn of the twentieth century and in the 1960s and 1970s, geophysical survey, aerial photographic survey, analytical earthwork survey and palaeoenvironmental assessment through coring.

Documentary research

The history of Hailes Abbey and the cult of the Holy Blood there has been usefully summarised by Brown (2006, 11-16).

Graham Brown, in his research relating to the analytical earthwork survey carried out in 2005, undertook documentary research at the Gloucestershire Record Office and the National Archives in Kew. The highlight of this work has been the discovery at the National Archives of a map dating to around 1587 (Brown 2006, 16-20). This map, dating to less then fifty years after the abbey's suppression, is extremely important. It depicts in considerable detail the land-use, water management, roads and tracks and buildings – many of them surviving monastic structures – in the area around the abbey. Especially noteworthy is the fact that this map does not depict the rectangular 'pond' area to the south-east of the surviving abbey buildings.

Previous excavation

Excavation was first undertaken at Hailes Abbey at the turn of the 20th century by the Bristol and Gloucestershire Archaeological Society. The excavations, in 1899 and 1900, were lead by the Revd William Bazeley and Welbore St Clair Baddeley (see Bazeley 1899; Baddeley 1908). The work carried out was typical of the period, in that the goal was to clear the site and recover the plan of the church and its associated claustral buildings (Greene 1992, 37-42).

Baddeley (1908) published a plan based on the excavations. This plan indicated that the abbey followed a common Cistercian layout, with the cloister lying to the south of the church. The plan is curious in that it shows the alignment of the culvert and attached latrine at the south-east corner of the cloister, as well as traces of walls and the infirmary, skewed to the south east. The surviving elements of the culvert and the latrine as they exist today clearly extend at right angles from the monks' dormitory. The nature and date of the stubs of walls branching off from the culvert and latrine on Baddeley's plan are unclear.

Further 'clearance' and consolidation of the site, including the south-east corner of the cloister, the culvert and the latrine, took place in the 1960s, as indicated by photographic records held in the NMR (see NMR photographs AL0715/A6718/1- AL0715/A6718/22, dated 4 February 1965).

Further excavation was carried out in the 1970s by the (then) Department of the Environment, under the direction of T J Miles, Anthony Musty and P J Brown. This work consisted of clearance and conservation of the east end of the abbey church and the east range, re-excavation of the south-west corner of the cloister and of the west range of the church and monitoring of drainage works north of the north transept, confirming the presence of the monastic cemetery in that area (Webster and Cherry 1972, 173; Webster and Cherry 1974, 189; Webster and Cherry 1976, 177).

Extensive, largely unsorted archival material relating to work at Hailes in the 1970s is held by English Heritage's National Collections Curatorial team based (at the time of writing) at Atcham, Shropshire (Cameron Moffett, pers comm). Anthony Musty is currently working on collating this and other archival material into a coherent interim publication, but it is unclear when this publication might appear.

Aerial survey

Aerial photographic transcription of the area surrounding Hailes Abbey undertaken in 2002 as part of the Gloucestershire Cotswolds National Mapping Programme project has revealed the extent of archaeological features detectable as either cropmarks or earthworks (see Brown 2006, 9-10). Large tracts of ridge-and-furrow were detected, as well as cropmarks indicative of prehistoric/Romano-British settlement. A report by English Heritage's Aerial Investigation and Mapping Team on the Gloucestershire Cotswolds NMP project is currently in preparation.

Interpretative earthwork survey

Analytical survey and investigation of the earthworks in the fields surrounding Hailes Abbey was undertaken in November 2005 by members of English Heritage's Archaeological Survey and Investigation Team (see Brown 2006). A number of features of the monastic precinct were delineated, including the site of a mill, fish ponds, the gate house complex, building platforms, gardens and part of the probable inner court boundary. In the wider landscape, the area of the monastic precinct was identified, as well as elements of the water management system and the site of the home grange. Following the suppression of the abbey in 1539, the abbot's lodging was converted into a secular manor house and gardens were established in the former cloister and to the east of the cloister.

A fragmentary bank running across the field to the east of the abbey and north of the 'pond,' marked 'c' on the published earthwork plan, gives the appearance of being truncated by the 'pond' area, as does a slight bank to the south of the 'pond,' lying between the features marked 'l' and 'n' on the published plan. Brown suggests that bank 'c' is probably related to the enclosed garden or orchard lying to the east of the surviving abbey buildings depicted on the 1587 map (Brown 2006, 21-2).

The rectangular boggy area to the south-east of the exposed remains of the culvert, marked 'm' on the earthwork plan, is interpreted unequivocally as a pond, but post-medieval in date (Brown 2006, 23-4).

Geophysical survey

Two campaigns of geophysical survey have been undertaken at Hailes Abbey. The first was done by staff from the (then) Ancient Monuments Laboratory in 1978. The aims of this survey were to investigate whether there was any evidence of monastic buildings in

the field immediately to the east of the surviving abbey ruins and whether there was any evidence of tile-making activity. Resistivity results indicated the presence of what was interpreted as the remains of the infirmary, but magnetometry results were unrewarding (David 1981).

The second survey, carried out in March 2006 by Stratascan Ltd, was considerably more extensive in scope. An area of approximately 8ha around the abbey remains was investigated, using both magnetic and resistance techniques. Additionally, six resistivity pseudosections were produced: two across the dam and four across the rectangular 'pond' area (Elks 2006).

The survey enabled the identification of a complex set of anomalies in the area around the abbey, indicating the presence of extensive structural, garden and pond remains. Of particular interest are the strong linear resistance anomalies that appear to correspond to the banks leading into the 'pond' area. These were interpreted as possibly the remains of boundary walls enclosing garden features. The resistivity pseudosections across the 'pond' area indicated lens-shaped anomalies extending to a maximum depth of approximately 1.6m. These were interpreted as representing sediment fill in the 'pond.'

Bore-hole survey

There have been two bore-hole surveys of the rectangular 'pond' area. The first was carried out in 2000 by a team from the (then) Centre for Archaeology (Wells *et al* 2001). Five bore-holes were sunk in a line along the middle of the 'pond' along its long axis. The sediment sequence recovered was interpreted as reflecting a fairly deep (ca. 3-3.5m) pond, filled with water-lain deposits capped with organic-rich, peaty soils, the latter perhaps indicating the abandonment of the 'pond.' Samples from one core were subjected to more intensive investigation, assessing the presence and nature of plant macrofossil remains, pollen, ostracods and diatoms. Only a minimum of information was extracted from the samples. There was, however, sufficient evidence to suggest that further analysis, in particular of plant macrofossils and pollen, would provide insights into the management of the 'pond' and into the vegetation in the vicinity of the abbey.

A more intensive bore-hole survey was undertaken in 2006 by ArchaeoScape (Swindle and Green 2006). Twenty bore-holes were sunk in five transects across the 'pond' area. The resulting cores were inspected and recorded in the field. No samples were taken for subsequent assessment for plant macrofossils, pollen, etc. The sedimentary successions recorded in the survey were interpreted as showing that a body of organic sediments occupied a depression in the valley floor. The depression cut through silty colluvial deposits with subordinate stony horizons, also probably of colluvial origin. These colluvial deposits are overlain with organic sediments, most likely the deposits of a shallow and slow-moving stream. The course of the stream (or streams) is likely to have changed over time, illustrated by the presence of thin peat horizons in some of the sediment sequences. No direct evidence was found to suggest that the area was ever utilised as a fish pond.

Designation and permissions

Hailes Abbey and Ringwork is a scheduled ancient monument (No 28850). It is owned by the National Trust in the care of English Heritage as an historic property. Scheduled Monument Class Consent (SMCC6) was required prior to the excavation work. This was applied for and given on 16 August 2006. Permission to undertake the excavation was also sought from the National Trust, which was given, a license being issued on 10 August 2006.

Reasons for the excavation

The location of the abbey at the base of a valley has meant that in the past there have been episodes of flooding. The standing water has caused damage to the stonework of the abbey ruins, especially during cold periods when the saturated stone has been subjected to freezing.

In order to mitigate the damage, the decision has been taken to try to prevent any future floodwater reaching the stonework. A number of ideas have been discussed, including improving the flow of water in the stream traversing the rectangular 'pond' into the culvert, and the partial excavation of the 'pond' to provide a small holding area for any flood water to prevent it flowing into the ruins.

The date and nature of the 'pond' were unclear, as were the date, nature and survival of remains of the monastic culvert and any associated structures which are not currently exposed as part of the presentation of the site. It was, therefore, necessary to evaluate the area archaeologically in advance of any flood control scheme, especially the nature and date of the rectangular 'pond' area and the nature and date of any further remains of the culvert and associated structures, beyond those which are currently exposed.

AIMS AND OBJECTIVES

The aims and supporting objectives of the project were:

1. to achieve a better understanding of the nature and date of the rectangular 'pond'

    1.1 to examine the fills of the rectangular 'pond' to gain a better understanding of their nature and date, by retrieving archaeological artefacts and environmental evidence that could establish the date of the deposits and the depositional processes that contributed to its infilling

1.2 to investigate the relationships between the 'pond' and major banks, possibly representing the monastic precinct and/or later garden walls that enter, abut or are cut by its north and south edges

2. to recover evidence regarding the location, nature, date and condition of any further remains of the culvert and any associated structures

2.1 to establish the plan and investigate the function of the range of buildings to the east of the latrine ('Reredorter')

2.2 to establish the course and condition of the culvert that carried the water supply from the dam to the latrine drain

2.3 to determine the extent and depth of post-1976 landscaping over the culvert

2.4 to investigate the end of the culvert where it connects to the 'pond'

3. to achieve a better understanding of how water currently feeds from the 'pond' into the culvert.

METHODOLOGY

Excavation methodology

A total of four trenches was excavated. The main trench was located to the south-east of the open remains of the culvert (Trench A); two were sited within the 'pond' area where linear earthwork features abut the 'pond' (trenches B (north) and C (south)); and two geotechnical test pits was dug within the 'pond' area (Trench D) (see Figure 2).

The site was cordoned off and access was restricted, in accordance with applicable Health and Safety procedures. The trenches were secured using a combination of HERAS and existing stock-proof fencing, with the relevant Health and Safety signage displayed.

The position of the trenches was surveyed using a Total Station EDM using an arbitrary, site-specific grid. The site grid was tied into the Ordnance Survey National Grid using survey-grade GPS.

Turf and topsoil in Trench A were removed by machine, using a toothless bucket. Exposed deposits were then cleaned by hand to allow recording, assessment and interpretation. The modern fill in the culvert (see below) was excavated by machine down to the bottom of the culvert. All further excavation in Trench A was carried out by hand. 'Turf' and topsoil in trenches B and C was removed by machine, using a toothless

bucket. Exposed deposits were then cleaned and excavated further by hand to allow recording, assessment and interpretation.

In Trench D, the first geotechnical test pit was excavated by machine in spits, using a toothless bucket. When excavation of this test pit revealed substantial masonry remains (see below), the trench was extended further to the south-east and a second test pit dug into the sediments in the 'pond.' The masonry was cleaned by hand. The second test pit was also excavated by machine in spits, using a toothless bucket. The second test pit was shored in a fashion that one face of the test pit was sufficiently exposed to allow appropriate recording and geoarchaeological/environmental sampling to be undertaken. The specific scheme of recording and sampling is outlined below in the section on Environmental methodology.

The excavation was recorded using the principals and techniques outlined in the 2006 edition of the English Heritage *Recording Manual* (English Heritage 2006) – henceforth referred to as the Recording Manual. Deposits were excavated stratigraphically and with the minimum level of intrusion required to achieve the project's aims and objectives. The character, composition and depositional sequence of the site's archaeological remains was recorded on pro-forma sheets, with a unique context number allocated to each distinct deposit, feature or structure. A drawing record was produced with each context recorded on a plan, section or elevation drawing as appropriate, following procedures outlined in the Recording Manual.

All features encountered were photographed using monochrome print and colour transparency film. In addition, general photographs were taken of the trenches at appropriate intervals, as well as 'working shots' of the excavation in progress, in particular the excavation of Trench D. A digital camera was used to supplement the site photographic record.

On completion of the excavation, all trenches were backfilled by machine. In Trench A, a geotextile membrane (Terram) was used to cover unexcavated remains prior to backfilling. This will serve to protect surviving *in situ* remains and to indicate the depth to which controlled archaeological excavation has been carried out should the area be re-excavated for flood prevention/mitigation works. A plastic pipe was also inserted above the Terram to direct water flowing from the small stream emanating from the 'pond' into the surviving culvert.

Finds and samples from relevant contexts were retrieved and processed in accordance with the procedures set down in the Recording Manual and detailed in the following sections.

Finds methodology

A total finds retrieval and retention policy was adopted for all hand-excavated areas of the excavation. All finds work was carried out in line with the principles and techniques outlined in the Recording Manual and under the guidance of the Project Finds Officer (Sarah Jennings), who visited the site at several points during the excavation, and the on-site Project Finds Supervisor (Foxy Demeanour).

All portable material from secure layers and features was three dimensionally located within the site grid and given the appropriate context and small finds number before individual bagging.

Much of the initial finds processing work (washing, cleaning, marking) was undertaken on site, led by the Project Finds Supervisor following guidelines laid out in the Recording Manual, and appropriate facilities were provided. Bulk finds were quantified by context and objects and items defined as small finds were individually recorded. Storage was in line with the principles and techniques outlined in the Recording Manual.

Bulk finds were washed, marked, and bagged and boxed in standard-sized cardboard boxes by context, for transport to Fort Cumberland. Any small or fragile items were boxed separately and clearly labelled. The finds were examined during the post-excavation phase by appropriate specialists.

Conservation methodology

Initial care of finds was in line with the principles and techniques outlined in the Recording Manual and *First Aid for Finds* (Watkinson and Neal 2001).

During fieldwork, English Heritage conservators were available if needed to advise on and assist with the retrieval of finds, any on site emergency conservation and initial care of fragile finds. In the event, this was not required.

After selection, metal finds were X-rayed by the Project Finds Supervisor (Foxy Demeanour) at Fort Cumberland.

Environmental methodology

The sampling strategy followed the advice and guidance of the Project Environmental Officer (Gill Campbell). A total of 50 samples were taken from the site.

Three flotation samples were taken from Trench A: one from a well-sealed context above the culvert, one from an ashy probable occupation layer, and one from a rubble layer on the NE side of the culvert. One flotation sample was taken from a possible ditch fill in Trench B.

In Trench D, the geotechnical test pits were sampled in spits approximately every 25cms, largely for finds retrieval and for the recovery of environmental remains. Seven of these, from waterlogged contexts, were then sub-sampled into 10-litre specialist samples for general biological analysis. A column of samples using monolith tins was taken from the exposed face of the second test pit throughout the depth of the deposits following machining, except for a rubble layer part-way down, where it was not possible to take a monolith. Monolith tins measuring 10cm by 10cm by 50cm were used. The tins were hammered into the exposed section in such a fashion as to overlap by approximately 10cm (see English Heritage 2002, 21, fig 29). The top of each tin was marked with an arrow and recorded in 3 dimensions. A further specialist sample being taken from the rubble layer which was not included in the monolith sample.

All 19 coarse-sieved samples were processed on site over a 4 millimetre mesh. Five of the flotation samples which were waterlogged clay were coarse-sieved at Fort Cumberland using a 500 micron mesh. Ten of the remaining flotation samples were processed using meshes of 500 microns for the residues and 250 microns for the flot, with one being floated using meshes of 500 microns for both residue and flot.

During assessment, further sub-samples have been taken from the monolith samples from Trench D. Fourteen have been taken for radiocarbon dating, nineteen for evaluation of pollen, and four for evaluation of diatoms.

Archives

On site the archive was stored in a secure and clean environment, following the code of good practice for the creation and maintenance of excavation archives employed by English Heritage's Archaeological Projects Team.

Upon completion, the site archive was accessioned by the Archaeological Archives team, where it remained unaltered – all subsequent amendments and additions have been made to the digital version of the project archive. The project archive was curated by Archaeological Archives in accordance with the appropriate standards defined by English Heritage, the Institute of Field Archaeologists, the MLA (formally the Museums & Galleries Commission), and ICON (formally the United Kingdom Institute of Conservation).

The site archive (paper, drawn, photographic and digital) was prepared in accordance with MAP 2 Guidelines (English Heritage 1991). It was checked and cross-referenced, with relevant indices, catalogues and matrices constructed. The primary site archive was copied on to the appropriate digital format to provide a security copy which will form the basis of any future research archive. Site records were entered into an Archaeological Projects database and the site drawings were scanned. The colour transparencies were scanned onto CD Rom in uncompressed TIFF format at 24 colour bit, 2048 lines x 3072 pixels.

All digital data that forms part of the site archive was created and managed in accordance with the Fort Cumberland Digital Archiving Strategy (Section 2: Pre-Preservation Management). All digital data commissioned from external consultants was subject to an appropriate specification covering documentation, file formats, and data standards.

Upon completion, the project archive will be deposited with English Heritage West Territory Curatorial team. The full archive will be completed and deposited with the designated repository as soon as possible and no later than six months after the completion of the final report.

The digital archive will continue to be curated at Fort Cumberland.

EXCAVATION RESULTS

The remains recovered from the four trenches can be assigned to five broad phases, corresponding to the general history of the site. The first phase encompasses everything prior to the foundation of the abbey in the mid-13th century. The next phase covers the construction and occupation of the abbey and its surrounding landscape features until its Dissolution in 1539. The third phase covers the post-Dissolution demolition and remodelling of the abbey as a secular manor house, lasting until the Tracy family left in the second quarter of the 18th century. The next phase refers to the use of the site as a farm from the mid-18th to the end of the 19th centuries, before the abbey remains were cleared. The fifth and latest phase relates to the clearance and excavation of the site from around the turn of the 20th century, as well as subsequent works undertaken since the site was taken into state care. An interpretative index of contexts recorded during the evaluation is presented below in Appendix I, and phased Harris matrices for all four trenches are shown in Figure 3 and Figure 4. The locations of key features revealed during the evaluation are shown in Figure 5.

Phase 1: Pre-medieval

The only pre-medieval contexts found during the excavation were in the second test pit in Trench D. Evaluation of samples taken from the excavated sediments has permitted a preliminary reconstruction of the depositional sequence. The bottom-most spit in test pit 2, context [4031] was Lower Lias clay, the underlying subsoil in the area (British Geological Survey 2001). This was encountered at a level of about 100.20mOD, about 3.35m below the modern ground surface.

Phase 2: Medieval

Trench A

Excavation in Trench A demonstrated that the culvert does survive to the south-east of the monks' latrine. The culvert turns further to the south-east at the south-east corner of the latrine undercroft.

The culvert is formed of two rubble-core walls, contexts [1052] on the south side and [10051] on the north, faced with roughly-squared blocks laid in uneven courses (see Figure 6 and Figure 7). The uppermost facing course of [1051] lay at 101.78mOD, that of [1052] at 101.56mOD. As neither wall was completely exposed in plan, their widths could not be determined. The width of the drain itself was 0.97m. Part of [1052] was robbed, presumably post-Dissolution, and it is likely that some courses of [10051] may have been robbed as well. The south-west boundary of context [1034] (see below in Phase 3) was clearly defined, and this edge may represent the line of the robbed-out culvert wall.

Part of the southern side of the culvert was rebuilt or at least re-pointed, probably post-1800 (see below, Phase 5), context [1053]. It is not clear whether the re-pointed section reflects the original height and outline of the southern side of the culvert wall or not. Rubble core material visible to the south of the re-pointed face (on the far left of Figure 7) suggests that the culvert wall on the south side may have continued up to a height equivalent to that seen in the exposed part of the culvert south of the latrine undercroft. It is not clear to what height the north wall of the culvert might have originally extended.

The modern fill in the culvert (see below, Phase 5) was excavated by machine down to the bottom of the culvert. As is the case in the exposed portion, the bottom is lined with large stone slabs. Levels were taken on the bottom of the exposed culvert and in the excavated portion. Comparison of the levels (see Figure 8) indicates that there is an approximately 1.6% grade from one end of the exposed culvert to the other. The grade from the excavated section to the exposed section is approximately 4.7%. The difference in incline in the two sections may be due to a difference in ground level at the time the culvert was built, but this cannot be confirmed, as the 'natural' ground level was not seen in Trench A. The difference in grade may also have been intentional on the part of the builders, providing a steeper slope at the top end of the latrine drain in order to provide more effective flushing.

On the south side of the culvert lay part of a buttress, context [1054]. This buttress appears to have been bonded in with the rubble core of the south wall of the culvert, context [1052]. This feature may be similar to the one buttress present on the north side of the north wall of the latrine undercroft. If context [1054] is medieval in date, it suggests that there was a substantial structure in this area, further to the south-east of the latrine and undercroft currently exposed.

About 3.9m to the south of the culvert lay another substantial stone foundation at a level of 102.76mOD, context [1038]. Only a short length was exposed during the excavation, but it comprised a rubble-cored wall with two visible courses of roughly squared facing

blocks. Only a small portion of deposit [1039], immediately to the north of wall [1038], was exposed, but this context may represent the fill of a construction trench for wall [1039].

Wall [1038] was overlapped by another masonry feature, context [1037]. This ran north at right angles from [1038]. Overlying context [1037] was a single course of chamfered blocks, context [1020]. The alignment of [1020] was slightly offset from that of [1037]. Context [1020] might represent the line of a standing wall, intended to be visible above the ground surface, and [1037] its foundation, or [1020] could be a later rebuild on a subtly different orientation from [1037]. Only small portions of [1037] and [1020] were exposed, so their overall widths are not known, nor how far north they reached. The attribution of both [1037] and [1020] to Phase 2 is tentative; they could also be post-Dissolution features.

Trench B

A series of large, unbonded sandstone blocks, context [2021] were found in the base of Trench B, running roughly north-south (see Figure 9). This context may be the robbed-out remains of a wall foundation, possibly for the inner monastic precinct, as suggested by Brown (2006, 27, 32).

A silty clay bank, context [2007] was found to the south-east of the possible robbed-out wall. This may represent an earlier version of the precinct boundary, though this interpretation is highly tentative.

Trench D

Four courses of masonry, context [4032], were exposed during the excavation of the first test pit in Trench D, aligned north-east to south-west. The top of the masonry lay at 102.13mOD, about 1.4m below the modern ground surface. The exposed portion of the wall consisted of alternating chamfered and vertically faced courses. The lowest course of this wall was not seen. All the blocks showed signs of chisel dressing, and some were stained by the leaching of iron in the ground water. It is possible that there may have been one or more courses of masonry above those seen during excavation, but which have been robbed away. Context [4032] appears to be the masonry front or revetment to a dam and is almost certainly medieval in date (see Figure 10 and Figure 11).

A deposit of silty clay mixed with limestone fragments, context [4008], lay to the north-west of the masonry at a level of 102.50mOD, about 0.7m below the modern ground surface. This deposit seems to have formed a bank behind the masonry [4032]. Another similar layer, context [4007], lay above [4008], at a level of 102.95mOD, about 0.6m below the current ground level. It is not clear, however, whether [4007] was medieval or not.

In the second test pit, a black clay layer with copious plant remains was encountered at about 100.80mOD, approximately 2.6m below the current ground level. Samples indicated that this deposit, context [4029], formed in water, suggesting the existence of a pond. This context most likely represents the bottom of a pond, probably contemporary with the dam. Two sets of sub-samples taken from a monolith sample corresponding to context [4029] have been radiocarbon dated, one from the upper part of the layer and one from the lower part. The sediment sequence in the test pit and the levels at which the radiocarbon samples were taken are shown in Figure 12. Both samples produced late medieval dates, most likely falling in the fifteenth century. The results of the radiocarbon dating are discussed in more detail below in the assessment of plant macrofossils, pollen and diatoms.

Samples taken from the two spits above [4029] – contexts [4028] and [4027] – contained a mix of plant remains suggesting that the pond was drying out or silting up. It is possible that context [4027] was derived from flooding deposits. The speed at which the pond dried out or silted up cannot be determined, but it is clear from Ralph Treswell's map (Treswell 1587) that there was no water body in the location of the present boggy area by the later 16th century.

Phase 3: Post-Dissolution demolition and occupation, mid-16th to mid-18th centuries

Trench A

The 1587 Treswell map does not depict the area to the south-east of the converted Abbey in great detail. Close inspection of a digital image of the map, however, reveals a thin but clear line running from the watercourse along the north side of the area of the former pond to a point somewhere along the south range of the former abbey (see Figure 13). This line likely represents the course of the culvert, suggesting that it was still open and functioning in the late-16th century. The fact that there are no obvious structures shown in the area to the south-east of the manor house suggests that whatever buildings may have stood there during the life of the abbey had probably been demolished.

To the east of the excavated section of the culvert lay three walls, contexts [1033], [1048] and [1049] (see Figure 14). Wall [1049] was only revealed in the south-eastern edge of the trench, to the north of the line of the culvert. It appears to run perpendicular to the culvert. Walls [1033] and [1048] lay to the south of the culvert, [1033] running roughly parallel to it, and the stub of [1048] perpendicular to [1033]. Walls [1033] and [1048] are narrow, suggesting that they were either non-load-bearing, dividing walls inside a building or possibly walls for garden features.

Facing stones for the south side of the culvert (context [1052]) were missing from that part of the wall south-east of the re-pointed section. The fact that the rubble core was

still *in situ* suggests that the facing stones were robbed. Section 7044 (see Figure 14 and Figure 15) was cut perpendicular to the line of the excavated section of culvert. It revealed a series of rubble layers (contexts [1041], [1042] and [1043]), the uppermost of which lay at 101.70mOD. The bottommost, [1043], continued beyond the excavated depth of the trench. These contexts tip from south-east to north-west, suggesting that they may be the result of collapsing of the rubble core of wall [1052] after the facing stones were robbed.

To the north of the culvert lay a mortar surface, possibly a floor, context [1040]. This could have been a floor for a structure or courtyard to the north of the line of the culvert. Again, only a small portion of [1040] was exposed in a sondage, so its overall extent is not known. The surface was cut by a group of post/stake-holes and their fills, contexts [1044] and [1045]. This surface and the post/stake-hole group may represent a reorganisation or new use of this part of the site following the Dissolution and demolition of many of the abbey's buildings. The interpretation and attribution of [1040], [1044] and [1045] to Phase 3 is tentative. The contexts were partly exposed and recorded but not excavated, so no dating material was recovered from them.

Overlying [1040], [1044] and [1045] was a layer of clayey silt, with copious amounts of ash and charcoal mixed in, context [1034]. The south-west edge of this context was well-defined, probably indicating the line of the robbed-out wall on the north side of the culvert. Only a limited portion of this context was exposed, so its full extent is unknown (see Figure 16). The whole of the exposed context was taken as a bulk soil sample, and animal bone, metalworking debris, many coal fragments, one pottery sherd, a few fragments of charcoal and a single charred seed of *Cannabis sativa* L. (hemp) were recovered from it. The animal bone included perinatal pig, rabbit, bird (among them a possible medullary bone which provides possible evidence of egg-laying) and fish. Some of the bone fragments were calcined, suggesting that this layer may include hearth waste. The pottery was a single sherd of redware, dating from the 16th century or later, but this could be residual and as such provides only a very general *terminus post quem* for this layer. Metalworking waste (slag, probable casting waste and ceramic casting/mould fragments) were also recovered from this context. The metalworking waste might stem from the well-documented stripping of the abbey in the immediate aftermath of the Dissolution (Winkless 2001, 59-61). The composition of the waste material suggests that it could be the by-product of small-scale metal-casting (eg, producing domestic vessels) undertaken at nearly any time until the abandonment of the site in the mid-18th century. This layer provides considerable evidence of a variety of post-medieval activities at Hailes, but a more specific and concrete interpretation is impossible due to the limited extent of the context revealed.

A variety of layers of mixed soil and rubble lay over the whole of Trench A, including contexts [1009/1027], [1013], [1029], [1032], [1035], [1036] and [1046], all less than 0.5m below the modern ground surface. Decorated medieval floor tiles and carved stone architectural fragments were recovered from these layers, as well as a variety of iron

objects, a clay pipe bowl dated ca. 1610-1640, and fragments of lead and copper. Only small amounts of pottery were recovered, so it is effectively impossible to tell how much of the pottery might be residual in any given layer. It is possible that one or more of the uppermost layers may be spoil from the excavation and clearance of the site at the turn of the 20th century or later.

Trench B

The possible medieval wall noted above appears to have been robbed out, and copious amounts of soil and rubble, with inclusions of mortar and ceramic building material, dumped in its place. Context [2012] was tentatively identified as the cut of a robber trench, aligned along the same axis as context [2021]. The line of context [2012] could only be established to the south-east of context [2021] (see Figure 9). Overlying context [2021] and the extent of the posited robber trench were contexts [2009], [2010], [2013], [2014] and [2024], which likely represent robbing debris and spreads of rubble.

Trench D

The fact that the pond is not depicted on the 1587 Treswell map indicates clearly that it had, by that time, ceased to exist as a water body. Close inspection of a digital image of the map reveals a faint ink line which suggests the outline of the pond area (see Figure 13). There is also what appears to be a wall running north-east to south-west from the terminus of the watercourse along the north side of the area of the former pond. It is possible that this represents the line of the dam. These features on the 1587 map give hints that the dam and the remains of the pond were still visible in the late 16th century.

Context [4026] (spit 6 in test pit 2) included a distinct band of sandstone rubble, found at a level of 101.75mOD, about 1.7m below the modern ground surface. Plant remains from this context indicate that the area was wet but not supporting fully aquatic vegetation (ie, year-round standing water), probably not unlike conditions today. The rubble and fragments of plaster, some possibly painted, suggest the dumping of demolition debris. It is impossible to say whether this material was from an immediate post-Dissolution demolition campaign or from the destruction of the Tracy manor house in the 18th century. The fact that the Treswell map does not show the 'pond' area as a water body suggests that the rubble layer dates from the Dissolution.

This context was overlain by a layer of mid to dark grey clay, context [4025], at a level of about 101.95mOD. This deposit may correspond to context [4012], found immediately to the south-east of the masonry revetment of the dam at a level of 102.10mOD (see Figure 12). Post-medieval pottery and a waterlogged fragment of wood (Small Find 576) were recovered from [4012], and if [4012] is the same as [4025], then it is almost certainly post-Dissolution in date.

Deposits above [4012] and [4025] in the second test pit and in the area over the dam carry the sequence up to about 102.90mOD in both areas. Whether all these layers,

including [4012] and [4025], represent further deliberate infilling, more gradual colluvial accumulation or a combination of both is not clear.

Phase 4: Abandonment, mid-18th to late-19th centuries

Trench A

The rubble collapse deposits in the culvert were overlain by a thick, clayey silt layer, recorded as contexts [1002], [1010] and [1023]. This deposit extended over much of the northern and eastern side of Trench A (see Figure 17). This may represent a deliberate infilling of the line of the culvert and levelling of the surrounding area.

Overlying [1002/1010/1023] was another layer of mixed rubble and soil, recorded as contexts [1014], [1015] and [1025]. This, in turn was overlain by context [1003]. Contexts [1014/1015/1025] and [1003] all contained fragments of dressed and decorative architectural stonework. It is not clear whether some or all of these rubble layers might be demolition and levelling layers or spoil from the clearance of the abbey site at the turn of the 20th century. A similar layer of rubble and soil, context [1022], lay along the western side of Trench A, to the west of the present line of the stream feeding from the the boggy area into culvert.

Trench B

A dry-stone wall, context [2015], running SSE to NNW appears to have been constructed at some stage, perhaps to act as a revetment for rubble deposits to its north-east (eg, contexts [2016] and [2028]) (see Figure 9). The dry-stone wall and associated rubble seem to continue to the north-west, running parallel to the modern field boundary. The wall and rubble are probably the source of the slight resistance anomaly revealed by geophysical survey in the area (see Elks 2006, fig 14). This feature may have been built to respect the stream indicated by a sinuous line on the 1587 map (see Figure 13).

Another dry-stone wall, context [2018], may have been built running north-east, along the line of the low bank visible today in the field to the east of the abbey ruins (feature 'c' in Brown 2006, fig 10).

A medieval decorated floor tile, fragments of ceramic building material and worked stone architectural fragments – including a column base – were recovered from the various layers in Trench B. None of these finds were in situ, and their presence indicates that the rubble contexts are post-Dissolution.

Trench B seems to be located directly over the south-east corner of the walled enclosure shown on the 1587 map (see Figure 13). The dry-stone walls noted above were probably flattened once Hailes was abandoned as a manor house. The rubble from wall [2018],

recorded as contexts [2002] and [2008], forms the low bank running across the field to the east of the abbey (feature 'c' in Brown 2006, fig 10). Contexts [2002] and [2008] covered most of the northern two-thirds of the trench.

Trench C

Excavation in Trench C proved difficult, as the water table here was very close to the ground surface. Beneath the topsoil, a silty clay deposit (context [3001]) overlay a layer of soil and rubble (context [3002]). Below this was a clayey layer, [3002]. All of these deposits appear to be colluvial in origin and probably quite recent. No datable material was recovered from Trench C, so the assignment of these contexts to Phase 4 is on the basis of comparison with the uppermost layers in Trench D.

Trench D

A layer of compact silty clay, context [4006], overlay the whole of Trench D. The pond was clearly almost completely filled in or silted up by this period. This layer may have formed since the whole of the site was turned over to farming, though this interpretation must be regarded as tentative.

Phase 5: Modern clearance and presentation, late-19th to late-20th centuries

Trench A

The present line of the small stream running from the boggy area to just short of the exposed culvert – recorded as context [1007] for the 'cut' of the stream and [1024] for its silty fill – must pre-date the re-pointing of the culvert wall [1053] (see Figure 18). The assignment of this feature to Phase 5 is tentative and is based on the premise that the re-pointing [1053] dates to after 1900. The stream could equally well date from Phase 4.

The re-pointing of the culvert wall [1053] post-dates the presence of the stream. The re-pointing probably took place after the clearance of the site around the turn of the 20th century. There might have been a concern to conserve an element of the culvert wall and facilitate the flow of water into the culvert at this point in an earlier phase, but the use of cement for the re-pointing suggests a fairly modern (post-1800 at the earliest) date. It seems unlikely that the culvert wall would have been re-pointed before the abbey site was cleared.

As noted above, some of the uppermost layers of soil and rubble encountered in Trench A – for example, context [1019] – may be spoil from the excavation and clearance of the site at the turn of the 20th century or later. One layer, context [1018], contained one sherd of refined whiteware, probably dating to the 20th century.

The most recent activity in this area was the excavation of a hole to the east of the exposed part of the culvert, recorded as context [1005], probably for the insertion of the gabions into the culvert. This cut was backfilled with large amounts of rubble, context [1001], including at least one fragment with an 'X' marked on it in black paint. This rubble is likely discarded material from excavation, clearance and consolidation work on the site in the 1970s and earlier. A concrete drainage box was placed over the rubble, perhaps in hopes that it would serve to direct the flow of water from the stream and into the rubble and gabions in the culvert. A series of photos supplied by Niall Morrissey indicates that this intervention most likely took place in 1977.

Discussion

The discovery of the dam and the nature of the sediments observed in the second test pit in Trench D demonstrate conclusively that the 'pond' was, indeed, an artificial water body. The radiocarbon dates obtained from the peaty layer near the bottom of the sediment sequence shows that the pond was medieval in date. This pond seems to have dried out or silted up fairly rapidly, and clearly no longer existed as a water body by the late 16th century. The rubble layer encountered in test pit 2 suggests that some deliberate attempt may have been made to fill in the pond. The sediments above the rubble layer could be the results of further deliberate infilling, more gradual colluvial accumulation or a combination of both. The top 1.5m of the sedimentary sequence shown in test pit 2 in Trench D appears to be relatively recent.

The boundaries to the north and south of the present-day 'boggy area' must have stopped at the edge of the pond in their original incarnations. To the north of the pond, the original boundary may have been a substantial wall, but this is not certain. Subsequent versions of the boundary along the same line were likely of less robust construction. The boundary was probably removed once Hailes ceased to be used as a manor house. Due to the high water table in Trench C, the amount of information recovered was very limited, but it is surmised that the sequence revealed to the north of the pond was mirrored to the south of the pond.

It is clear that significant archaeological remains survive very near the surface immediately to the south-east of the standing remains of the abbey latrine and undercroft. Some of the masonry features exposed in Trench A relate to the post-Dissolution use of the site, but there are medieval features in the area as well, possibly substantial buildings. An insufficient area was excavated to determine the exact nature and plan of these buildings. There is considerable evidence of a range of post-medieval activity in this part of the site, and animal bone and metalworking waste recovered from context [1034] may give indications of the diet and activities of people occupying the site following its conversion to a secular manor house.

The culvert itself does survive and continues further to the south-east, towards the pond, but due to the depth and complexity of the archaeological remains overlying it, the whole

of the culvert was not uncovered. The exact line the culvert takes beyond the excavated section in the direction of the pond remains unknown, as does the location and nature of the junction between the culvert and the pond. It is not clear when the culvert collapsed or was filled in, but the 1587 Treswell map suggests that the culvert may have continued in use until the later 16th century at least. More of the culvert, and its likely connection with the dam found in Trench D, almost certainly lie further to the south-east of Trench A (see Figure 5).

The evaluation revealed evidence of a relatively recent attempt, probably in 1977, to address the flooding problems at Hailes. Flooding that has occurred since then shows that this attempt was not successful.

One fundamental problem in interpreting the excavated contexts in trenches A and D is that it is not clear where the ground level was at the time of the construction and occupation of the abbey. The marked terraces to the east and south of the exposed ruins of the abbey suggest that the medieval and post-Dissolution ground levels were probably rather lower than the modern ground level in those areas. Some of the material found in Trench A is probably the product of successive campaigns of re-deposition of material following episodes of demolition and clearance/excavation of the abbey. This 'mask' of re-deposited material to the south and south-east of the surviving abbey remains is, however, almost certainly not even or uniform in depth.

FINDS ASSESSMENT

Kayt Brown

This report is an assessment of selected material finds recovered during archaeological investigations of the culvert and pond at Hailes Abbey, Gloucestershire, in 2006. Finds were recovered from three of the four trenches excavated (A, B and D) although the majority of the assemblage is derived from Trench A.

The assemblage is almost exclusively post-medieval in date, with a few medieval and modern items. All finds have been quantified by material type within each context, and the results are presented in Table 1.

Table 1: Finds totals by material type

Material Type	Count	Weight (g)
Pottery	89	1247
Fired clay	-	32
Ceramic building materials	52	3940
Decorated floor tile	29	5130
Metalwork	107	-
Iron	*80*	-
Copper Alloy	*14*	-
Lead	*13*	-
Glass	11	-
Slag	-	156
Mortar	23	515
Plaster	33	139
Stone	29	-
Other finds	14	-
Total	494	11159

The pottery

The assemblage of 89 sherds (1247 g) was predominantly post-medieval in date, although a small number (9 sherds) of earlier, medieval wares occurred as residual finds.

A rapid scan of the pottery was undertaken including a basic quantification by sherd count and weight, by broad ware group or ware type, for each context. Vessel form and decoration were also noted where present. Totals by ware type are given in Table 2.

Table 2: Pottery totals by ware group

Date Range	Ware group	Count	Weight (g)
12th-13th century	Sandy coarsewares	7	68
13th-14th century	Glazed sandy coarsewares	2	21
Late 15th/early 16th century +	Tudor Green ware	7	8
	Raeren	4	66
	Frechen	1	3
	Malvernian redwares	31	428
	Redwares (unsourced)	18	336

Date Range	Ware group	Count	Weight (g)
17th / 18th century	Black-glazed wares	12	164
	Tin glaze ware	2	2
	Staffordshire type slipwares	2	10
19th century +	Refined whiteware	2	28
	Stoneware	1	113
Total		89	1247

Sandy coarseware sherds of probable 12th to 13th century date were identified within layers [1028], [10031], [2001] and [4012]. All are residual finds, occurring in most instances with sherds of 15th century date or later. Two sandy glazed sherds dated to the 13th – 14th centuries comprised an abraded body sherd from phase 2 layer [4005] (test pit 1) and a jug strap handle with slashed decoration from phase 3 layer [1041]. A small quantity of Tudor Green type body sherds (late 15th – 16th century) were similarly residual within Phase 3 and later deposits.

Four sherds of Raeren stoneware and a single sherd of Frechen stoneware were the only imported sherds within the assemblage. Large numbers of drinking jugs from these production centres were imported into England during the 16th and 17th centuries. Both vessels occurred within Phase 5 topsoil/clearance layers ([1000] and [2001] respectively).

The bulk of the assemblage consisted of locally produced late 15th/early 16th – 17th century wares, in particular the redwares. These are likely to originate from a number of local sources, although only the Malvernian redwares (which predominate) have been recognised at this stage. Diagnostic sherds were rare, but identified vessel forms include a jug with strap handle from rubble layer [1022], a pinched spout fragment and two further strap handles (layers [4003], [4004], and [2002]).

Black-glazed, Cistercian-type wares were also well represented, again likely to derive from more than one source, including south Gloucestershire. Two mid-17th to 18th century Bristol/Staffordshire slipware sherds comprised a single mottled ware sherd from topsoil ([1000]) and a slipware sherd from layer [1023] within the culvert. Both sherds had the same pale buff fabric, brown slip and clear glaze that characterises these production centres. Two tin glazed sherds with blue and purple/manganese decoration are both very small and abraded (topsoil [1000] and rubble layer [1022]).

Two sherds of refined whiteware and a stoneware bottle rim are 19th – 20th century in date.

Ceramic building materials

The ceramic building materials include fragments of brick and roof tiles and also floor tiles, both plain and decorated. Sixteen ceramic brick fragments were retained, although no complete dimensions survived. Medieval ceramic roof tiles comprised peg tiles and a small number of plain glazed roof tiles.

The floor tile assemblage included a mix of plain, glazed and decorated tiles, at least one of which can be paralleled within the Hailes Collections. This tile (object 565), residual within layer [2008], is a rectangular border tile with alternating fleur-de-lis and castles within a straight double border enclosing a diamond pattern. Similar tiles have been previously recorded at Hailes Abbey, with variants also occurring at Chertsey and Halesowen Abbeys, the design possibly associated with Eleanor of Castile (Eames 1985, 46) and originating in the late 13th century. Four stamped and slipped tiles were recovered from phase 4, layer [1014]; comprising two incomplete rectangular tiles, a small square tile with fleur-de-lis decoration, part of a four-tile pattern, and a very detailed inlaid tile featuring a lion within a border. This latter tile (object 550) was provisionally paralleled within the Hailes Collection during the excavation. There was only one example of a relief-decorated tile (incomplete) with green glaze, from layer [2014].

Two lozenge shaped tiles, both within Trench A (layers [1001] and [1003]) are probably later in date than the decorated tiles, either relating to the later stages of the Abbey's occupation or potentially part of the remodelling and reuse of the Abbey as a secular house.

Plaster and mortar

Plaster (33 fragments) and mortar (23 fragments) were recovered primarily from Trench A although a small quantity of mortar was also recovered from Trench B (2 fragments) and Trench D (1 fragment). The plaster was generally a cream or off/white colour (layers [1009], [1022]) or with a dark surface finish, possibly degraded cream (layer [4027]). A single fragment (layer [1003]) had a cream background over which was a faint trace of reddish brown and two black lines at right angles, ending in a trefoil, probably part of a cross.

Stone

All the stone retained is of local limestone. Eighteen fragments of stone roof tiles, some with peg holes were recovered from layers within phases 3 – 5. No complete dimensions survived although the thickness of the tiles ranged from 13-16mm. Ten fragments of worked limestone were recorded, three of which were discarded on site. A partial column base (object 563) was retained from rubble layer [2002], measuring 270mm x 140mm x 15mm. The only stone object is a probable oolitic limestone weight (object 583, layer [2016]), almost teardrop in shape with a drilled hole below the apex, weighing 620g.

Fired clay

Fired clay mould fragments from the casting of copper alloy objects were recovered from layer [1034] (sample 5041) along with a small quantity of copper working waste (see metalwork below). The mould fragments, in a sandy fabric tempered with organic material, were all too small for any profile reconstruction, and most showed evidence of exposure to high temperature.

Only two other fragments were recovered, both unidentifiable to type, from layer [4005].

Metalwork

Iron objects were the most common metal finds, predominantly nails or nail fragments (65 objects). Other identifiable objects include a single hobnail (object 551) from within layer [1021] and a U-shaped staple (object 503) from rubble layer [2001]. A possible tool fragment (object 500) comprising a short blade with partial tang was identified within the topsoil.

Fourteen copper alloy objects were identified including four fragments of metal working waste from layer [1034] (object 582). Fragments of probable fittings (objects 513, 552, 561, 562, 564, 585) were the most common find of this material type. A post-medieval button (object 555, layer [1023]) and a complete ring (object 598, [4007]) were the only other identifiable object types.

Thirteen lead objects, mainly strip or sheet fragments and a single, short, incomplete rod fragment (object 506) were recorded from layers within Trenches A and D.

Apart from the button, none of these objects are particularly chronologically distinctive, but have been dated through association with pottery, where possible, to the post-medieval period or later.

Slag

In total 156 g of slag was recovered, of which 148g came from layer [1034], associated with the mould fragments and copper working waste (see above). The remaining slag fragments were from layers [2001] and [4004]. The slag is discussed further below, in the assessment of metalworking waste.

Glass

Ten fragments of post-medieval glass were identified, from six contexts, all within Trench A. A single corner fragment of window glass quarry with two grozed edges was recovered from [1030].

Clay pipe

Identification and a short report on the clay pipe has been prepared by D A Higgins and is included below.

Other finds

A small number of other finds were recovered which comprised a 2p coin (c.AD2000), and 11 fossil fragments including a single Ammonite and at least 7 Belemnite pieces.

Statement of potential

The finds assemblage is relatively small, in particular the pottery element which should provide the clearest dating evidence. The bulk of the assemblage, however, is derived from post-Dissolution deposits, in particular the mixed soil and rubble layers within Trench A and it has not been possible to ascertain the quantity of residual sherds within some these deposits. The finds assemblage, therefore, offers little in the way of potential for further analysis.

The pottery assemblage contains sherds dating from the 12th or 13th century through to the 19th century, all of which are common wares within this region and which correspond with known occupation at the site. The majority of the assemblage is 16th – 18th century in date, comprising German stonewares, local redwares and Cistercian type wares, and this corresponds with other finds, such as the early-mid 17th century clay pipe bowl.

Evidence of small scale copper working was provided by the fired clay and slag remains within [1034]. The only dating evidence for this layer is a single redware body sherd, which can only be assigned a broad post-medieval date.

The only artefact category which may be worthy of limited further analysis is the decorated floor tile assemblage. Although all the tiles were from post-Dissolution contexts, there are a small number of interesting decorated tiles within this group for which further comparisons, including those within the existing Hailes Collection, could be sought.

Recommendations

No further work is recommended on any material types, with the possible exception of the decorated floor tile assemblage, for which a short note on the tiles should be included within any publication of the results of the fieldwork.

The materials are, in general, adequately packed for long term storage, though further recommendations are made below in the Conservation Assessment.

ASSESSMENT OF WOOD FRAGMENT (SMALL FIND 576)

Sandra Rowntree

The object is a wooden plank, 310mm in length, 100-125mm in width and 15-32mm high, recovered from context [4012]. There are 'cut-marks' visible, as well as one treenail or wooden peg-nail hole (see Figure 21). One possible interpreatation is that the object is a fragment or repair patch 'tingle' (Allen *et al* 2005, 293) of clinker-built boat planking, re-used as part of a water control mechanism between the pond and culvert.

There are a number of things which might qualify as candidates for identification that fall within the remit of plumbing, water-supply and sanitation and would be expected to be in association with a culvert. Medieval water-systems were quite sophisticated as can be seen by Prior Wiberts (1167) at Canterbury (Salzman 1952, 268-9) and could include, for example, wooden pumps or tread wheels (ibid, 278) and conduits made of oak, as at Charterhouse in 1500 (ibid, 271).

Medieval planks were often made of oak, radially cut and axed to shape. During the Post-medieval period both oak and elm were used, and the wood was cut tangentially and frequently has sawmarks. The method used to cut planks of oak-wood during the medieval period was expensive because not many planks could be cut in this way from a log. This would indicate the possibility of re-use for the construction or repair of water-control mechanisms that would not be seen. It seems unlikely that the fragment would have served any decorative purpose, but as long as the wood was sound and durable, it would have been suitable for use in construction or repair.

Dating

Although dendrochronological dating of the fragment may be possible, it is reliant on some sapwood remaining and can only be a *terminus post quem* that could be years before the wood was used. Nevertheless, during the 12th century it was common practise to use wood that was unseasoned or green and this has a direct effect on dates obtained by dendrochronology (Allen *et al* 2005, 295).

Recommendations

It was recommended to ask Damian Goodburn (Ancient Timber Specialist, Museum of London Archaeology) to examine the fragment following conservation. Further investigation was needed to confirm the identification of the fragment, assess its potential for dendrochronological dating, elucidate possible comparanda and examine the significance of the fragment.

A short note by Damian Goodburn on SF 576 is included below as Appendix V.

CLAY PIPE ASSESSMENT

D A Higgins

This note deals with a clay tobacco pipe that was recovered by English Heritage during the 2006 excavations at Hailes Abbey. The pipe was examined and this report prepared in March 2007.

The excavations produced a single pipe bowl from context [1002]. This is an early heel pipe bowl, dating from c1610-1640 (see Figure 22). Pipes of this period are not particularly common nationally and this example provides a useful early example from Gloucestershire as well as potentially good dating evidence for the context from which it was recovered. Regional forms of pipe had not generally evolved by this period and so it is not possible to be sure where this piece was produced. Its clean lines and neat finish, however, are typical of London products of this period and it may have been brought from there. In any event, its presence on the site provides evidence for the early adoption of smoking at a time when it was still a relatively new and expensive fashion.

The surface of this piece is slightly abraded and so it is not possible to sure whether it was originally burnished. The overall form, however, is good and it has been neatly trimmed and finished with a bottered and fully milled rim. The fabric has an irregular and slightly granular fracture and the stem, which has a bore of 7/64", has a reduced grey core.

METALWORKING WASTE ASSESSMENT

Sarah Paynter

As noted above, the finds assemblage from Hailes Abbey is almost exclusively post-medieval in date and included some metalworking waste, primarily from context [1034]. This context was an ashy, possible occupation layer over what may have been a mortar floor.

Numerous fragments of clay mould (see Bayley *et al* 2001), identified by characteristic black, reduce-fired interior surfaces and orange, oxidised-fired outer surfaces, were present in layer [1034] but were too fragmentary to reconstruct the type of object being cast. Many small pieces of slag waste from copper working, with a characteristic greenish or red colour (Bayley *et al* 2001), were found in the same layer. Together this evidence suggests the casting of copper alloys took place at the site sometime in the post-medieval period. Crucible fragments (ceramic vessels used to hold the metal whilst it was melted) would also be expected with this type of assemblage but none were identified; the other pieces of pottery examined, from context [4005] (sample 5005) and context [1034] (sample 5115), are unlikely to have been associated with metalworking.

Fourteen copper alloy objects were identified from the site, including four fragments of probable casting waste from layer [1034] (object 582). These were not available for examination at the time of the assessment, but several small runs of metal were found amongst the slag from layer [1034] described above. XRF (X-ray fluorescence) analysis of these fragments found that the alloy was a leaded bronze. No zinc was detected, but the small quantities of arsenic, iron and nickel present suggest that the alloy was of the type used for large domestic castings at this time, eg cauldrons (Dungworth 2002).

Discussion and recommendations

The assemblage indicates that copper alloy objects, such as domestic vessels, were cast at the site, probably sometime in the post-medieval period, and the waste may have been *in situ*, perhaps indicating the location of this activity.

Further XRF analysis of the metal fragments from layer [1034], together with the results so far, will confirm the type of alloy being cast and the type of object being made. XRF analysis is rapid and non-destructive. Liaison with a pottery specialist could lead to fragments of crucible being identified.

CONSERVATION ASSESSMENT

Karla Graham

This conservation assessment covers the metal (copper alloy, iron and lead), inorganic finds (glass, stone and floor tile) and organic (wood) finds. The aim of the conservation assessment is to provide the following information:

- A summary of the type, quantity and condition of the finds recovered.
- A statement of their potential to address the aims and objectives of the project and, the investigative conservation methodology to achieve this (including costs).
- The work required (including costs) to make the assemblage suitable for deposition (Walker 1990).

Quantification

The number and materials of the finds assessed are set out in Table 3.

Table 3: Number of finds assessed

Material	Number of small finds
Copper alloy	10
Iron	67
Lead	13
Glass	4 *2 not seen (SF509 & SF510)
Stone	2
Tile	2
Wood	2

Site Archive Completion: X-Radiography

The aims of the X-radiography programme were to meet the requirement of site archive completion (to provide a long term record of material) and to inform the conservation assessment. The small finds were X-rayed in December 2006 by Foxy Demeanour, the project Finds Supervisor, who was an intern on placement with the English Heritage Professional Placements in Conservation (EPPIC) scheme.

The ferrous and non-ferrous material was visually examined and where appropriate, finds were X-rayed at Fort Cumberland using an AGO HS 225kV Hi-Stability x-ray system. Industrial Kodak MX125 and AGFA FW 100 film was used and the X-radiographs packaged in archival enclosures (polyester sleeves and acid free envelopes). Material that was not x-rayed included lead alloys, very dense or thick material and obviously modern material which would not produce informative x-radiographs (Fell *et al* 2006). Table 4 lists

the total number of finds x-rayed, the number of x-radiographs produced and the x-radiograph numbers.

Table 4: Total number of Small Finds x-rayed and x-radiographs by material

Material	Total number of small finds x-rayed	No. of x-radiographs	X-Radiograph numbers
Copper alloy	10	1	P2563
Iron	65	3	P2561, P2562, P2570
Total	75	4	

Conservation assessment methodology

The copper alloy, iron, lead and inorganic finds were assessed at Fort Cumberland in April 2010. The assessment was based on visual examination of all the finds including examination under low power microscopy and where appropriate, the small finds were examined alongside their X-radiographs. The information gathered includes, where appropriate:

- Additional information on form, typology and technology to aid identification and interpretation.
- The condition of the finds to comment on the influence of the burial environment, any remedial conservation requirements and to advice on the long term preventive conservation measures.

Recommendations for investigative conservation have been made based on the aims and objectives of the project and following the report by the project Finds Specialist Kayt Brown (see above). The assessment data was entered onto an Excel Worksheet with additional columns created for Stability, Condition and Potential for Investigative Conservation. The information was collated according to the following criteria:

a) Stability: Stable (no active corrosion visible at present) or Unstable (active corrosion visible at present).

b) Condition: as defined in Table 5

c) Conservation assessment: this includes in some cases a more detailed description of the object and its condition derived from examination of both the object and where appropriate, the X-radiographs.

d) Potential for investigative conservation

Table 5: Conservation assessment condition categories

Term	Description of object
Very good	Very well preserved. Surface largely intact.
Good	Well preserved. Only small surface loss.
Fair	Fairly well preserved. Some surface loss has occurred.
Poor	Not well preserved. Large surface losses have occurred.
Very poor	Very badly preserved. Large losses have occurred all over.

Results

Stability and condition

Brief summaries of the condition results and potential for investigative conservation are presented in Table 6 and Table 7. Overall, the majority of the metalwork is in a stable and fair condition.

Table 6: Condition (stability) results

Material	Stable	Unstable
Copper alloy	8	1
Iron	66	1
Lead	12	
Glass		2
Stone	1	1
Tile	2	
Wood	2	

Table 7: Condition results

Material	Good	Fair	Fair-Poor	Poor	Very Poor
Copper alloy		7	2		
Iron		66	1		
Lead		12			
Glass				1	1
Stone		1	1		
Tile		2			
Wood	2				

Potential for Investigative Conservation

No small finds were identified for further investigative conservation. The Finds Assessment report (see above) highlights one small find, a decorative tile (SF 565) for limited further analysis but no investigative or remedial conservation is required to enable this study.

Further X-radiography is however required for 2 objects for the purpose of identification and clarification where sufficient detail was not visible on the original X-radiograph. For copper alloy SF 559, the X-ray image shows slag like characteristics but with a very dense strip across the width. It is proposed to re X-ray the object at 90 degrees to ascertain its nature. Iron SF 527 is not visible on the X-ray.

Remedial conservation

There are two wooden finds: a find from context 3001 (no SF number) and SF 576. On discussion with the Project Manager, the wood from context 3001 is modern and can be discarded.

SF576 was recommended for remedial conservation, ie, stabilisation prior to deposition. Following an assessment by Sandra Rowntree and preliminary illustration by Chris Evans, the wood was conserved in 2011 as part of a waterlogged wood programme being undertaken by the Archaeological Conservation Team. The conservation involved a two-stage pre-treatment with Polyethylene Glycol (PEG) and freeze drying (see Appendix IV).

Storage and curation

All of the objects are currently stored in individually pierced bags or Crystal boxes. The metalwork is stored in sealed Stewart® and polyethylene boxes containing conditioned silica gel (a mixture of non-indicating and indicating silica gel) and a humidity indicator card. The inorganic and glass finds are stored in cardboard boxes.

Box 8 contains inorganic stone and floor tiles contained inside in self-seal polyethylene bags. It is advised to introduce cushioning materials to protect the glazed surfaces of the floor tiles from physical damage by some of the larger material in the box.

Long term storage

The organic finds should be kept at 55% RH (± 5%). It is recommended that in the long term the metalwork finds are stored in desiccated conditions (less than 35% RH for non ferrous (± 5%) and less than 15% RH (± 5%) for ferrous metals) and according to the recommended guidelines (Walker 1990; Brown 2007; Museums & Galleries Commission 1992). All materials should be kept at an average temperature of 18°C (10-25°C) and low light levels. All objects should be handled wearing appropriate gloves.

The recommended environmental conditions for the long term storage of processed X-radiographs are less than 21°C and 20 to 50% relative humidity (Brown 2007; British Standards Institution 2000).

ANIMAL BONE ASSESSMENT

Polydora Baker

This assessment reports on a small assemblage of animal bones recovered during excavations in August-September 2006 at Hailes Abbey.

Methods

This assessment report follows 'MAP2' (English Heritage 1991) and English Heritage (2002) environmental guidelines. It comments on the quantity, quality and information potential of the assemblage. Recovery was by hand and by sieving. The >4mm fractions of the environmental samples were sorted in their entirety and 25% of each 2-4mm fraction was sorted. All countable, measurable and ageable specimens were quantified. Countable specimens are those which include 50% of at least one bone zone (after Cohen and Serjeantson 1996; Serjeantson 1996) or half of a tooth crown. Vertebrae, other than the atlas and axis, rib fragments and unidentifiable longbone fragments were not quantified but their presence is noted in the archive tables. No attempt has been made to distinguish between closely related species such as sheep and goat, horse/donkey, medium size galliformes, or corvid species, but some preliminary identifications have been made based on size for lagomorphs-rabbit and hare, and pigeon. Ageable mandibles and teeth, following Payne (1973; 1987) for sheep/goat and Grant (1982) for cattle and pig, include mandibles with at least one tooth in the dP4/P4 row and isolated mandibular teeth. Ageable postcranial elements are quantified also (epiphysial fusion in Silver 1969). Measurable specimens are those yielding data following Driesch (1976), Davis (1992) and/or Payne and Bull (1988). Preservation was recorded as poor, moderate or good.

Results

The assemblage includes a total of 89 countable fragments, including 50 hand-collected bones and 39 fragments from samples (Table 8). The bones come mainly from Phases 3 and 4, with few fragments recovered from deposits contemporaneous with or earlier than occupation of the abbey itself. Most of the sieved fragments are from Phase 3 as sampling was concentrated on the post-dissolution features, due to archaeology encountered during the excavation. Almost all of the bird and fish bones were recovered by sieving. The hand-collected portion is clearly biased against the recovery of small species and small bones of the larger species. The condition of the bones appears to worsen from Phase 5 (modern) to Phase 2 with more fragments qualified as poor-moderate in the earlier phases. A few fragments appear particularly poorly preserved/abraded suggesting they may be residual. Green staining, probably resulting from proximity to a copper alloy object, was observed on fragments from context [1034] and burnt (charring and/or calcination) countable and/or unidentified fragments were present in contexts [1034], [4004], [4012] and [4024].

The assemblage includes mainly the domestic taxa, cattle, sheep/goat and pig, but a wide variety of other animals are present including equid, dog, lagomorpha-probably rabbit, domestic fowl, duck, pigeon/dove, corvid (crow or rook size), fish, and various microfauna (rodents, shrews and amphibia) (Table 8). Rabbit may be intrusive, but the bones differ little in preservation from those of other animals. The species data are considered by phase below. Very few ageable or measurable specimens are available, which limits the information potential for husbandry or meat quality and procurement (Table 9 and Table 10). Given the small assemblage size, information about skeletal element representation is limited. There is no evidence for unusual deposits, with all body parts of the main taxa represented, including ribs and vertebrae.

Phase 2

The few countable fragments (NISP=9) from Phase 2 are from samples recovered from layers in test pits and from a possible bank behind a wall. The assemblage includes cattle, sheep/goat, pig (in the non-countable portion) and medium size galliformes, probably domestic fowl. The latter specimens are from juvenile and adult birds. Shrew and amphibia are present in the 2-4mm fraction. Bone waste from livestock, fowl and fish are commonly found on monastic sites (Eynsham Abbey: Ayres *et al* 2003; St. Gregory's Priory: Powell *et al* 2001; Serjeantson 2001; Barking Abbey: Baker 2001), revealing involvement in husbandry, and consumption of an array of animals and animal products. In the Cistercian monastic tradition, the consumption of meat from four-legged animals was forbidden to the monks except when ill (eg Grant 1988), and in some religious orders meat was served to visitors as well (Harvey 2006).

Phase 3

The Phase 3 assemblage includes 38 countable bones recovered from demolition rubble, a possible occupation layer, layers in test pits, a possible bank behind a wall and a silty layer in the 'pond.' The assemblage includes the main domestic taxa and an array of other species, revealing the varied diet of the post-dissolution inhabitants. The fragments from the possible occupation layer [1034] include perinatal pig (unerupted/newly erupted deciduous incisor), rabbit, medium size galliformes, a juvenile medium size bird, bird bone with possible medullary bone (evidence of egg laying) and fish. Pigeon and duck (*Anatidae*?) were identified in layers of rubble. Some of the fragments from Phase 3 contexts, including the ashy layer [1034] and the 'silting-up' layer of the 'pond,' are calcined, possibly indicating the dispersal of waste from hearths.

Phase 4

The assemblage from Phase 4 includes 35 fragments, derived mainly by hand-collection from culvert fills, including possible flooding deposits, rubble layers and a layer in a test pit. In addition to cattle, sheep/goat and pig, equid and dog are present in contexts [1023] (layer in collapsed culvert, deliberate or unintentional fill) and [1003] (rubble spread) respectively, their presence possibly relating to the changed function (farms) of the

property (and predominance of demolition/rubble layers). One very eroded rabbit bone was recovered from layer [1028] and may be residual or was perhaps exposed to the elements before burial. Bird taxa include medium size galliformes, crow or rook and possibly rock/stock dove, *Columba livia* or *C. oenas* (the specimen is smaller than wood pigeon, *Columba palumbus*), both from layers of rubble. Cut marks encircling the shaft of sheep/goat femur may derive from defleshing. A pathological proximal phalange of cattle has osteophytes on the distal dorsal surface and seems to show spreading of the bone as if part had sheared off. A sample from test pit layer [4024] yielded many small mammal fragments (only five are included in the countable bones) which probably derive from a single skeleton. The fragments are dark brown and may be charred or stained by the surrounding deposit (possibly through waterlogging).

Phase 5

The Phase 5 assemblage includes eight hand-collected countable fragments of cattle, sheep/goat and pig, from topsoil, rubble backfill, stream bed deposits and a possible ditch fill. Other unidentified fragments include butchered rib and a possible amphibian bone.

Discussion

The faunal assemblage from Hailes Abbey is very small with few identifiable/countable, ageable or measurable specimens. Most of the material derives from contexts such as rubble layers, possible flooding events and non-descript layers within test pits. Few occupation layers or well-defined features were excavated thus the origin of the material is largely uncertain. The assemblage does include a wide array of species, which while dominated by the domestic livestock, also suggests that rabbit, fowl and fish were exploited during the medieval monastic phase and by the later secular inhabitants of the property.

While no further analysis of this assemblage is recommended, the data shows that if further excavation were to be undertaken, sampling is of utmost importance for the recovery of the smaller species including, for example, rabbit, bird and fish. Sampling procedures should follow the English Heritage *Environmental Archaeology* guidelines (2002).

Table 8: Countable bone by recovery method and phase (bird vertebrae not included in totals)

Phase	Countable teeth and bones												
	Cattle		Sheep/Goat		Pig		Bird			Fish	Other		
	teeth	bone	teeth	bone	teeth	bone	bone	vert	phal		teeth	bone	Total
>4mm													
Phase 2	0	1	0	1	0	0	4	1	0	0	0	2	8
Phase 3	0	0	0	3	1	1	5	1	2	2	0	2	16
Phase 4	0	0	0	0	0	0	0	0	0	0	0	3	3
Phase 5													0
Total	**0**	**1**	**0**	**4**	**1**	**1**	**9**	**2**	**2**	**2**	**0**	**7**	**27**
2-4mm fraction (25% sorted)													
Phase 2												1	1
Phase 3	0	0	0	0	0	0	0	0	0	4	0	5	9
Phase 4	0	0	0	0	0	0	0	0	0	0	0	2	2
Phase 5													0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**0**	**8**	**12**
Hand-collected													
Phase 2													
Phase 3	0	1	0	6	0	1	4	0	0	0	0	0	12
Phase 4	2	9	3	8	0	1	4	0	0	0	1	3	31
Phase 5	4	1	0	1	0	1	0	0	0	0	0	0	7
Total	**6**	**11**	**3**	**15**	**0**	**3**	**8**	**0**	**0**	**0**	**1**	**3**	**50**

Table 9: Number of ageable bones, mandibles (MD) and isolated teeth

Context	Ageable mandibles, teeth and bone									
	Cattle			Sheep/Goat			Pig			Other
	Bone	MD	Teeth	Bone	MD	Teeth	Bone	MD	Teeth	Bone
Phase 2	1	0	0	0	0	0	0	0	0	4
Phase 3	0	0	0	4	0	0	1	0	0	2
Phase 4	8	0	0	3	2	1	1	0	0	2
Phase 5	1	0	1	1	0	0	1	0	0	0
Total	10	0	1	8	2	1	3	0	0	8

Table 10: Number of measurable bones (# spec) and total number of measurements

	Measurable teeth and bones									
Context	Cattle		Sheep/Goat		Pig		Bird		Other	
	# spec	Total	# spec	Total	# spec	Total	# spec	Total	# spec	Total
Phase 2	0	0	0	0	0	0	0	0	0	0
Phase 3	0	0	2	5	0	0	2	2	1	1
Phase 4	2	10	4	5	0	0	3	6	1	0
Phase 5	1	1	1	1	1	1	0	0	0	0
Total	3	11	7	11	1	1	5	8	2	1

MARINE MOLLUSCS ASSESSMENT

Greg Campbell

There is a small, oyster dominated, assemblage of marine shell from the site. None of the contexts produced sufficient material to allow consideration of size differences and procurement. No further work is merited.

CHARRED PLANT REMAINS ASSESSMENT

Gill Campbell

Method

Each flot was assessed as to its contents by scanning part or all of the flot under a binocular-dissecting microscope at magnifications up to x 50. The preservation and the nature of any plant material present was recorded. Notes were made on the amount of charcoal, cereal grain, other seeds, and cereal chaff present in each flot using the following four point scale: 1= present, 2=frequent, 3=common, 4=abundant. Identifications were also made. Nomenclature follows Stace (1997) for wild plants and Zohary and Hopf (1994, table 3, table 5) for the cereals.

Results

Very few charred plant remains were recovered from any of the samples other than occasional charcoal fragments. The large flot obtained from sample 5041 (context [1034]) consisted principally of coal, with some slag fragments and a small amount of charcoal. This sample also produced a single charred seed of *Cannabis sativa* L (hemp).

Sample 5007 from context [4005] produced two *Triticum* sp. (wheat), grains one of which had a morphology consistent with a naked wheat. Sample 5029 contained a single charred *Galium* cf. *aparine* L. (cleavers) seed. A single charred fragment of hazelnut shell was hand-picked from the top soil in trench A.

Recommendations

Given the paucity of material in these samples, no further work is required.

MACROFOSSIL, POLLEN AND DIATOM ASSESSMENT

David Earle Robinson and Emily Forster, with notes on radiocarbon dating by John Meadows

The aim of monolith sampling the deposits in the second test pit in Trench D was to gain access to information on conditions in and around the pond which was potentially preserved in the pollen, diatom and macrofossil content of the sediments during the abbey's period of use. The following is an assessment, with this aim in mind, of the pollen, diatom and macrofossil content of the sediments as sampled in the monolith tins.

Sampling and stratigraphy

The monolith samples taken from Trench D are listed in Table 11. It should be noted that Sample 5054 was marked in error in the field as 101.56 – 102.06mOD. Table 12 lists brief descriptions of the sediments represented in the monolith samples, listed from bottom (oldest) to top (most recent).

A series of sub-samples have been taken for the purpose of radiocarbon dating. Two sub-samples were taken in August 2007, and both were submitted for dating. Twelve further sub-samples were taken in January 2009, and four of these were submitted for dating. Details of the sub-samples taken for radiocarbon dating are given in Table 13. Some shrinkage had occurred by the time the samples were taken in January 2009: 5050 had lost c. 2 mm in length and 5053 had lost c. 7 – 8 mm in length.

Another series of sub-samples was taken for pollen analysis. Details of these sub-samples are given in Table 14. A final series of sub-samples was taken for diatom analysis, details of which are given in Table 15.

Table 11: Monolith samples from Trench D

Sample number	Level mOD at bottom	Level mOD at top
5050	100.07	100.57
5051	100.51	101.01
5052	100.97	101.47
5053	101.09	101.59
5054	101.66	102.16
5055	102.09	102.59
5056	102.42	102.92
5057 (Small specialist sample)	from rubble layer	

Table 12: Description of sediments represented in monolith samples

Sample	cm from base of tin	Level (mOD)	Description
5050			
	0 -18	100.07 – 100.25	Natural light grey clay unstratified, blocky structure with no signs of laminations.
	18 – c. 32	100.25 – 100.39	Light grey/khaki banded (horizontal), stratified water-lain clay, soft and plastic in consistency.
	32 – c. 45	c. 100.39 – 100.52	Light grey/khaki banded stratified clay with bands (horizontal) of darker orange colour and obvious flecks of organic/herbaceous material.
	c. 45 – 50	100.52 – 100.57	as 32-45 but with darker organic lenses – horizontal.
5051	N.B. 6 cm overlap at base with top of 5050		
	0 – c. 6	100.51 – 100.57	As 45 – 50 in 5050
	c. 6 – c. 9	100.57 – 100.60	banded highly stratified clay-rich material with highly organic bands – horizontal.
	c. 9 – c. 11	100.60 – 100.62	dense, highly organic band (horizontal).
	c. 11 – c. 25	100.62 – 100.76	grey greasy clay with organic flecks and lens – horizontal at first but becoming more and more multi-directional upwards.
	c. 25 – c. 27	100.76 – 100.78	dense, highly organic band (horizontal).
	c. 27 – c. 41	100.78 – 100.92	striped horizontal clay deposits with occasional organic stripes and flecks.
	c. 41 – 50	100.92 – 101.01	blocky non-laminated/unstratified clay – not obviously water-lain.
5052	N.B. 4 cm overlap at base with top of 5051		
			Clay layers of varying colour and content of organic material and inclusions. Not yet described in detail.
5053	N.B. 38 cm overlap at base with top of 5052		
			Clay layers of varying colour and content of organic material and inclusions. Not yet described in detail.
Rubble layer		c. 101.55 – c.101.80	
	The sediments above the rubble layer show features suggestive of repeated re-cutting and their content of earthworm eggs is consistent with some degree of bioturbation having taken place.		
5054	N.B. 10 cm gap at base down to top of 5053		
			Clay layers of varying colour and content of organic material and inclusions. Not yet described in detail.
5055	N.B. 7 cm overlap at base with top of 5054		
			Clay layers of varying colour and content of organic material and inclusions. Not yet described in detail.
5056	N.B. 17 cm overlap at base with top of 5055		
			Clay layers of varying colour and content of organic material and inclusions. Not yet described in detail.

Table 13: Sub-samples taken for radiocarbon dating

Sample	cm from base of tin	Level (mOD)	Date taken	Submitted for dating
5051	9 – 11	100.60 – 100.62	August 2007	September 2007
	25 – 27	100.76 – 100.78	August 2007	September 2007
5050	18 – 19	100.25 – 100.26	January 2009	February 2009
	19 – 20	100.26 – 100.27	January 2009	
	20 – 21	100.27 – 100.28	January 2009	
	34 – 35	100.41 – 100.42	January 2009	February 2009
	35 – 36	100.42 – 100.43	January 2009	
	36 – 37	100.43 – 100.44	January 2009	
5053	5 – 6.5	101.14 – 101.15.5	January 2009	
	25 – 26	101.34 – 101.35	January 2009	February 2009
	26 – 27	101.35 – 101.36	January 2009	
	c. 42	100.51	January 2009	
	47 – 48	101.56-101.57	January 2009	
	48 – 49	101.57 – 101.58	January 2009	February 2009

Table 14: Sub-samples taken for pollen analysis

Sample	cm from base of tin	Level (mOD)	Prepared and counted?
5050	16 – 17	100.23 – 100.24	No
	19 – 20	100.26 – 100.27	Yes
	27 – 28	100.34 – 100.35	No
	35 – 36	100.42 – 100.43	Yes
	43 – 44	100.50 – 100.51	No
5051	7 – 8	100.58 – 100.59	No
	9 – 10	100.60 – 100.61	Yes
	15 – 16	100.66 – 100.67	No
	23 – 24	100.74 – 100.75	No
	25 – 26	100.76 – 100.77	Yes
	33 – 34	100.84 – 100.85	No
	41 – 42	100.92 – 100.93	No
	45 – 46	100.96 – 100.97	No
5053	5 - 6.6	101.14 – 101.15.5	Yes
	26 – 27	101.35 – 101.36	Yes
5054	10 – 11	101.76 – 101.77	Yes
	20 – 21	101.86 – 101.87	Yes
5055	10 – 11	102.19 – 102.20	Yes
	20 – 21	102.29 – 102.30	Yes

Table 15 Sub-samples taken for diatom analysis

Sample	cm from base of tin	Level (mOD)
5050	19 – 20	100.26 – 100.27
	20 – 21	100.27 – 100.28
	35 – 36	100.42 – 100.43
	36 – 37	100.43 – 100.44

Methods

It was decided to concentrate primarily on the lower deposits, below the level of the rubble layer at c. 101.60m – 101.75m (AOD), as it seemed likely that these corresponded to the monastic period, an assumption supported to some degree by the first pair of radiocarbon dates obtained in 2007 (see below). A further four samples submitted for radiocarbon dating in February 2009 will hopefully provide solid confirmation. However, the upper deposits, overlying the rubble layer were also cursorily examined via limited pollen analysis and examination of the stratigraphy.

Macrofossils/material for radiocarbon dating

A sub-sample of sediment (25-50 ml in volume), representing a vertical depth of 1 cm was soaked in water and washed though a fine (180 or 250 micron mesh) sieve. A brief description of the nature and content of the sample was made and all potential datable material was then picked out under a lower power binocular microscope and retained. A selection of plant macrofossils was submitted for dating (see below).

Pollen

Samples (0.5 – 1 ml) were prepared using standard pollen preparation procedures, ie addition of an 'exotic' spike (*Lycopodium* spores), treatment with hydrochloric acid, potassium hydroxide, hydrofluoric acid and acetolysis. The resulting pollen residues were stained with safranin and mounted in silicone oil. Slides were counted until at least 100 fossil pollen grains had been encountered. Nomenclature follows Bennett (1994).

Diatoms

Samples (0.2 – 0.5 ml) were prepared using a simplified version of the standard diatom preparation procedure: sediment was treated with hydrogen peroxide to remove organic matter, then dried on coverslips (on a hotplate) and mounted in naphrax. Slides were counted at x1000 magnification (oil immersion with phase contrast) until at least 100 diatoms had been encountered. Nomenclature follows the European Diatom Database (EDDI) (2009).

Results

Macrofossils

Macrofossils recorded during the sorting of samples for selection of material for radiocarbon dating are detailed in Table 16.

Table 16: Macrofossils recorded from monolith sub-samples

Sample	cm from base of tin	Level (mOD)	Notes	Macrofossils recorded
5050	18 – 19	100.25 – 100.26	Approx. 50 ml of sediment soaked in water and washed though a 180 micron sieve. Almost all the sample washed through the sieve. Generally very well-preserved plant and animal remains were recorded from a fine grey clay matrix, with little apparent humus content.	*Chara* sp oospores and possibly also stems & leaves, cf. *Agrostemma* seed fragments, cf. *Juncus*/ *Typha* seeds, small bark fragments, small fragments of charred material; Diptera wings, fish scales, small insect fragments, cf. ostracod valves, occasional small stones
	34 – 35	100.41 – 100.42	Approx. 50 ml of sediment soaked in water and washed though a 180 micron sieve. Generally very well-preserved plant and animal remains (these constituted a very small proportion of the sample, the remainder of which mostly washed through the sieve) were recorded from a brownish-grey clay matrix with modest humus content.	Dicot. leaf fragments and stem fragments (black bundles = cf. *Urtica*), *Potamogeton* fruits and fruit stones, charred bark fragments; Insect fragments, occasional cf. ostracod valves
5051	9 – 11	100.60 – 100.62	Approx. 25 ml of sediment soaked in water and washed though a 250 micron sieve. A fine sandy, silty matrix.	cf. *Anthemis cotula* achene, *Lemna* sp seeds, *Alisma plantago-aquatica* embryo, *Sonchus* sp achene, *Juncus* sp seeds, cf. *Eupatorium* sp achene. Fibrous plant tissue including cf. fern & cf. moss stems, some 'sheath-like' structures and broad monocot. leaf fragments (some partially mineralised), small twig (unidentified.); *Daphnia* egg cases, Diptera puparia, beetle fragments, small molluscs and mollusc shell fragments.
	25 – 27	100.76 – 100.78	Approx. 25 ml of sediment soaked in water and washed though a 250 micron sieve. A fine sandy, silty matrix containing fine rootlets	Moss fragments, bark fragments, rhizome (cf. fern) fragments
5053	25 – 26	101.34 – 101.35	Approx. 30 ml of sediment soaked in water and washed though a 180 micron sieve. Well-preserved plant and animal remains (these constituted a very small proportion of the sample, the remainder of which mostly washed through the sieve) were recorded from a brownish clay matrix.	*Lemna* sp seed, *Stellaria* sp seed, cf. *Cerastium* sp seed, *Carex* (biconvex & trigonous nutlets, incl. utricle), Poaceae caryopses, Brassicaceae seed; Daphnia egg cases, some iron precipitation and staining.
	48 – 49	101.57 – 101.58	Approx. 30 ml of sediment soaked in water and washed though a 180 micron sieve. Almost the whole sample washed through the sieve. The following, together with mostly fine plant material, were recorded from a brownish-grey clay matrix with modest humus content plus a little silt and a few small stones:	*Juncus* seeds (abundant), *Glyceria* caryopses, *Lamiaceae* nutlet, *Ranunculus* achene, biconvex & trigonous *Carex* nutlets

Pollen

A total of 10 samples were assessed in all, six from below the rubble layer and four from above it (see Table 14). Pollen was mostly well-preserved, but not overly abundant, in the ten samples assessed. A full slide (in excess of 100 pollen grains) was counted for each level. The results are shown in Table 17 and in an assessment pollen diagram, Figure 23.

The lower spectra (below the rubble layer) had a pollen spectrum dominated by open habitat species and types (*Poaceae*, including one possible cereal pollen grain, together with a number of arable and ruderal indicator species and a range of herbs). Tree and shrub pollen (mostly *Quercus*, with some *Betula*, *Fraxinus*, *Ulmus*, *Corylus*, *Pinus* and *Salix*) was moderately abundant. There was also a good quantity of *Typha* and *Cyperaceae* pollen and spores of lower plants, especially *Equisetum*.

The upper spectra revealed a similar open-habitat picture, dominated by grasses (with some cereals), low values for trees and shrubs and an even more extensive range of arable and ruderal indicator species, herbs, sedges and lower plants.

The spectra below and above the rubble layer included a slight heath/bog component.

Table 17: Pollen assessment counts, by type, per sub-sample

	Level (mOD)									
Pollen Assessment counts by type	100.26-100.27	100.42-100.43	100.60-100.61	100.76-100.77	101.14-101.15.5	101.35-101.36	101.76-101.77	101.86-101.87	102.19-102.20	102.29-102.30
Trees and shrubs										
Alnus	2	0	0	0	0	0	1	0	0	2
Betula	2	0	1	0	1	0	0	0	0	2
Fagus	0	2	0	0	0	0	0	0	0	0
Fraxinus excelsior	0	0	2	0	0	0	1	0	1	0
Pinus	0.5	0	0	0	1.5	2.5	5	8.5	2	5
Quercus	10	3	16	1	7	12	2	12	3	3
Ulmus	1	0	1	0	2	1	1	0	0	0
Corylus avellana-type	6	1	2	0	2	3	8	5	5	1
Salix	6	26	3	0	8	5	1	0	1	1
sum	**27.5**	**32**	**25**	**1**	**21.5**	**23.5**	**19**	**25.5**	**12**	**14**
Grasses and cereals										
Poaceae	43	44	57	77	40	38	51	65	67	64
?Cereal (Hordeum-type)	0	0	1	0	0	0	0	1	1	0
sum	**43**	**44**	**58**	**77**	**40**	**38**	**51**	**66**	**68**	**64**
Arable and ruderal indicators										
Artemisia-type	0	0	1	0	0	0	0	0	0	0
Caryophyllaceae/ Silene	0	0	0	0	0	0	0	1	0	0
Chenopodiaceae	0	0	0	0	0	1	0	0	0	0
Cichorium intybus-type	1	0	2	1	1	4	3	5	2	7
Plantago lanceolata	1	0	1	3	0	3	1	1	0	1
Plantago media/major	4	0	2	0	1	0	0	1	0	1
Rubiaceae	0	0	0	0	0	5	4	2	1	3
Rumex acetosella	4	1	0	0	1	1	2	0	2	0
Rumex acetosa	0	2	0	0	0	0	1	0	0	0
Urtica dioica	1	0	3	0	3	1	1	2	0	0
sum	**11**	**3**	**9**	**4**	**6**	**15**	**12**	**12**	**5**	**12**
Herbs										
Apiaceae undiff.	0	1	1	0	4	0	0	0	0	0
Achillea-type	0	0	0	1	0	0	0	0	0	0

Solidago virgaurea-type	2	0	3	8	0	0	0	0	0	0
Centaurea	0	0	0	0	0	0	0	0	1	1
Campanula-type	0	1	0	0	0	0	0	0	0	1
Drosera intermedia	0	0	0	0	2	0	0	0	1	0
Liliaceae	0	0	0	0	0	0	0	0	0	1
Linaceae undiff.	0	0	2	0	0	5	0	0	0	0
Fabaceae	0	1	0	0	0	0	0	0	0	0
Lotus sp.	0	1	0	0	5	0	0	0	0	0
Ranunculaceae undiff.	3	4	3	0	3	1	2	2	3	2
Saxifragaceae	0	0	0	0	5	0	2	1	2	0
Spergula-type	0	0	0	0	0	1	0	0	0	0
Rosaceae undiff.	5	7	1	0	1	3	4	1	1	1
Filipendula	7	5	3	0	4	7	3	4	2	2
Potentilla-type	0	5	0	0	0	5	2	0	1	0
sum	**17**	**25**	**13**	**9**	**24**	**22**	**13**	**8**	**11**	**8**
Heaths										
Calluna vulgaris	0	0	0	0	0	0	0	0	0	1
Ericaceae	0	0	0	0	1	0	0	0	2	0
Sum	0	0	0	0	1	0	0	0	2	1
Sedges, etc.										
Cyperaceae undiff.	10	8	6	13	8	6	9	10	8	6
Typha latifolia	0	0	26	2	0	0	0	0	0	0
sum	**10**	**8**	**32**	**15**	**8**	**6**	**9**	**10**	**8**	**6**
Spores										
Equisetum	0	0	73	19	0	0	1	0	0	0
Pteropsida monolete undiff.	10	7	2	52	5	6	14	11	12	12
Isoetaceae undiff.	2	0	2	0	1	0	1	0	0	0
Pteridium aquilinum	3	1	1	7	2	4	5	4	10	7
Polypodium	2	1	0	0	1	0	2	2	4	0
Ophioglossum vulgatum	0	0	0	0	0	0	0	2	0	0
Hymenophyllum	0	0	0	0	0	1	1	0	0	0
Sphagnum	0	0	1	2	0	0	0	1	3	2
Selaginella selaginoides	0	0	0	2	0	0	0	0	0	0
Thelypteris palustris-type	0	0	0	0	1	0	0	0	0	0
sum	**17**	**9**	**79**	**82**	**10**	**11**	**24**	**20**	**29**	**21**
Lycopodium (exotic marker)	54	52	38	449	66	104	142	86	107	95
Aquatics										
Lemna	0	0	0	0	1	0	0	1	0	0
Nymphaea	0	0	0	0	0	0	0	0	1	0
Menyanthes	1	0	0	0	0	0	0	0	0	0
Potamogeton	0	2	0	0	0	0	0	0	0	0
sum	**1**	**2**	**0**	**0**	**1**	**0**	**0**	**1**	**1**	**0**
Unidentifiable										
Unidentifiable - degraded	2	3	1	7	0	8	1	2	5	7
Unidentifiable - broken	2	4	3	0	1	5	0	2	2	2
Unidentifiable - crushed	5	4	2	3	1	10	4	5	10	6
Unidentifiable - obscured	2	1	2	5	2	0	1	1	5	1
sum	**11**	**12**	**8**	**15**	**4**	**23**	**6**	**10**	**22**	**16**

Diatoms

A total of four samples from the lower deposits were assessed for their diatom content (see Table 15). Results of the assessment are presented in Table 18. Diatoms were present in all samples, but were poorly preserved and in many cases difficult to identify beyond genus level. The species that could be identified are indicative of fresh/brackish-fresh, neutral/alkaline water and eutrophic conditions. The assemblage was dominated by

Achnanthes minutissima, *Achnanthes* undiff. (undifferentiated) and *Fragilaria construens*, with a small number of centric diatoms and examples of *Navicula*, *Nitzschia* and *Cymbella*. A gradual increase in *F. construens* moving up the profile corresponds to a reduction in the number of centric diatoms and indicates a possible deterioration in water quality.

Table 18: Diatom assessment results

Sample	5050	5050	5050	5050	Indicators		
cm from base of tin	19-20	20-21	35-36	36-37			Nutrient
Level (mOD)	100.26-27	100.27-28	100.43-43	100.43-44	Salinity	pH	status
Centric diatoms							
Cyclotella pseudostelligera	0	3	1	1	brackish-fresh	Circum-neutral	eutrophic
Cyclostephanos dubius	3	0	0	0	brackish-fresh	Alkali-philous	eutrophic
Sum	3	3	1	1			
Pennate diatoms							
Achnanthes minutissima	25	33	25	34	fresh-brackish	Circum-neutral	eutrophic to dystrophic
Achnanthes undiff.	17	25	40	13	n/a	n/a	n/a
c.f. *Brachysira* undiff.	5	0	0	0	n/a	n/a	n/a
Cymbella undiff.	0	0	0	2	n/a	n/a	n/a
Eunotia incisa	3	0	0	0	n/a	n/a	n/a
Fragilaria brevistriata (agg.)	2	0	0	3	fresh-brackish	Alkali-philous	eutrophic to meso-trophic
Fragilaria construens (agg.)	32	37	41	53	fresh-brackish	Alkali-philous	eutrophic to meso-trophic
Fragillaria crotonensis	3	0	0	0	fresh	Alkali-philous	eutrophic
Gomphonema undiff.	1	0	0	0	n/a	n/a	n/a
Navicula mediocris	3	7	0	1	n/a	n/a	?unpro-ductive (Huttenun and Meriläinen 1983)
Navicula undiff.	2	0	0	3	n/a	n/a	n/a
Nitzschia undiff.	5	0	0	0	n/a	n/a	n/a
Sum	98	102	106	109			

The nomenclature used here complies with the EDDI (European Diatom Database) and Denys (1991a; 1991b), both of which were used for interpretation of the ecology. Many species have been renamed in recent years by researchers at the NERC Centre for Ecology and Hydrology (CEH). The outdated names are used here as habitat information was not readily available for the new classifications at the time of writing; of the species mentioned, the names that have changed are *Achnanthes minutissima*, which has been split into several species of *Achnanthidium*, and *Fragilaria construens*, now *Staurosira construens* (Whitton *et al* 2003).

Radiocarbon dating

John Meadows

The results from the samples submitted for radiocarbon dating have been returned, details of which are presented in Table 19, Figure 19 and Figure 20. These samples date the sequence extending from the base of the deposits to the rubble layer – possibly associated with demolition – 1.3 m higher up, including the top and bottom of an organically-rich layer extending from 0.35 to 0. 51 cm above the base of the sediments.

Table 19: Radiocarbon dating results for sub-samples submitted in September 2007 and February 2009

Laboratory code	Level (mOD)	Identification	$\delta^{13}C$ (‰)	Radiocarbon age (BP)	Calibrated date (95% confidence)
SUERC-22564	101.57–8	Carex nutlets	-25.0	420 ±30	cal AD 1430–1620
P24269	101.34–5	Carex nutlets	-	failed	[too small]
OxA-18044	100.76–8 [1] A	fern rhizome fragment	-27.8	371 ±27	cal AD 1440–1640
SUERC-15515	100.76–8 [1] B	fern rhizome fragment	-28.1	430 ±35	cal AD 1420–1620
OxA-17950	100.60–2 [1] A	small twig	-26.6	534 ±27	cal AD 1320–1440
SUERC-15511	100.60–2 [1] B	small twig	-27.1	535 ±35	cal AD 1310–1440
SUERC-22560	100.41–2	fragments of charred bark	-25.0	2850 ±30	1120–910 cal BC
OxA-20311	100.25–6	fragments of uncharred bark	-31.1	775 ±25	cal AD 1210–1280

The samples were processed and measured by Accelerator Mass Spectrometry at the Scottish Universities Environmental Research Centre (SUERC) in East Kilbride and the Oxford Radiocarbon Accelerator Unit (ORAU) at Oxford University. Relevant laboratory procedures are described by Vandenputte *et al* (1996), Slota *et al* (1987), Xu *et al* (2004), and Bronk-Ramsey *et al* (2002; 2004). The results are conventional radiocarbon ages (Stuiver and Polach 1977), quoted according to the Trondheim convention (Stuiver and Kra 1986). The corresponding calibrated date ranges were calculated by the maximum intercept method (Stuiver and Reimer 1986), using the program OxCal 4.0.5 (Bronk Ramsey 1995; 1998; 2001; 2008) and the INTCAL04 dataset (Reimer *et al* 2004).

The two results from each level sampled twice are statistically consistent, according to Ward and Wilson (1978), with test statistics (T') of 0.0 (60–2cm) and 1.8 (76–8cm), both well within the critical value (T'(5%) = 3.8, ν = 1). The four results are not consistent with a single radiocarbon age, however (T' = 23.6, T'(5%) = 7.8, ν = 3), suggesting that deposition between the levels 100.60–2 and 100.76–8 was not instantaneous.

With the obvious exception of SUERC-22560, the results appear to be in sequence, as shown in Figure 19. Figure 20, produced using the Sequence function in OxCal, illustrates the succession of dating results. This model structure requires stratigraphically earlier samples to pre-date samples from later levels, and the satisfactory overall index of agreement (A_{model} >60) shows that this is permitted by the radiocarbon results. The

posterior density estimates of the dates of samples and events (solid distributions) would change if any of the ingredients of the model were altered; for example, the mid-fifteenth-century dates estimated for OxA-18044 and SUERC-15515 clearly depend on the assumption that SUERC-22564 dates deposition at 101.57–8m; if the latter sample included residual material, a sixteenth-century date for the earlier samples could be feasible.

The Sequence model does not estimate the date the deposition of sediment between the levels of the radiocarbon samples, beyond providing minimum and maximum ages. There are now functions which allow such estimates, but their implementation requires the introduction of assumptions about the process of sedimentation, including where it may have been interrupted. This modelling would best be undertaken once palynological and lithostratigraphic analysis are completed.

Discussion

Macrofossils

Examination of the sub-samples processed for the extraction of material suitable for radiocarbon dating revealed the presence of modest quantities of generally very well preserved plant and animal remains within a silty and/or sandy clay matrix of variable organic content. This is consistent in detail with information gained from wet-sieving of bulk samples from Trench D (see Appendix II). The animal remains recorded here comprised various insect fragments (cf. fly wings & puparia, beetle wing cases and other body parts), Daphnia egg cases, fish scales, cf. Ostracod valves, small mollusc shells and shell fragments. Similarly, there was a range of well preserved waterlogged plant remains, from aquatic species (Characeae, *Lemna* sp. *Potamogeton* sp, *Alisma plantago-aquatica*, *Glyceria* sp), through wetland (or probable wetland) species (cf. *Typha*, *Carex* sp (biconvex & trigonous), *Eupatorium cannabinum*, *Juncus* sp) to arable weeds/ruderals (*Anthemis cotula*, *Sonchus* sp). In addition, there were records of Poaceae, Brassicaceae, Lamiaceae, *Ranunculus* sp, monocot. and dicot. leaf fragments, bark fragments (charred and uncharred), fibrous stem fragments, mosses, cf. fern rhizomes and small fragments of charred herbaceous plant material.

Collectively, these macrofossils have the potential to provide a very detailed picture of conditions in and around the pond during the time when the monastery was in use. In particular, they will give information on how wet/dry it was at various times, and perhaps something on approximate water depth and quality. Full analysis of a series of samples is therefore recommended.

Pollen

Pollen preserved in the pond sediments reflects primarily the vegetation of the pond itself and the immediate pond-side area, within a radius of a few hundred metres. Both pollen

spectra reveal an open cultural landscape, dominated by grasses, arable weeds and ruderal species, herbs and plants characteristic of damp/wet areas. There are few trees. All in all, the pollen data reveal a very consistent and rather uniform picture of the vegetation up through the deposits.

Detailed pollen analysis of the sediments should provide an informative picture of developments in the vegetation in the immediate vicinity of the pond during the time the deposits accumulated. Full analysis is recommended and may well reveal greater variation and diversity.

Diatoms

All of the samples were found to contain diatoms and were dominated by species inhabiting nutrient-rich (eutrophic) and circumneutral/alkaline environments (eg *Achnanthes minutissima*, *Fragilaria construens*). The samples were relatively diverse for preliminary counts and initial assessment suggested that diatoms were present in quantities sufficient for full analysis, although the broken/degraded nature of the frustules made identification beyond genus level difficult. However, on closer examination, many of the diatoms were found to be clumped together in chains, thought to be a result of electrostatic forces within the clay matrix. Several techniques were attempted in an effort to disperse the clay particles and separate the diatoms, including treatment with sodium pyrophosphate, gentle sonication and repeated resuspension of sediments; unfortunately these methods proved unsuccessful and it was not possible to obtain sufficient concentrations of identifiable diatoms for analysis.

The results of the diatom assessment indicate eutrophic conditions, supporting interpretation of the site as a fish pond and perhaps evincing further organic inputs to the water. Further analysis is not recommended due to low concentrations, the poor condition of many of the diatoms and the difficulties surrounding identification.

STATEMENT OF POTENTIAL

The aims the project were:

- to achieve a better understanding of the nature and date of the rectangular 'pond,'
- to recover evidence regarding the location, nature, date and condition of any further remains of the culvert and any associated structures, and
- to achieve a better understanding of how water currently feeds from the 'pond' into the culvert.

Assessment of the results of the evaluation shows that all of these aims have been met. Some of the more specific objectives, particularly those relating to fully exposing the whole of the culvert, were not achieved. The depth and complexity of the archaeological remains in Trench A, in particular the depth at which surviving elements of the culvert lie below the current ground surface, meant that it was not possible to excavate and record the whole of the culvert and all features overlying it in the time available for the evaluation. Nevertheless, the evaluation demonstrated that significant archaeological remains relating to both the medieval and post-medieval history of the site survive to the south and south-east of the standing structures of the abbey.

While sufficient to meet the project aims, the materials recovered do not, in general, warrant further detailed analysis. The main exception to this is the further examination of macrofossils and pollen, which should provide considerable information about conditions in the pond and the environment around the pond during the occupation of the abbey. A limited amount of further work is also required on the floor tiles and metalworking waste recovered during the excavation in order to better intrepret the assemblages.

RECOMMENDATIONS

Any flood mitigation works at Hailes Abbey must be preceded by controlled archaeological excavation to recover artefactual and environmental evidence and record any features that would be affected by those works. Such excavation must include a comprehensive and well-thought-out sampling strategy for the recovery of artefactual and environmental evidence. The scope and depth of archaeological excavation would be determined by the scope and depth of any flood mitigation works. The greater the scale and depth of the flood mitigation works, the greater must be the scale and depth of the concomitant archaeological excavation.

In the pond area, it is essential that any flood mitigation works which would result in a lowering of the water table below the rubble layer or cause any other disturbance to the sediments at and below this level be strenuously avoided. The sediments above the rubble layer are of considerably less interpretative value and works here, including

lowering of the water table, could be considered. Targeted excavation to reveal the junction between the pond and the head of the culvert would be desirable, as would be excavation or coring aimed at recovering the profile of the edges of the pond.

It is essential that the results of and the materials recovered during the 2006 evaluation be considered in conjunction with those from any archaeological excavation done in advance of flood mitigation works. The range and quantity of material recovered in the 2006 evaluation was, generally, fairly limited. If combined with materials recovered from further excavation, however, their potential to illuminate a variety of aspects of the history of activity at Hailes could be dramatically increased.

FIGURES

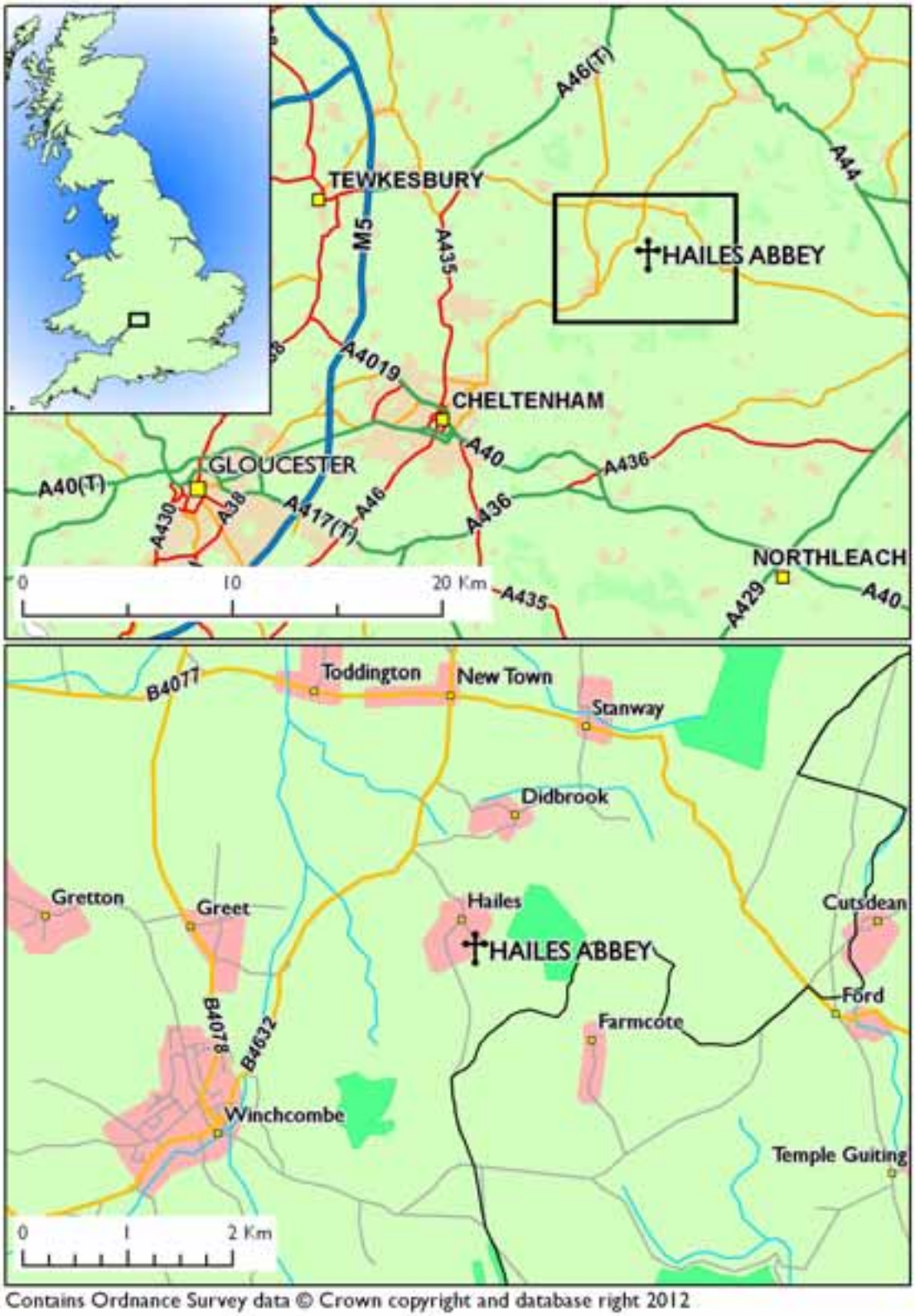

Figure 1: Location map for Hailes Abbey

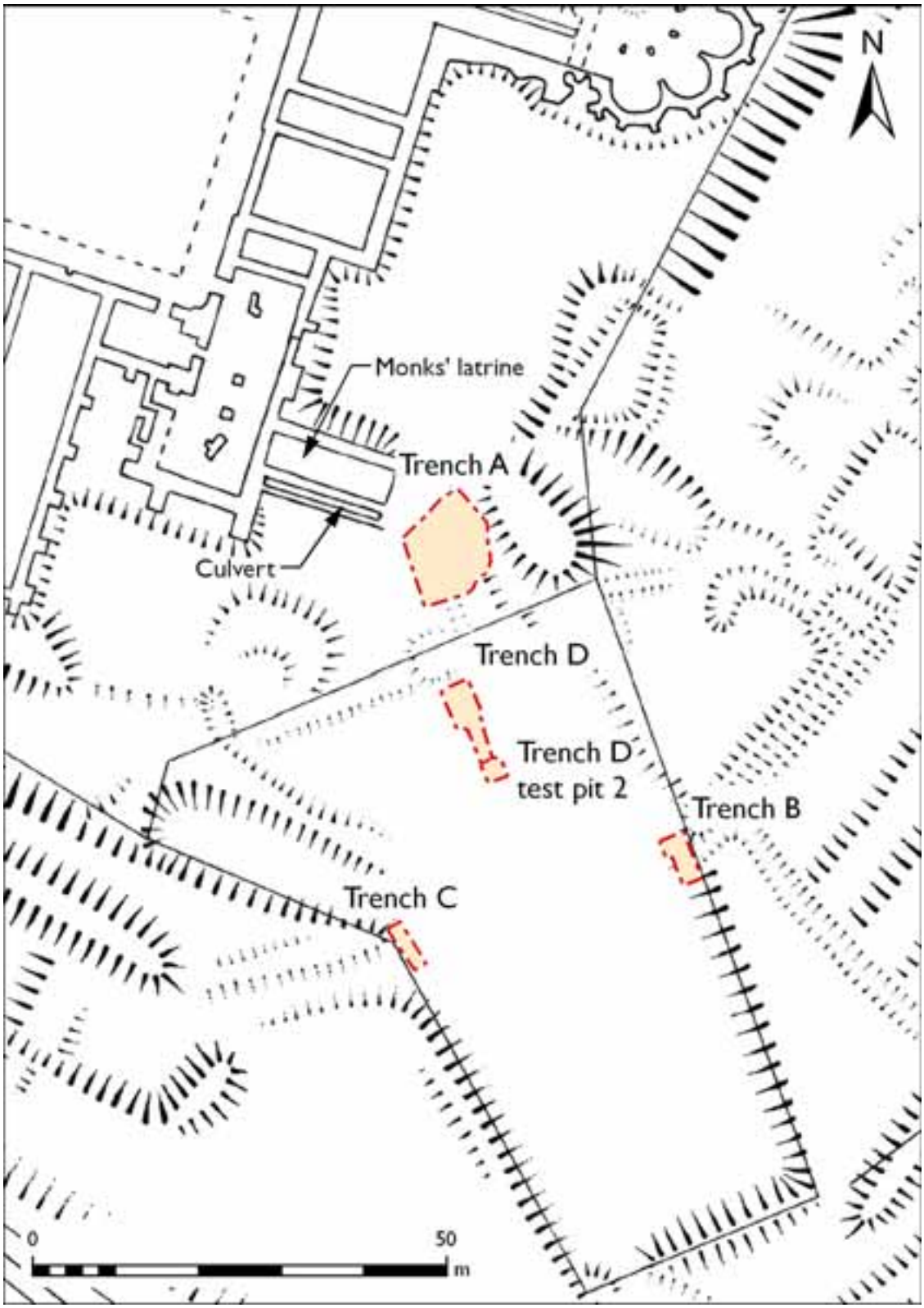

Figure 2: Trench locations (background map from Brown (2006, fig 10))

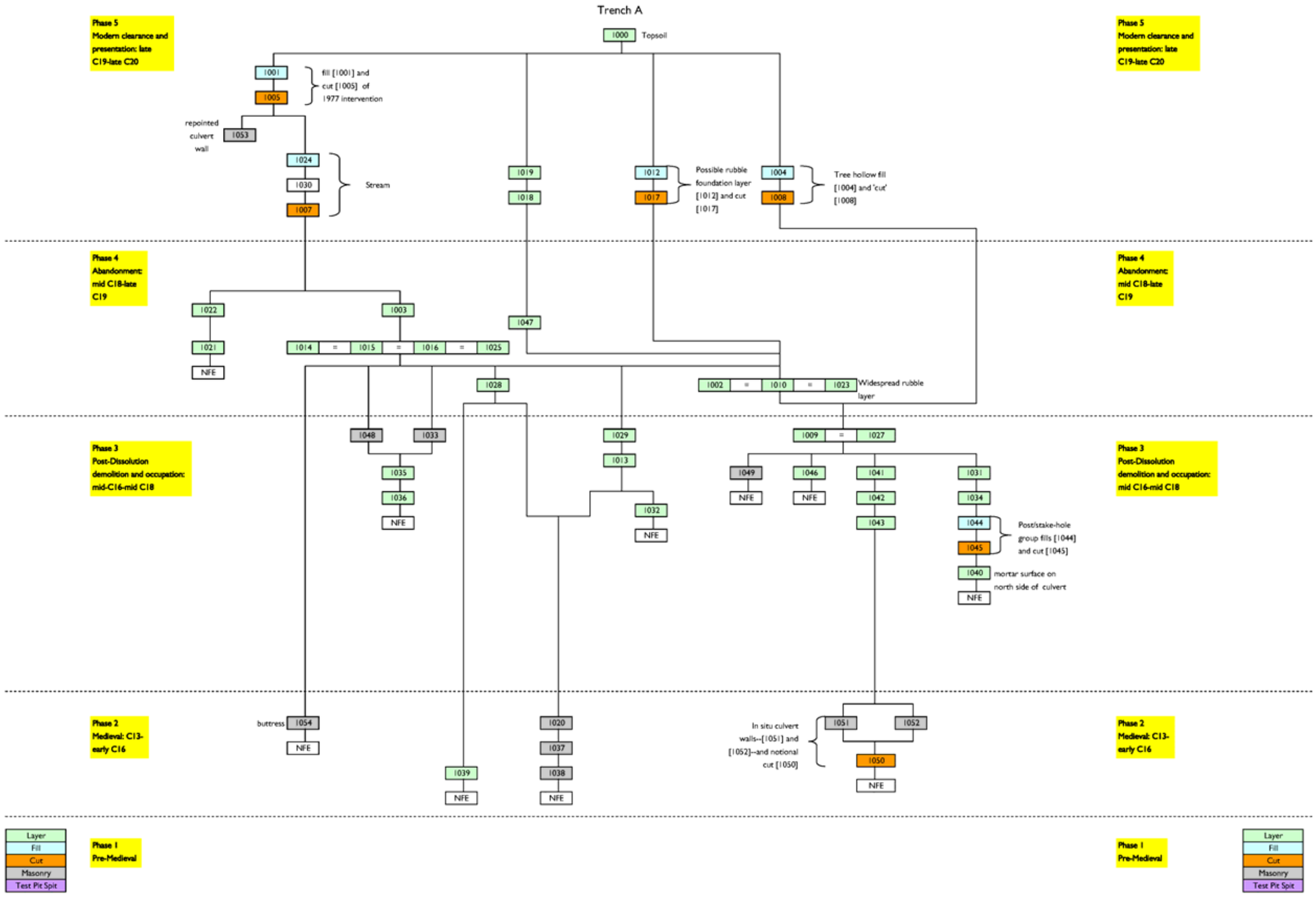

Figure 3: Phased Harris matrix for Trench A

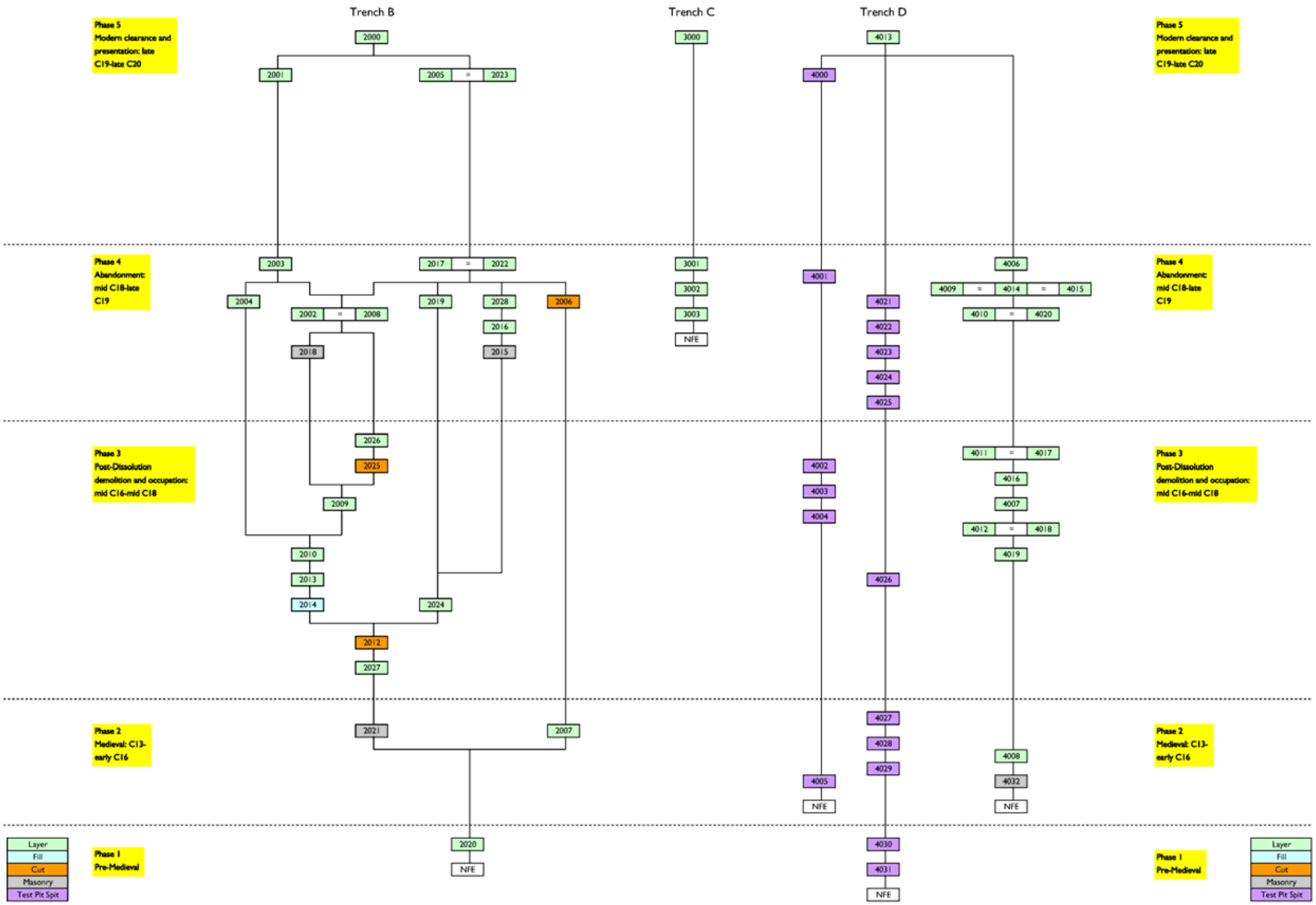

Figure 4: Phased Harris matrices for trenches B, C and D

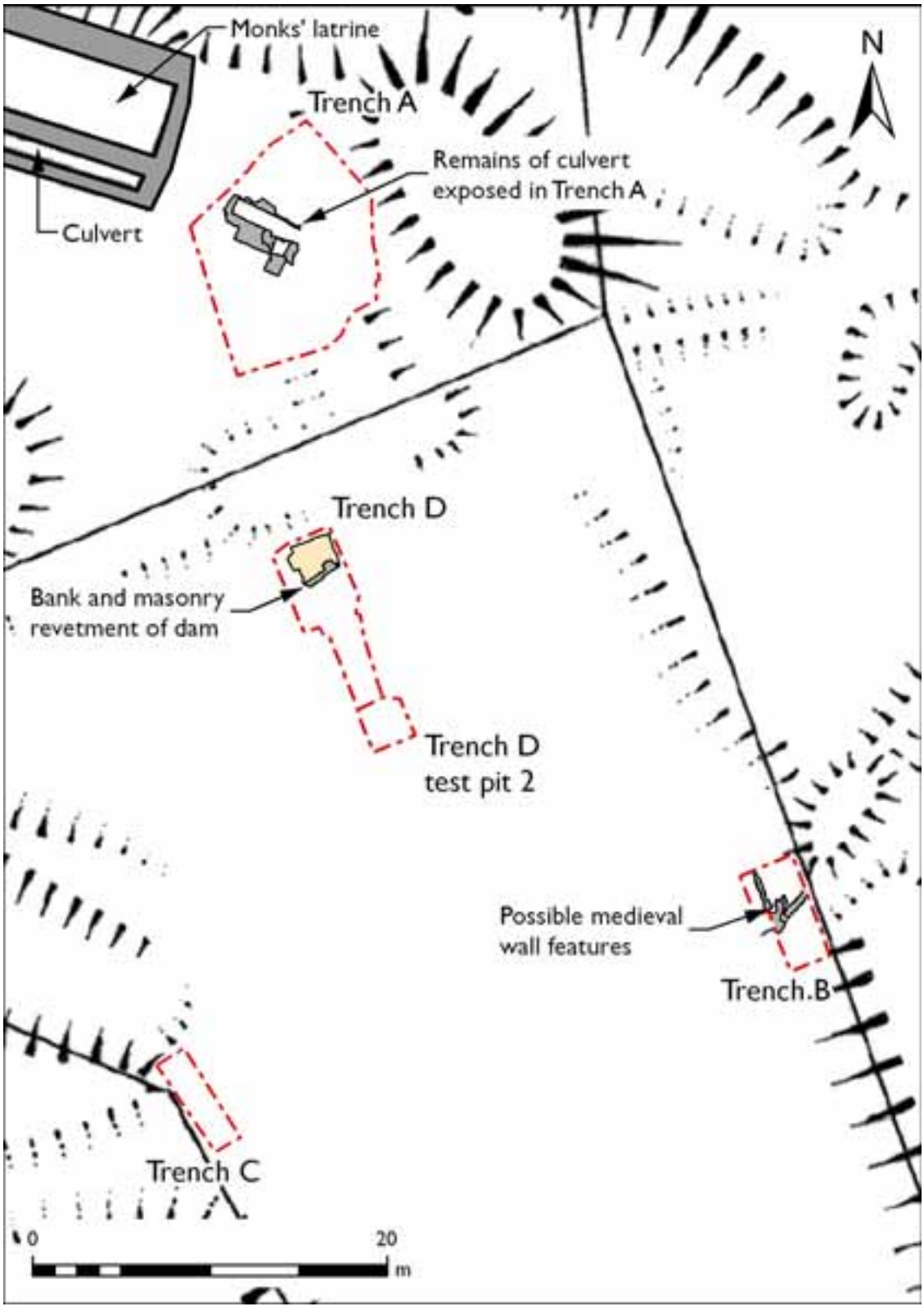

Figure 5: Trench locations and key features revealed during the evaluation (background map from Brown (2006, fig 10))

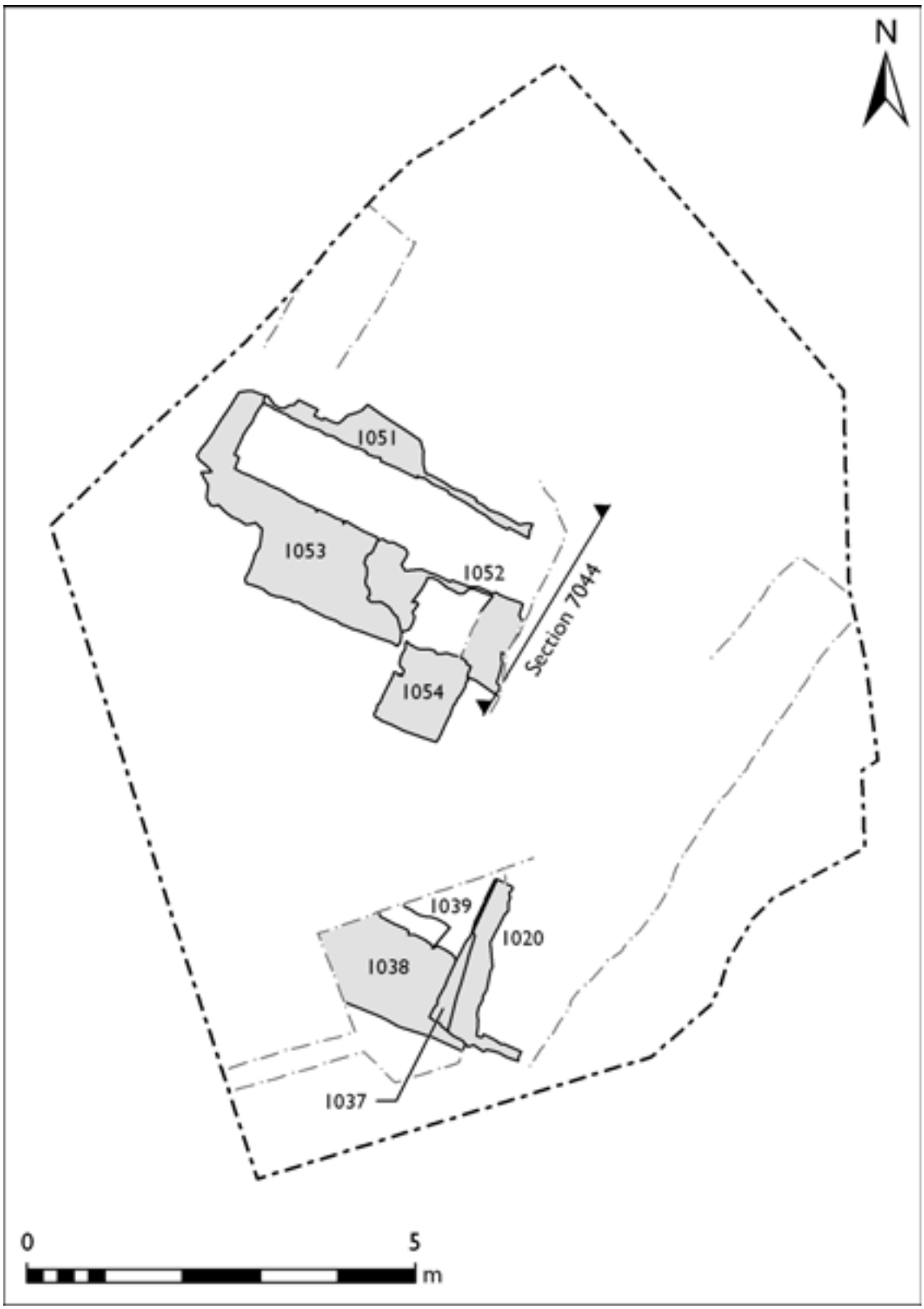

Figure 6: Trench A, showing key Phase 2 contexts and line of section drawing 7044

Figure 7: Excavated culvert (looking north-west), showing culvert walls [1052] (left) and [1051] (right), with re-pointed section of culvert wall [1053] on the left; modern rubble fill [1001] is in the centre (photo by D Stirk)

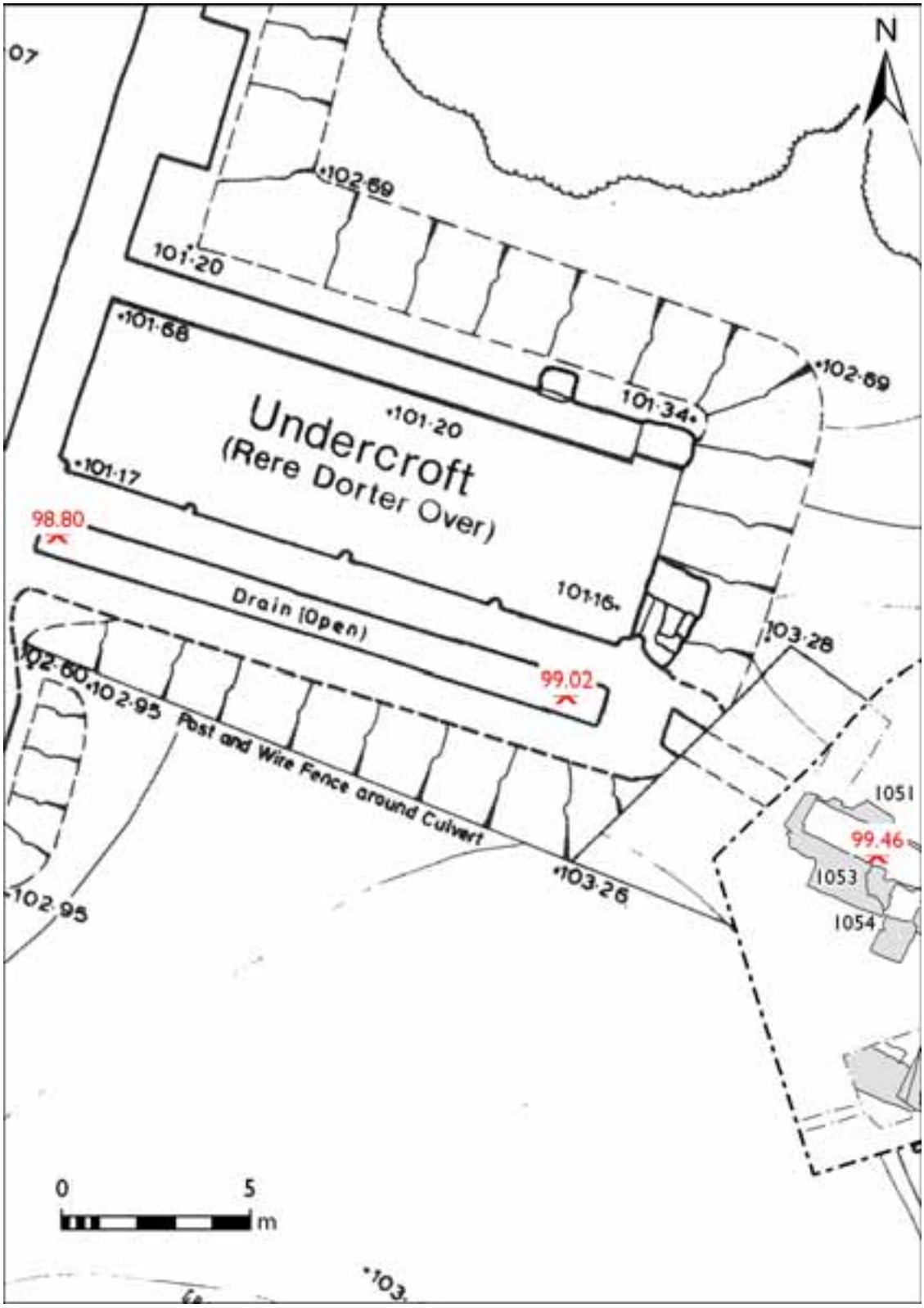

Figure 8: Detail of exposed and excavated culvert, showing levels at bottom (background map taken from 1976 topographic survey)

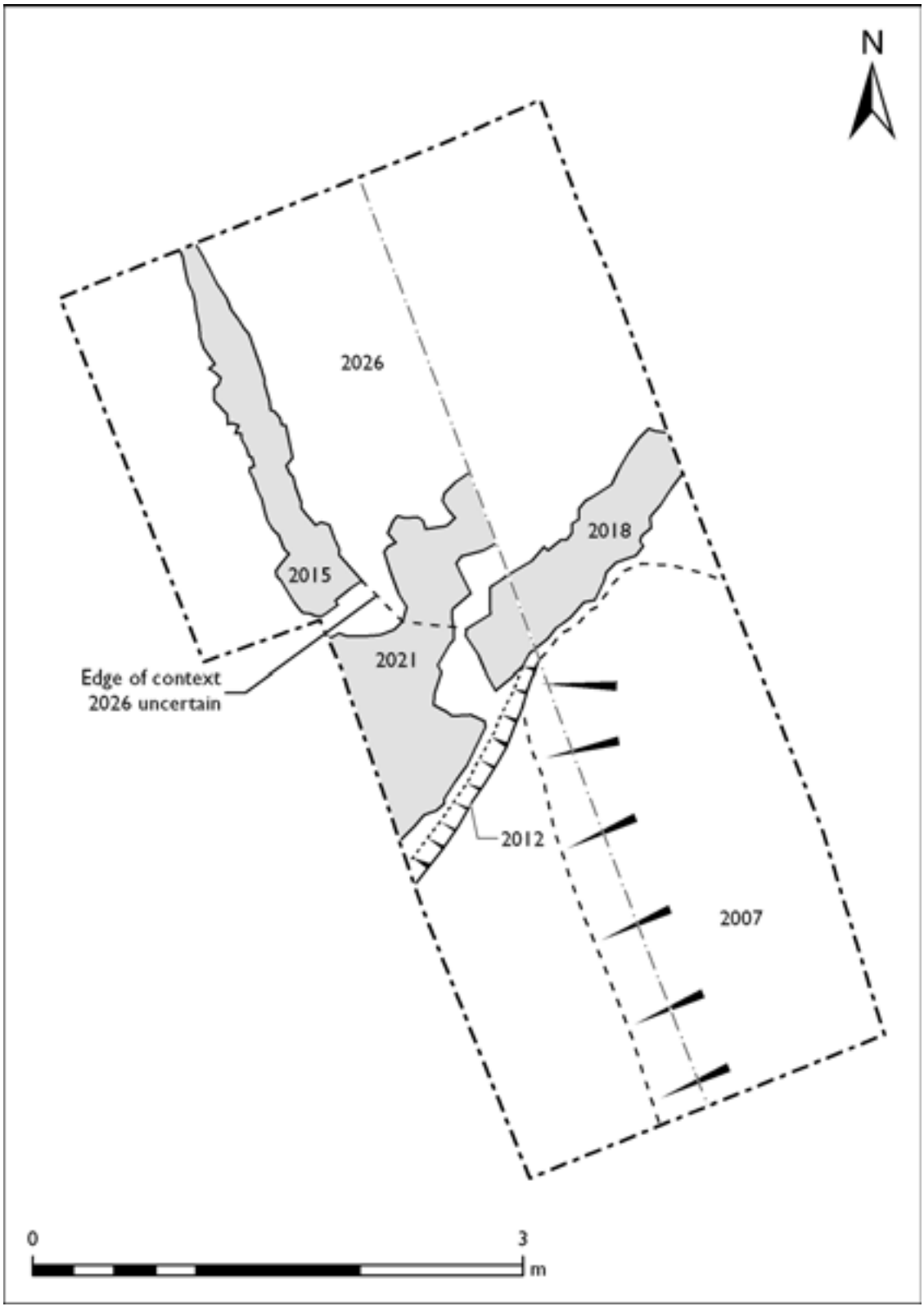

Figure 9: Trench B, showing key contexts from Phases 2–4

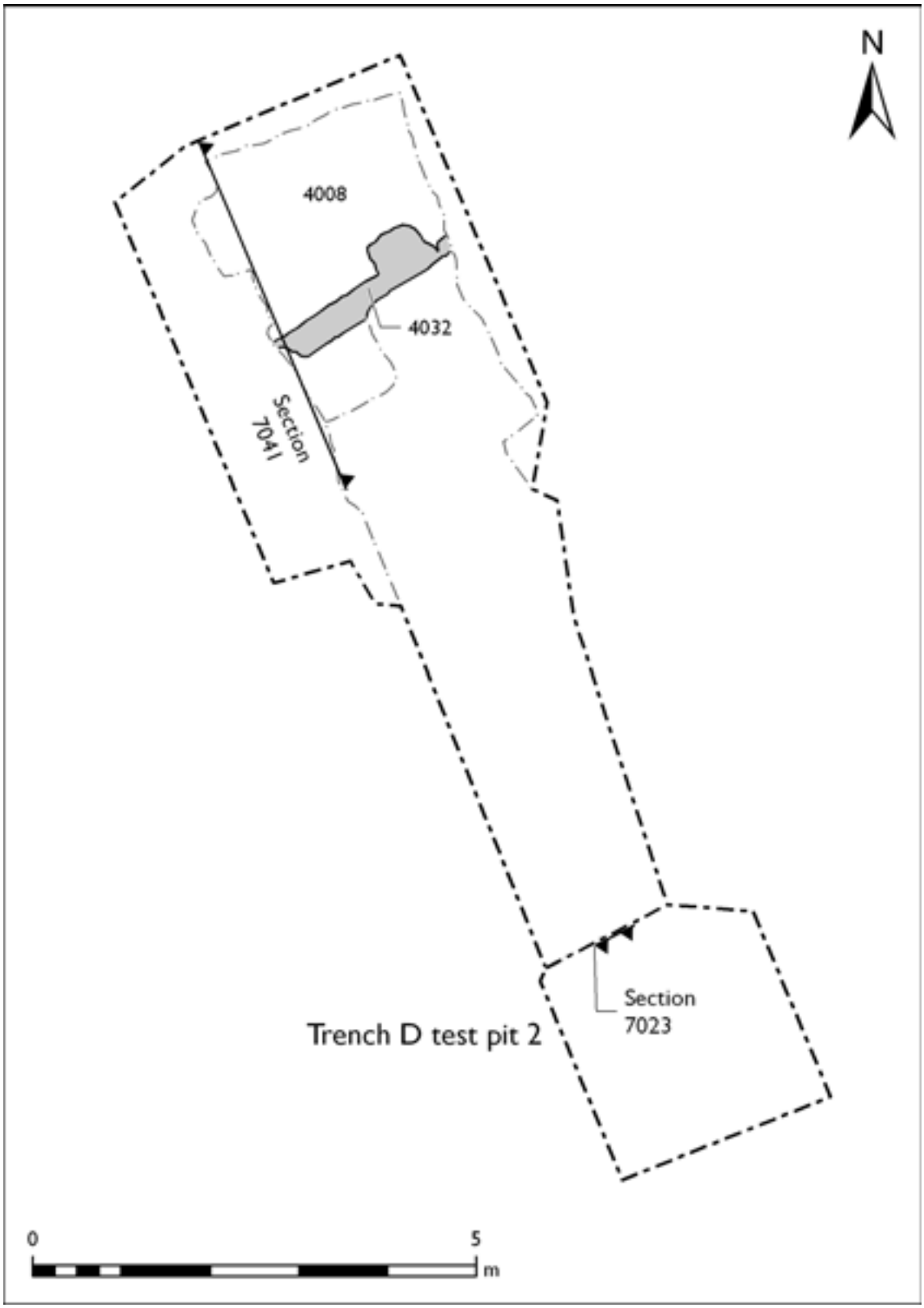

Figure 10: Trench D, showing dam formed of contexts [4032] (masonry) and [4008] (soil bank), and lines of section drawings 7023 and 7041

Figure 11: Contexts [4032] (masonry) and [4007] (soil bank) (looking north)

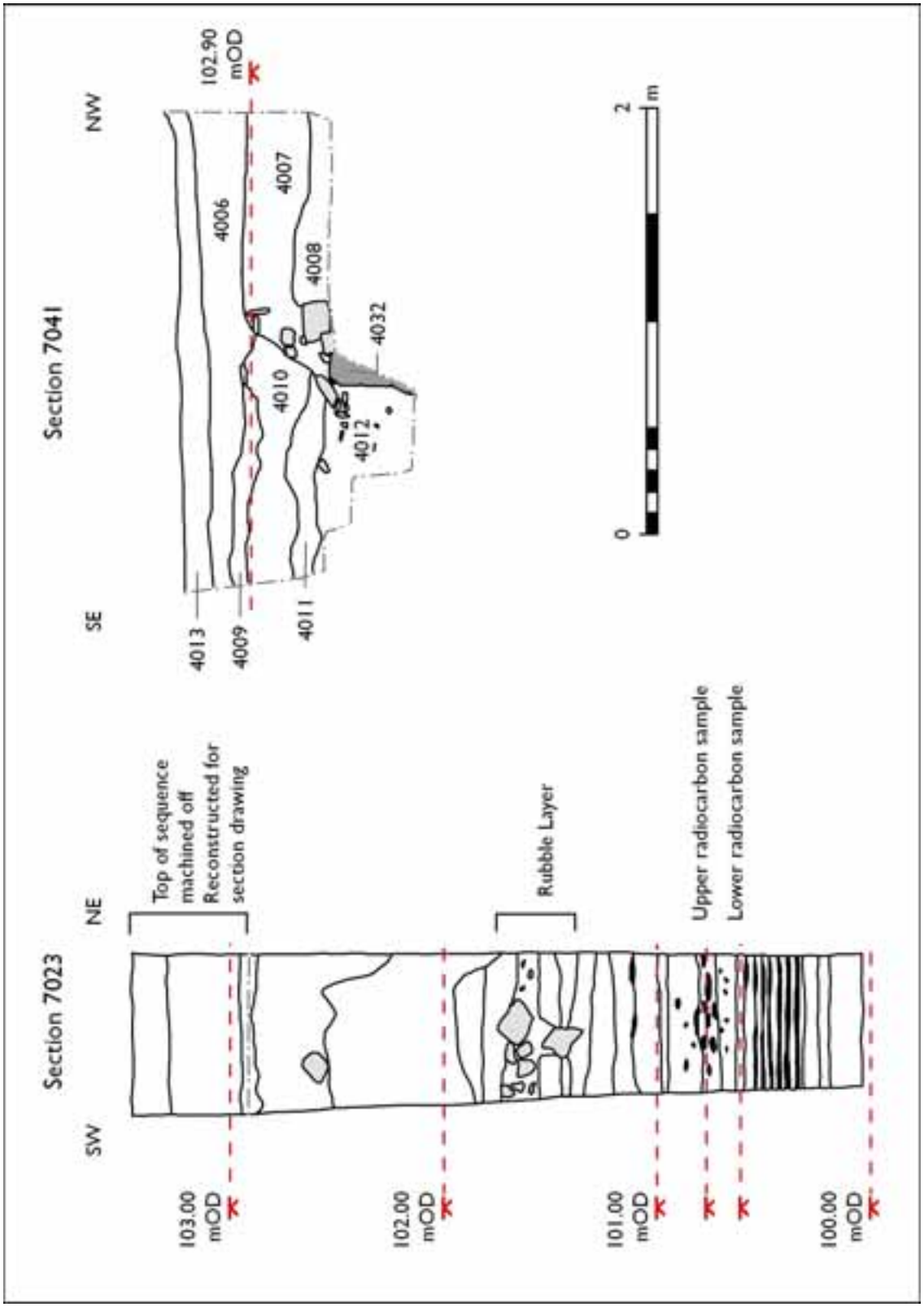

Figure 12: Sections 7023 and 7041, from Trench D

Figure 13: Detail from Treswell's 1587 map (MF/1/59, The National Archives UK), showing possible outline of former pond and line of culvert. North is to the left of the image

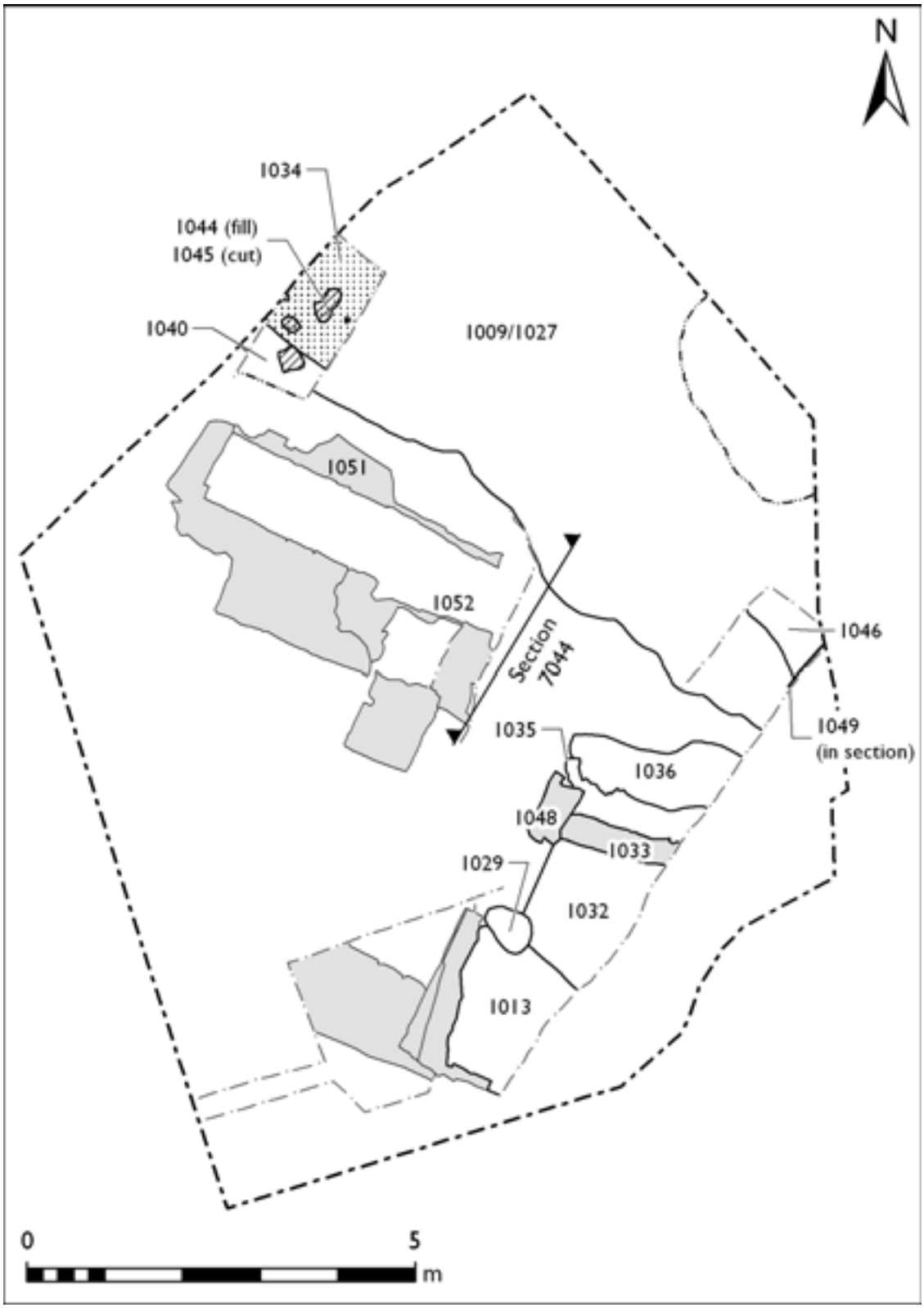

Figure 14: Trench A, showing key Phase 3 contexts and line of section drawing 7044

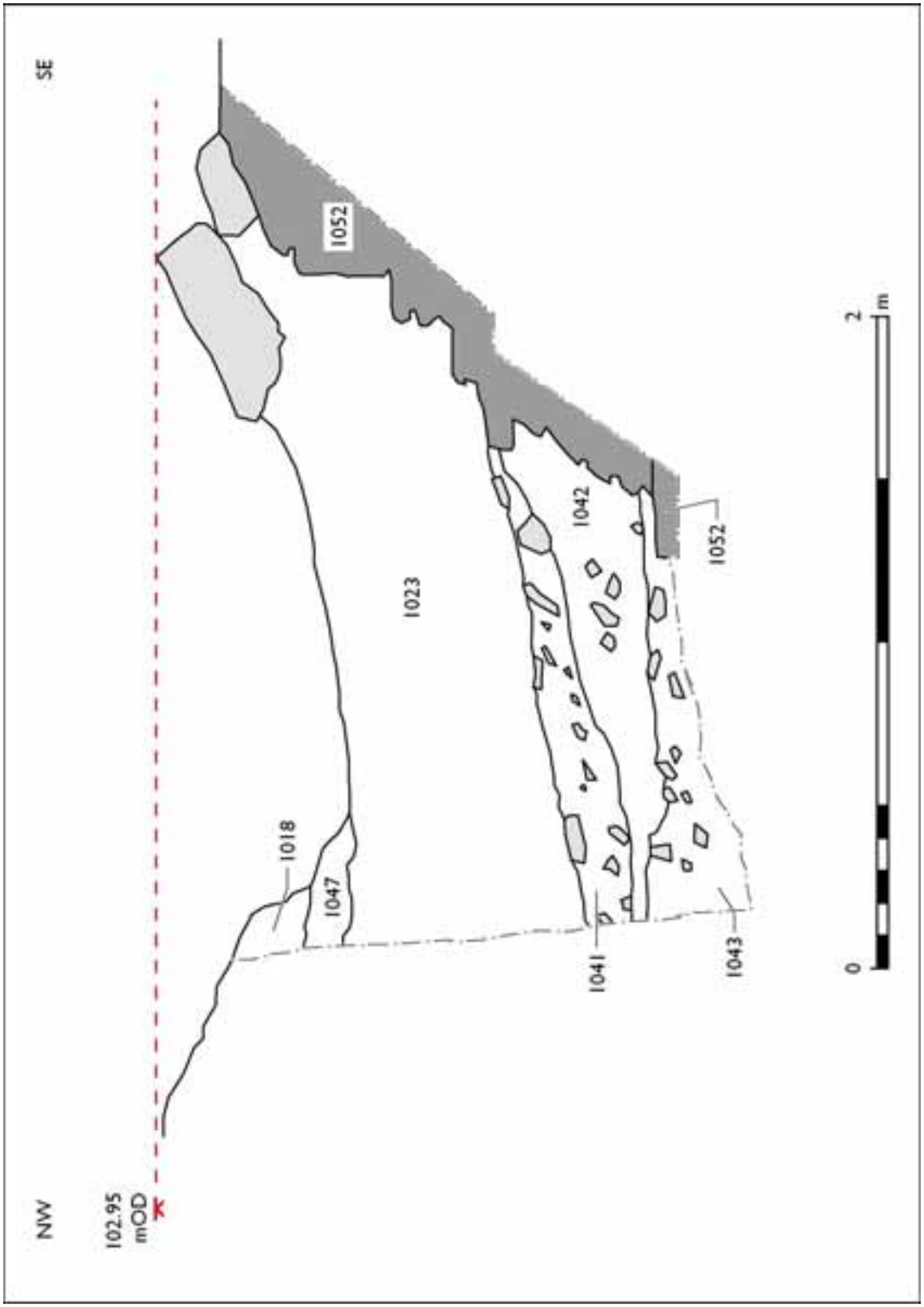

Figure 15: Section 7044

Figure 16: Context [1034] (darker soil) (looking north-east) (photo by D Stirk)

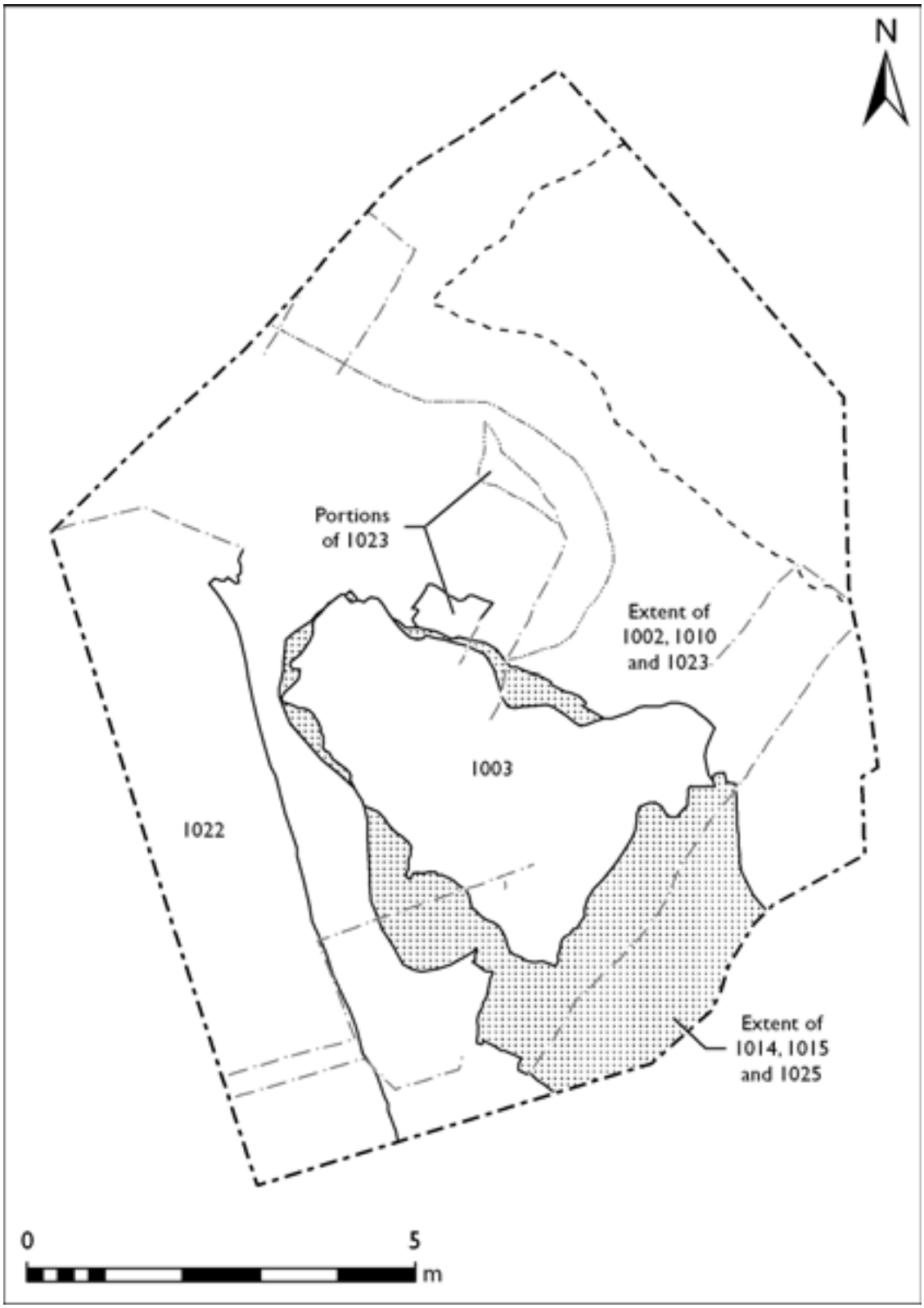

Figure 17: Trench A, showing key Phase 4 contexts

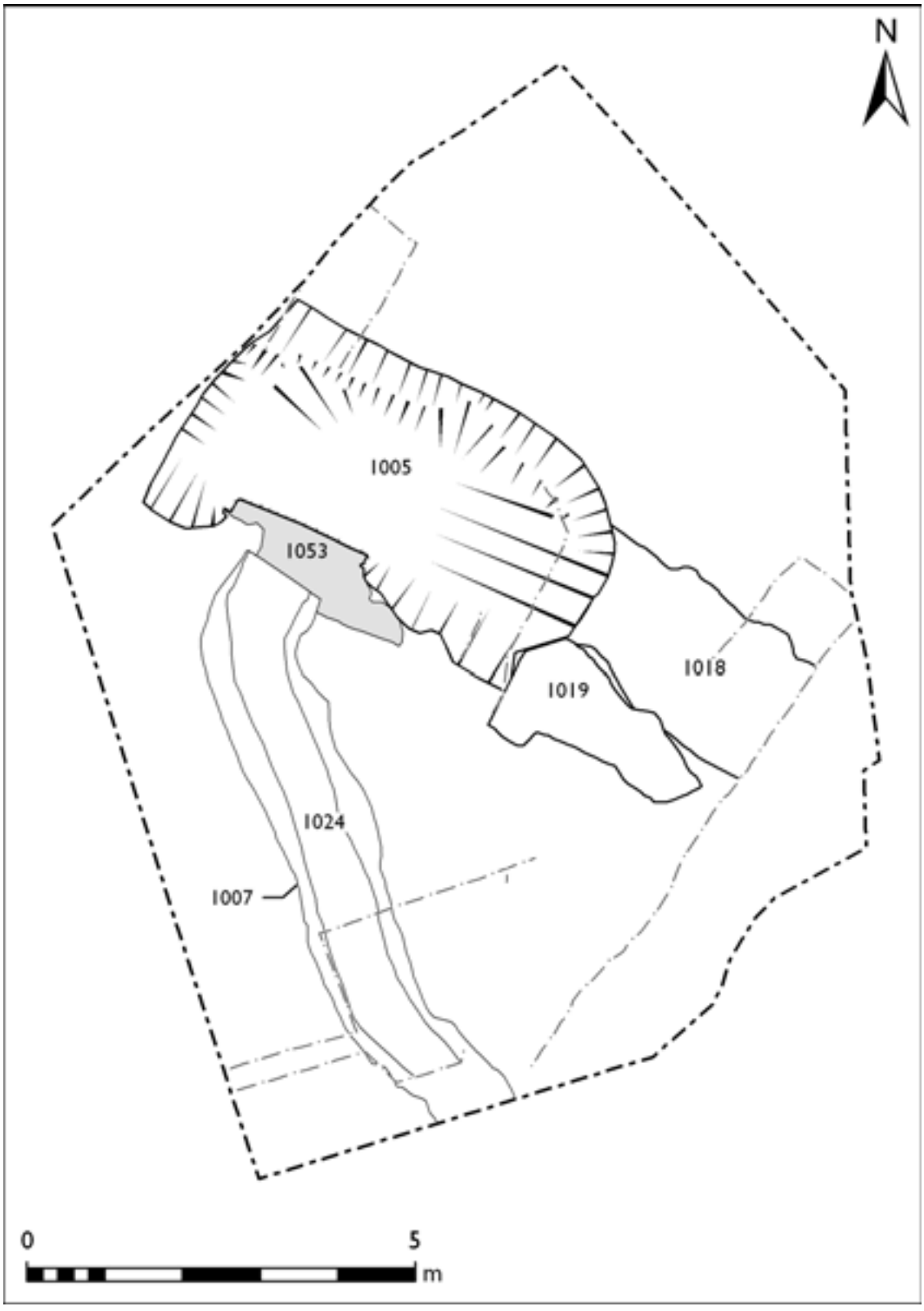

Figure 18: Trench A, showing key Phase 5 contexts

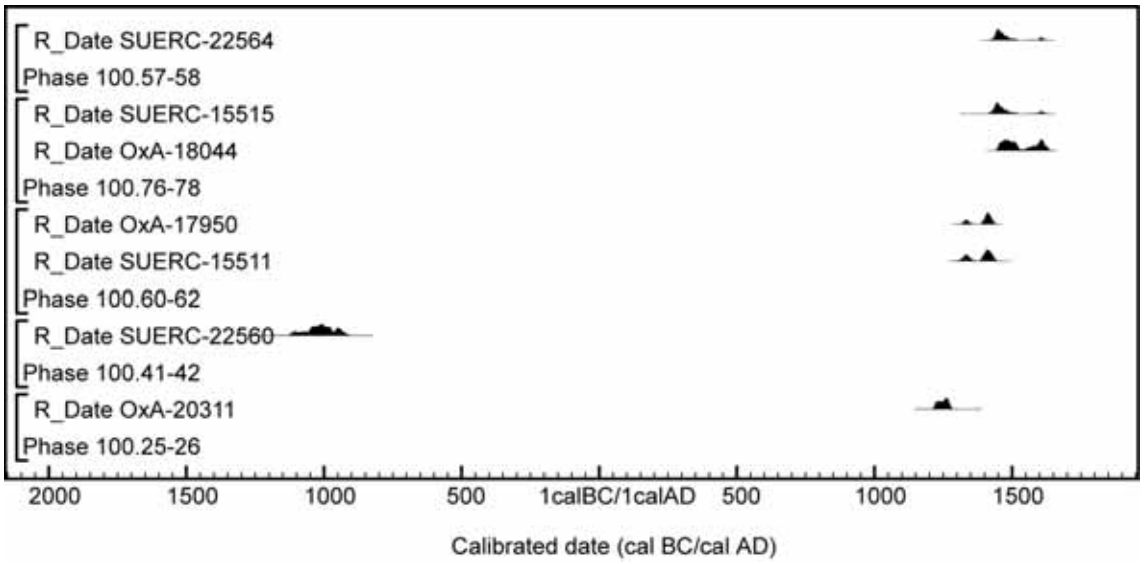

Figure 19: Calibration by the probability method (Stuiver and Reimer 1993) of radiocarbon results. The height of each distribution is proportional to the probability that the sample is of the corresponding calendar date (prepared by J Meadows)

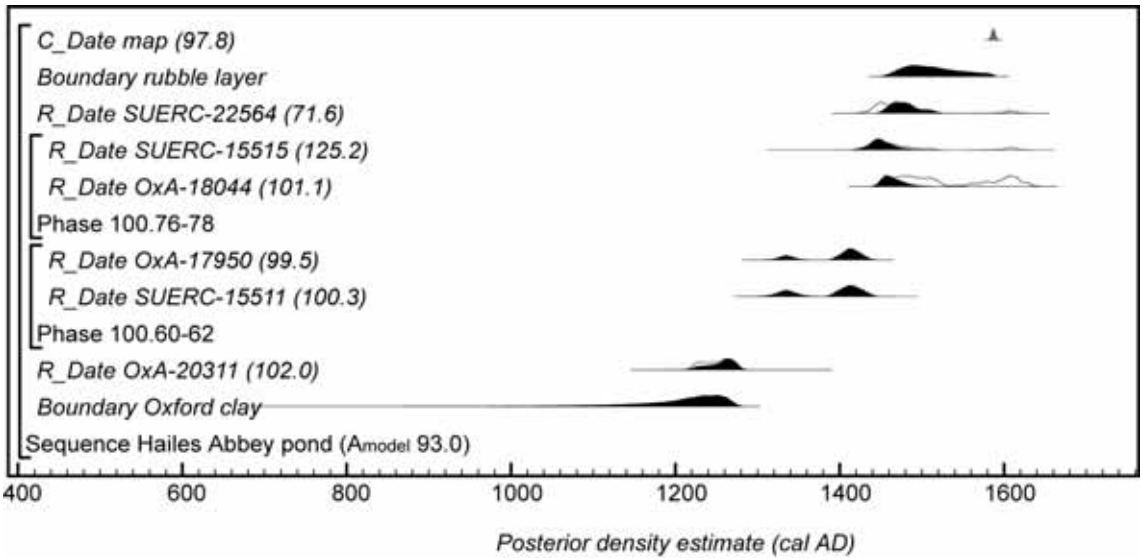

Figure 20: A Bayesian model for the dates of the Hailes Abbey pond samples, implemented in OxCal v4.0.5 (Bronk Ramsey 1995; 1998; 2001; 2008), excluding SUERC-22560. Distributions in outline are the calibrations of radiocarbon results by the probability method (Stuiver and Reimer 1993); solid distributions are posterior density estimates of the dates of these samples, based on the radiocarbon results and the relative dating implicit in the model structure, defined by the brackets and keywords (prepared by J Meadows)

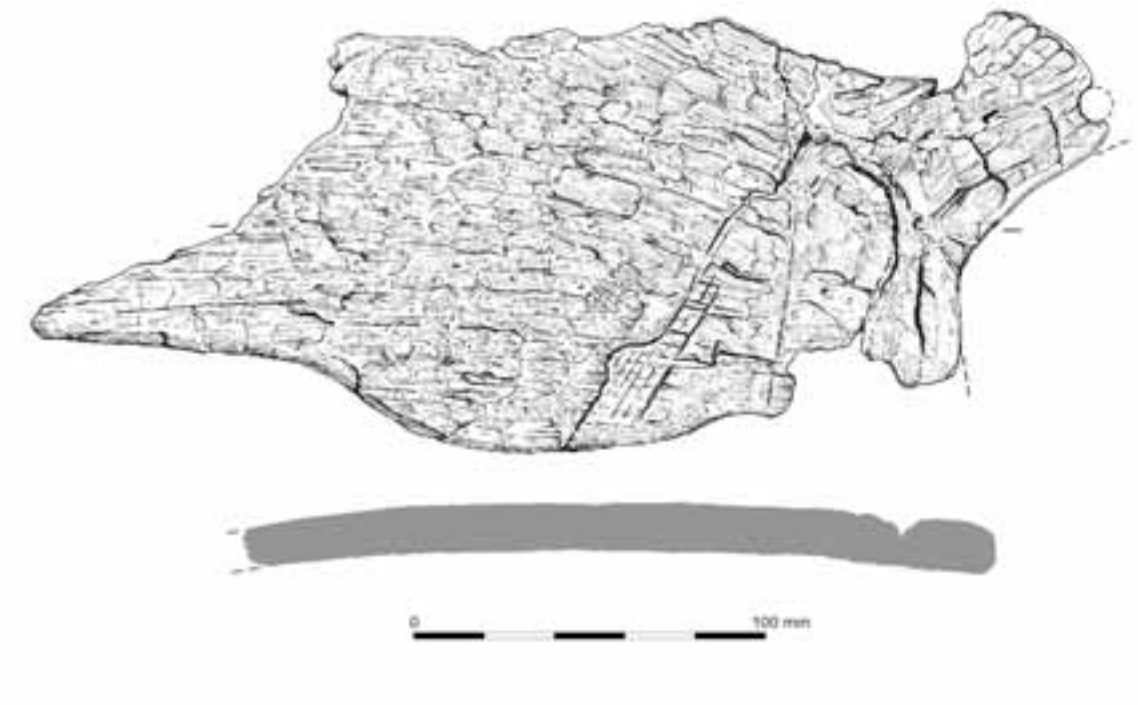

Figure 21: Wood fragment, Small Find 576, after conservation (drawn by C Evans)

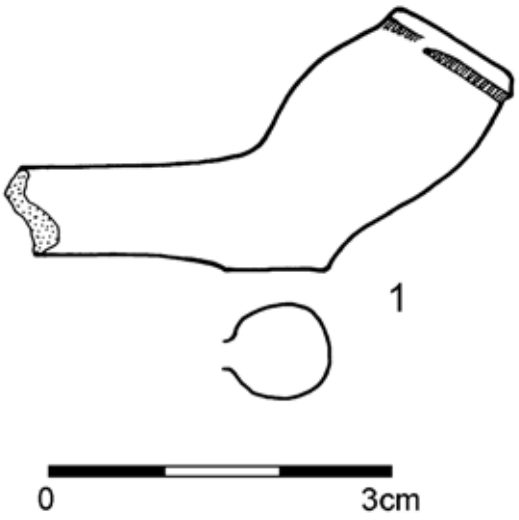

Figure 22: Complete heel pipe bowl of c1610-40 from context [1002] (drawn by D A Higgins)

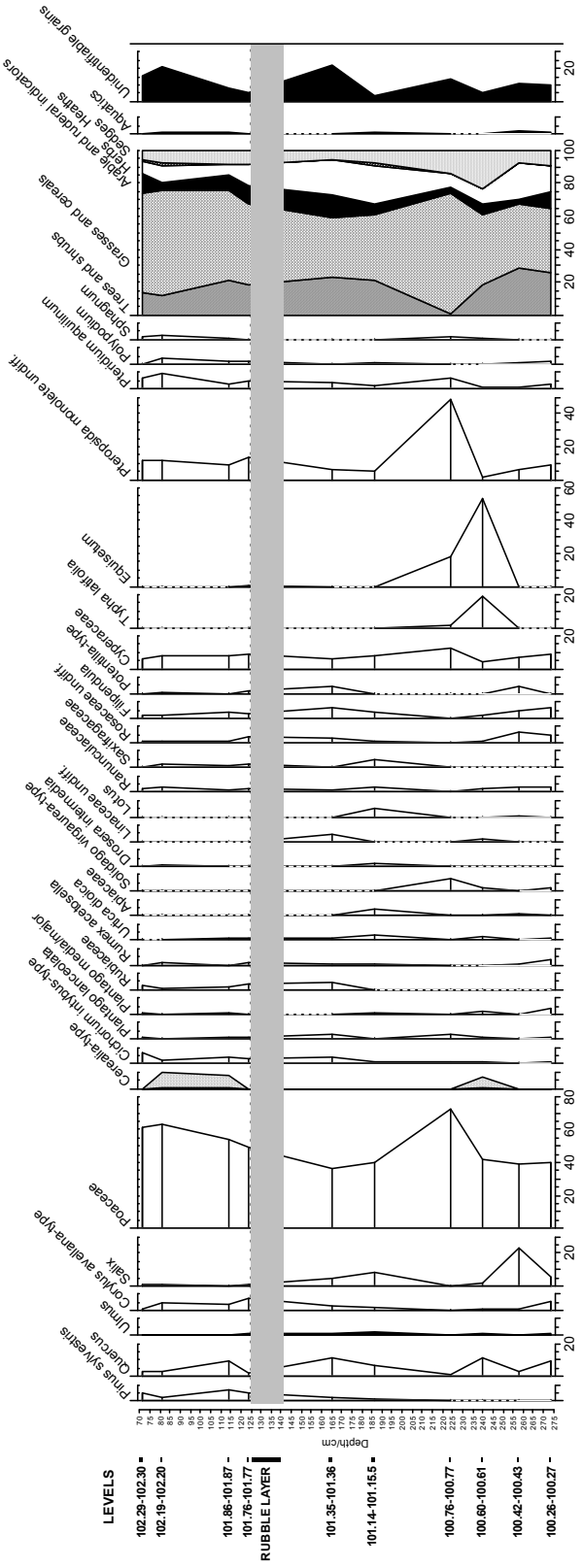

Figure 23: Pollen diagram showing taxa exceeding 2% maximum and cereals (exaggerated by 10%) (prepared by D E Robinson and E Forster)

Before conservation

After conservation

Figure 24: Small Find 576 before and after conservation treatment (photos by K Graham)

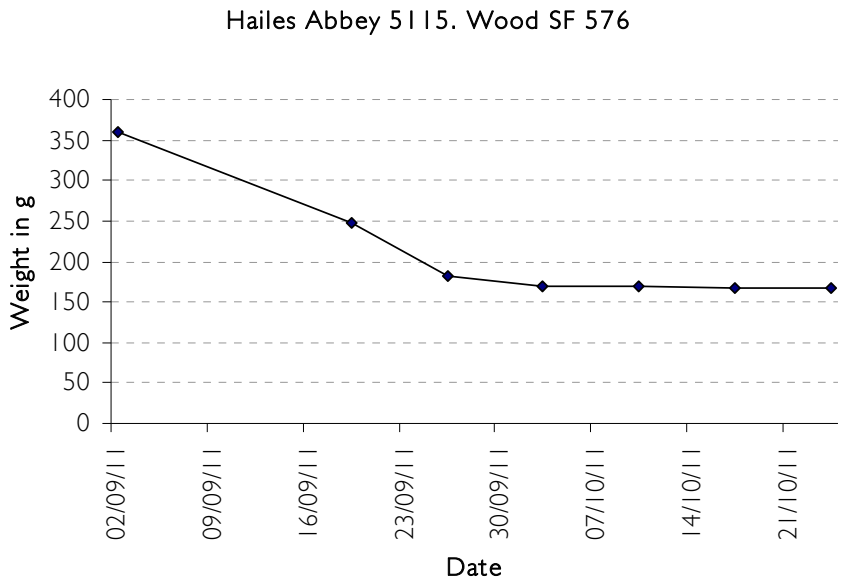

Figure 25: Drying graph for conservation treatment of Small Find 576

REFERENCES

Allen, S J, Goodburn, D M, McComish, J M and Rogers, P W 2005 'Re-used Boat Planking from a 13th-century Revetment in Doncaster, South Yorkshire'. *Medieval Archaeology* **49**, 281-304

Ayres, K, Locker, A and Serjeantson, D 2003 'Phases 2f-4a. The Medieval abbey: food consumption and production', in Hardy, A, Dodd, A and Keevill, G D (eds) *Aelfric's Abbey. Excavations at Eynsham Abbey, Oxfordshire, 1989-92* (Oxford Archaeology Thames Valley Landscapes **16**). Oxford: Oxford University School of Archaeology, 360–406

Baddeley, W S C 1908 *A Cotteswold Shrine: Being a Contribution to the History of Hailes, County Gloucester: Manor, Parish and Abbey*. Gloucester: J Bellows

Baker, P 2001 'Appendix B: Animal Bone report. The animal remains from Barking Abbey (659); the excavations in 2000 by the Centre for Archaeology, English Heritage', in Cromwell, T, Jennings, S, Baker, P and Smith, W (eds) *Archive Summary Report and Assessment for Evaluation Trenching at Barking Abbey, Essex in September 2000 (Museum of London Site Code AED 00)* (Centre for Archaeology Report **38/2002**). London: English Heritage

Bayley, J, Dungworth, D and Paynter, S 2001 *Archaeometallurgy* (Centre for Archaeology Guidelines **2001-01**). Swindon: English Heritage

Bazeley, W 1899 'The abbey of St Mary's, Hayles'. *Transactions of the Bristol and Gloucestershire Archaeological Society* **22**, 256–71

Bennett, K D 1994 *Annotated catalogue of pollen and pteridophyte spore types of the British Isles* [PDF document]. Retrieved 7 February 2009 from <http://www.arrc.shef.ac.uk/content/1/c6/05/62/92/bennett.pdf >

British Geological Survey 2001 *Geological Survey Ten Mile Map (Solid): South Sheet*, 4th edn. London: British Geological Survey

British Standards Institution 2000 *Imaging materials. Processed safety photographic films. Storage practices.* **BS ISO 18911:2000** London: British Standards Institution

Bronk Ramsey, C 1995 'Radiocarbon Calibration and Analysis of Stratigraphy: The OxCal Program'. *Radiocarbon* **37**, 425-30

Bronk Ramsey, C 1998 'Probability and dating'. *Radiocarbon* **40**, 461-74

Bronk Ramsey, C 2001 'Development of the radiocarbon calibration program'. *Radiocarbon* **43**, 355-63

Bronk Ramsey, C 2008 'Deposition models for chronological records'. *Quaternary Science Reviews* **27**, 42-60

Bronk Ramsey, C, Higham, T and Leach, P 2004 'Towards high precision AMS: progress and limitations'. *Radiocarbon* **46**(1), 17-24

Bronk Ramsey, C, Higham, T F G, Owen, D C, Pike, A W G and Hedges, R E M 2002 'Radiocarbon dates from the Oxford AMS system: *Archaeometry* datelist 31'. *Archaeometry* **44**(3 (Supplement 1)), 1-149

Brown, D H 2007 *Archaeological Archives: A guide to best practice in creation, compilation, transfer and curation*. Reading: Institute of Field Archaeologists

Brown, G 2006 *Hailes Abbey, Stanway, Gloucestershire: Hailes Abbey and its Environs. Analytical Earthwork Survey and Investigation Report*. (English Heritage Research Department Report Series **29/2006**). London: English Heritage

Cohen, A and Serjeantson, D 1996 *A Manual for the Identification of Bird Bones from Archaeological Sites*. London: Birkbeck College, University of London

David, A 1981 *Geophysics-Hailes Abbey*. (Ancient Monuments Lab Report (Old Series) **3272**). London: English Heritage

Davis, S 1992 *A Rapid Method for Recording Information About Mammal Bones from Archaeological Sites*. (Ancient Monument Laboratory Report **19/92**). London: English Heritage

Denys, L 1991a *A checklist of the diatoms in the Holocene deposits of the western Belgian coastal plain with a survey of their apparent ecological requirements. Part 1: Introduction, ecological code and complete list*. (Service Géologique de Belgique professional paper **246**).

Denys, L 1991b *A checklist of the diatoms in the Holocene deposits of the western Belgian coastal plain with a survey of their apparent ecological requirements. Part 2: Centrales*. (Service Géologique de Belgique professional paper **247**).

Driesch, A E v d 1976 *A Guide to the Measurement of Animal Bones from Archaeological Sites* (Peabody Museum Bulletin 1). Cambridge, Massachusetts: Peabody Museum of Archaeology and Ethnology, Harvard University

Dungworth, D 2002 *Sixteenth and seventeenth century bronze casting from Cowick Street, Exeter, Devon*. (Research Department Report Series **19/2002**). Swindon: English Heritage

Eames, E 1985 *English Medieval Tiles*. London: British Museum Publications

EDDI 2009 *The European Diatom Database* [web page]. Retrieved 27 February 2009 from <http://craticula.ncl.ac.uk/Eddi/jsp/index.jsp>

Elks, J 2006 *Geophysical Survey Report: Hailes Abbey, Gloucestershire*. Upton upon Severn: Stratascan Ltd

English Heritage 1991 *Management of Archaeological Projects*, 2nd edn. London: English Heritage

English Heritage 2002 *Environmental Archaeology: A guide to the theory and practice of methods, from sampling and recovery to post-excavation*. London: English Heritage

English Heritage 2006 *Recording Manual*, revised 2006 edn. Portsmouth: English Heritage

Fell, V, Mould, Q and White, R 2006 *Guidelines on the X-Radiography of archaeological metalwork*. Swindon: English Heritage

Goodburn, D 1992 'Wood and woodlands: carpenters and carpentry', in Milne, G (ed) *Timber Building Techniques in London c.900-1400: An Archaeological Study of Waterfront Installations and Related Material* (London and Middlesex Archaeology Society Special Paper 15). London: London and Middlesex Archaeology Society, 106-130

Grant, A 1982 'The Use of Tooth Wear as a Guide to the Age of Domestic Ungulates', in Wilson, B, Grigson, C and Payne, S (eds) *Ageing and Sexing Animal Bones from Archaeological Sites* (BAR, Brit Ser 109). Oxford: British Archaeological Reports, 91–108

Grant, A 1988 'Animal resources', in Astill, G G and Grant, A (eds) *The Countryside of Medieval England*. Oxford, 149-187

Greene, J P 1992 *Medieval Monasteries*. London: Leicester University Press

Harvey, B F 2006 'Monastic pittances in the Middle Ages', in Serjeantson, D, Waldron, T and Woolgar, C M (eds) *Food in Medieval England: Diet and Nutrition*. Oxford: Oxford University Press, 215-227

Huttenun, P and Meriläinen, J 1983 'Interpretation of lake quality from contemporary diatom assemblages'. *Hydrobiologia* 103(1), 91–97

Museums & Galleries Commission 1992 *Standards in the Museum Care of Archaeology Collections*. London: Museums & Galleries Commission

Payne, S 1973 'Kill-off Patterns in Sheep and Goats: The Mandibles from Asvan Kale'. *Anatolian Studies: Journal of the British Institute of Archaeology at Ankara* 23, 281–303

Payne, S 1987 'Reference Codes for the Wear States in the Mandibular Cheek Teeth of Sheep and Goats'. *Journal of Archaeological Science* 14, 609–614

Payne, S and Bull, G 1988 'Components of Variation in Measurements of Pig Bones and Teeth and the Use of Measurements to Distinguish Wild from Domestic Pig Remains'. *Archaezoologica* 2, 13–26

Powell, A, Smith, P and Serjeantson, D 2001 'Food consumption and disposal: the animal remains', in Hicks, M and Hicks, A (eds) *St. Gregory's Priory, Northgate, Canterbury Excavations 1988-1991*. Canterbury: Canterbury Archaeological Trust Ltd, 217–333

Reimer, P J, Baillie, M G L, Bard, E, Bayliss, A, Beck, J W, Bertrand, C J H, Blackwell, P G, Buck, C E, Burr, G S, Cutler, K B, Damon, P E, Edwards, R L, Fairbanks, R G, Friedrich, M, Guilderson, T P, Hogg, A G, Hughen, K A, Kromer, B, McCormac, G, Manning, S, Bronk Ramsey, C, Reimer, R W, Remmele, S, Southon, J R, Stuiver, M, Talamo, S, Taylor, F W, van der Plicht, J and E, W 2004 'IntCal04 Terrestrial radiocarbon age calibration, 0–26 Cal Kyr BP'. *Radiocarbon* **46**(3), 1029-58

Salzman, L F 1952 *Building in England Down to 1540: A Documentary History* Oxford: Clarendon Press

Serjeantson, D 1996 'The Animal Bones', in Needham, S and Spence, T (eds) *Refuse and Disposal at Area 16 East Runnymede: Runnymede Bridge Research Excavations, Volume 2*. London: British Museum Press, 194–223

Serjeantson, D 2001 'The bird bones', in Hicks, M and Hicks, A (eds) *St. Gregory's Priory, Northgate, Canterbury Excavations 1988-1991*. Canterbury: Canterbury Archaeological Trust Ltd, 289–333

Silver, I A 1969 'The ageing of domestic animals', in Brothwell, D and Higgs, E (eds) *Science in Archaeology*. London: Thames and Hudson, 283–302

Slota Jr, P J, Jull, A J T, Linick, T W and Toolin, L J 1987 'Preparation of small samples for ^{14}C accelerator targets by catalytic reduction of CO'. *Radiocarbon* **29**, 303-6

Soil Survey of England and Wales 1983 *Soils of England and Wales, Sheet 5: South West England*. London: Soil Survey of England and Wales

Stace, C 1997 *Flora of the British Isles*, 2nd edn. Cambridge: Cambridge University Press

Stuiver, M and Kra, R S 1986 'Editorial comment'. *Radiocarbon* **28**(2B), ii

Stuiver, M and Polach, H A 1977 'Reporting of ^{14}C data'. *Radiocarbon* **19**, 355-63

Stuiver, M and Reimer, P J 1986 'A computer program for radiocarbon age calculation'. *Radiocarbon* **28**, 1022-30

Stuiver, M and Reimer, P J 1993 'Extended ^{14}C data base and revised CALIB 3.0 ^{14}C age calibration program'. *Radiocarbon* **35**, 215–30

Swindle, G E and Green, C P 2006 *A Reconstruction of the Sub-Surface Sedimentary Architecture of a Possible Fishpond at Hailes Abbey, Winchcombe, Gloucestershire*. Egham, Surrey: ArchaeoScape, Department of Geography, Royal Holloway University of London

Treswell, R 1587 *Map of Hailes*. PRO MF/1/59. Kew: The National Archives.

Vandeputte, K, Moens, L and Dams, R 1996 'Improved sealed-tube combustion of organic samples to CO_2 for stable isotope analysis, radiocarbon dating and percent carbon determinations'. *Analytical Letters* **29**(15), 2761-73

Walker, K 1990 *Guidelines for the preparation of excavation archives for long-term storage*. London: United Kingdom Institute for Conservation (UKIC) Archaeology Section

Ward, G K and Wilson, S R 1978 'Procedures for comparing and combining radiocarbon age determinations: a critique'. *Archaeometry* **20**(1), 19-31

Watkinson, D and Neal, V 2001 *First Aid for Finds*. London: Rescue/United Kingdom Institute for Conservation (UKIC) Archaeology Section

Webster, L E and Cherry, J 1972 'Medieval Britain in 1971'. *Medieval Archaeology* **16**, 147–212

Webster, L E and Cherry, J 1974 'Medieval Britain in 1973'. *Medieval Archaeology* **18**, 174–223

Webster, L E and Cherry, J 1976 'Medieval Britain in 1975'. *Medieval Archaeology* **20**, 158–201

Wells, J, Canti, M and Irving, D 2001 *Palaeoenvironmental Assessment of a Disused Man-Made Pond Adjacent to the Ruins of Hailes Abbey, Gloucestershire*. (English Heritage Centre for Archaeology Report **7/200**). London: English Heritage

Whitton, B A, John, D M, Kelly, M G and Haworth, E Y 2003 *A Coded List of Freshwater Algae of the British Isles* 2nd edn. [web page]. Retrieved 15 February 2010 from <http://www.ceh.ac.uk/data/algae/algae_index.html>

Winkless, D 2001 *Hailes Abbey, Gloucestershire: The Story of a Medieval Abbey*, English Heritage reissued edn. London: English Heritage

Xu, S, Anderson, R, Bryant, C, Cook, G T, Dougans, A, Freeman, S, Naysmith, P, Schnabel, C and Scott, E M 2004 'Capabilities of the new SUERC 5MV AMS facility for ^{14}C dating'. *Radiocarbon* **46**(1), 59-64

Zohary, D and Hopf, M 1994 *Domestication of plants in the Old World*, 2nd edn. Oxford: Clarendon Press

APPENDIX 1: INTERPRETATIVE CONTEXT INDEX

Trench	Context	Type	Description	Phase	Same as	Contamination	Drawing nos.	Photo nos.	S F nos.	Sample nos.
A	1000	Layer	Layer: Topsoil	5	*	Unlikely	7016; 7021; 7022; 7038; 7040	121; 215	500; 511	*
A	1001	Fill	Rubble backfill of [1005]; prob from C20 MPBW work	5	*	Possible	7005; 7028; 7038	102; 103; 149; 150; 201; 202; 203; 205; 206; 240; 241	*	*
A	1002	Layer	Silty deposit in N corner of trench A	4	1010?	Unlikely	7000; 7038	110; 209	501; 502	*
A	1003	Layer	Rubble spread (rubble includes dressed stone)	4	1016?	Possible	7001; 7002; 7025; 7040	100; 154; 245	541; 553; 554; 558	*
A	1004	Fill	Fill of tree bole	5	*	Probable	7004	101; 209	506	*
A	1005	Interface	Interface between (1001) and (1009)	5	*	N/A	7005; 7006; 7019; 7021; 7022; 7028; 7038; 7039	102; 103; 137; 203; 205; 206; 209; 234	*	*
A	1006	VOID								
A	1007	Cut	"Cut" of stream bed	5	*	N/A	7008; 7009		*	*
A	1008	Cut	"Cut" of tree bole	5	*	N/A	7028	101; 110; 209	*	*
A	1009	Layer	Rubble deposit on NE side of culvert; poss Dissolution demolition rubble?	3	1027?	Possible	7007; 7026; 7028; 7038; 7040	110; 121; 154; 209; 215; 245	539; 540; 545	5040
A	1010	Layer	Clay layer in culvert; poss flooding deposit?	4	1002?; 1023	Possible	7004; 7006; 7028; 7038	102; 110; 121; 137; 209; 215; 234	504; 544	*
A	1011	VOID								
A	1012	Fill	Rubble layer, poss foundation layer in cut [1017]	5	*	Possible	7006; 7028; 7038	123; 127; 129; 217; 220; 224	*	*
A	1013	Layer	Limestone rubble and orange sand layer, overlying wall (1020)	3	*	Possible	7015; 7028; 7040	114; 115; 116; 119; 143; 144; 145; 153; 210; 211; 238; 244	*	*
A	1014	Layer	Rubble layer over much of Trench A, poss demolition layer; rubble includes some frags of architectural decoration	4	1015; 1025	Possible	7027; 7028; 7040; 7046	154; 156; 157; 245; 246	537; 550; 560; 562; 584; 589; 590	*
A	1015	Layer	Rubble layer	4	1014; 1025	Possible	7018; 7028		505	*
A	1016	Layer	Rubble layer	4	1016?	Possible	7015	114; 115; 116; 119; 210; 211	*	*
A	1017	Cut	Cut for poss foundation layer (1012)	5	*	N/A	7006; 7024; 7028; 7038; 7039	129; 224	*	*
A	1018	Layer	Fill in culvert, poss modern slumping into collapsing culvert	5	*	Unlikely	7019; 7040; 7044	154; 245	514	*
A	1019	Layer	Rubble layer, poss landscaping deposit	5	*	Possible	7017		*	*
A	1020	Masonry	Wall course of chamfered blocks, poss later rebuild on wall (1037)	2	1048?	N/A	7015; 7028	114; 115; 116; 119; 143; 144; 145; 210; 211; 238	*	*
A	1021	Layer	Rubble layer S of culvert	4	*	Possible	7020; 7028		551	*
A	1022	Layer	Rubble layer beneath topsoil on W side of stream	4	*	Possible	7020; 7028		509; 510; 517; 518; 519; 552; 586; 587; 588	*
A	1023	Layer	Layer in collapsed culvert; could be deliberate fill/levelling deposit or alluvial/colluvial accumulation	4	1010	Possible	7022; 7028; 7040; 7044	121; 147; 148; 154; 215; 245	515; 516; 526; 527; 555; 557; 559	5029
A	1024	Fill	Silt fill of stream [1007]; not excavated	5	*	Possible	7008; 7009; 7028		549	*
A	1025	Layer	Rubble layer	4	1014; 1015	Possible	7025		*	*
A	1026	VOID							556	
A	1027	Layer	Rubble demolition layer	3	1009?	Possible	7028; 7038	137; 234	533; 534; 535	*
A	1028	Layer	Layer overlying (1039) and wall (1020)	4	*	Unlikely	7028; 7046		538; 542; 543; 561	*
A	1029	Layer	Feature, poss fill of cut into (1013) and (1032)	3	*	Possible	7028		*	*
A	1030	Layer	Stream bed interface layer: mix of (1024) and underlying layers	5	*	Probable	7028		536; 581; 591	*

Trench	Context	Type	Description	Phase	Same as	Contamination	Drawing nos.	Photo nos.	S F nos.	Sample nos.
A	1031	Layer	Poss demolition layer over poss occupation layer (1034)	3	*	Possible	7038	137; 234	529; 530; 531; 532; 585	*
A	1032	Layer	Mortar-rich deposit against SW face of wall (1033); not excavated	3	*	Possible	7028	153; 244	*	*
A	1033	Masonry	Wall, poss post-Dissolution? Not fully excavated	3	*	N/A	7028; 7040	151; 152; 153; 242; 243; 244	*	*
A	1034	Layer	Ashy layer, poss occupation layer over poss mortar floor (1040)	3	*	Possible	7038; 7039	137; 138; 234; 235	574; 575; 578; 582	5041
A	1035	Layer	Foundation layer below walls (1033) and (1048); not excavated	3	*	Possible	7028; 7040	151; 152; 242; 243	*	*
A	1036	Layer	Rubble layer; not excavated	3	*	Possible	7028	151; 152; 242; 243	*	*
A	1037	Masonry	Wall, assoc with (1038) poss later rebuild (1020) on top	2	*	N/A	7028	143; 144; 145; 238	*	*
A	1038	Masonry	Wall, assoc with (1037)	2	*	N/A	7028; 7046	143; 144; 145; 238	*	*
A	1039	Layer	Layer, poss fill of construction trench for wall (1038)?	2	*	Unlikely	7028; 7046		*	*
A	1040	Layer	Mortar layer, poss floor?	2	*	Unlikely	7028; 7038	138; 146; 235; 239	*	*
A	1041	Layer	Poss fill material tipped into culvert from S side	3	*	Unlikely	7028; 7044	147; 148	*	*
A	1042	Layer	Poss fill material tipped into culvert	3	*	Possible	7044	147; 148	*	*
A	1043	Layer	Poss fill material tipped into culvert	3	*	Probable	7044	147; 148	*	*
A	1044	Fill	Fills of unexcavated group of post-holes & stake holes cutting (1040)	3	*	Unlikely	7028	146; 239	*	*
A	1045	Cut	Cuts of unexcavated group of post-holes and stake-holes	3	*	N/A	7028	146; 239	*	*
A	1046	Layer	Dumped demolition layer under (1009)	3	*	Unlikely	7028	154; 245	*	*
A	1047	Layer	Rubble layer over (1023), does not extend across the culvert	4	*	Possible	7044	147; 148	*	*
A	1048	Masonry	Wall, built of reused blocks, poss post-Dissolution?	3	1020?	N/A	7028	151; 152; 153; 242; 243; 244	*	*
A	1049	Masonry	Wall, traces of mortar facing remaining	3	*	N/A	7040	154; 245	*	*
A	1050	Cut	Nominal cut for construction of culvert, not seen in excavation	2	*	N/A			*	*
A	1051	Masonry	Wall forming N side of culvert	2	*	N/A	7028; 7044	102; 103; 147; 149; 205; 206; 240	*	*
A	1052	Masonry	Rubble core of wall forming S side of culvert	2	*	N/A	7028; 7044	102; 103; 147; 148; 149; 150; 158; 205; 206; 240; 241; 248	*	*
A	1053	Masonry	Wall, repointed with cement	5	*	N/A	7028	102; 103; 149; 150; 205; 206; 240; 241	*	*
A	1054	Masonry	Masonry, poss base of buttress to S side of culvert	2	*	N/A	7028	148; 156; 157; 158; 246; 247; 248	*	*
B	2000	Layer	Topsoil	5	*	Probable	7031; 7032; 7033; 7034; 7035; 7036	134; 136; 159; 161; 162; 163; 164; 167; 229; 231; 233	*	*
B	2001	Layer	Loose rubble layer under topsoil	5	*	Possible	7013; 7030; 7031	162; 165; 167	503	*
B	2002	Layer	Rubble layer, poss demolition	4	2008?	Possible	7003; 7013; 7014; 7029; 7030; 7036	104; 105; 106; 107; 108; 109; 124; 126; 132; 134; 160; 162; 165; 167; 207; 208; 218; 219; 229; 231	563; 564; 566	*
B	2003	Layer	Accumulation layer over (2002)	4	*	Possible	7003; 7014; 7031	105; 106; 109; 162; 167	*	*
B	2004	Layer	Rubble layer, more loosely packed than (2002)	4	*	Possible	7003; 7013; 7014; 7031; 7032	132; 136; 162; 167; 231; 233	*	*
B	2005	Fill?	Poss ditch fill, later interp accumulation of 'boggy mire'	5	*	Unlikely	7003; 7013; 7032; 7033	125; 132; 136; 163; 231; 233	512	5008
B	2006	Cut	Poss cut of ditch	4	*	N/A	7013; 7014; 7032	124; 125; 126; 132; 136; 231; 233	*	*

Trench	Context	Type	Description	Phase	Same as	Contamination	Drawing nos.	Photo nos.	S F nos.	Sample nos.
B	2007	Layer	Poss bank	2	*	Unlikely	7030; 7031; 7032	124; 125; 132; 135; 136; 162; 167; 228; 231; 233	*	*
B	2008	Layer	Rubble layer, same as (2002)	4	2002?	Possible	7030; 7036	134; 164; 165; 167; 229	565	*
B	2009	Layer	Accumulation layer over (2010)	3	*	Unlikely	7030	135; 160; 165; 167; 228	*	*
B	2010	Layer	Rubble layer	3	*	Possible	7030	135; 160; 165; 167; 228	567	*
B	2011	VOID								
B	2012	Cut	Cut of poss robber trench	3	*	N/A	7029; 7030; 7033	132; 133; 134; 135; 163; 165; 167; 228; 229; 230; 231	*	*
B	2013	Layer	Poss accumulation layer, may be same as (2014)	3	*	Possible	7030	135; 165; 167; 228	*	*
B	2014	Layer	Poss fill of robber trench [2012]	3	*	Unlikely	7030	165; 167; 228	*	*
B	2015	Masonry	Wall, unbonded re-used blocks incl architectural frags	4	*	N/A	7029; 7036; 7045	132; 133; 134; 160; 161; 164; 165; 166; 229; 230; 231	*	*
B	2016	Layer	Rubble layer to W of wall (2015)	4	*	Possible	7029; 7036	160; 164; 165	583	*
B	2017	Layer	Accumulation layer over (2008) and (2016)	4	*	Unlikely	7033; 7035; 7036	134; 159; 164; 229	*	*
B	2018	Masonry	Wall, lowest courses of demolished drystone wall	4	*	N/A	7013; 7014; 7030; 7031	126	*	*
B	2019	Layer	Rubble layer	4	*	Unlikely	7029; 7033; 7034; 7035	132; 133; 134; 159; 160; 161; 163; 165; 166; 229; 230; 231	*	*
B	2020	Layer	Layer, poss early ground level	1	*	Unlikely	7029; 7030; 7031; 7032	132; 133; 134; 135; 136; 162; 163; 167; 228; 229; 230; 231; 233	*	*
B	2021	Layer	Unbonded blocks, poss lowest unrobbed course of foundation	2	*	Unlikely	7029; 7030; 7033	132; 133; 134; 135; 228; 229; 230; 231	*	*
B	2022	Layer	Poss ditch fill or alluvial accumulation	4	*	Unlikely	7032; 7033; 7035; 7036	125; 132; 136; 163; 231; 233	*	*
B	2023	Layer	Poss accumulation layer, similar to (2005)	5	*	Possible	7033; 7034; 7035; 7036	134; 159; 161; 164; 229	*	*
B	2024	Layer	Rubble layer, poss robbing debris	3	*	Unlikely	7033	163	*	*
B	2025	Cut	Cut of poss robber trench	3	*	N/A	7030; 7036	160; 165	*	*
B	2026	Fill	Fill of poss robber trench [2025]	3	*	Possible	7030; 7036	134; 160; 164; 165; 229	*	*
B	2027	Layer	Levelling layer	3	*	Unlikely	7030; 7036; 7045	132; 133; 134; 165; 229; 230; 231	*	*
B	2028	Layer	Clay deposit packed against rubble layer (2016)	4	*	Possible	7036	*	*	*
C	3000	Layer	Topsoil	5	*	Possible	7037	131; 227	*	*
C	3001	Layer	Alluvial layer	4	*	Possible	7037	131; 227	*	*
C	3002	Layer	Rubble layer	4	*	Possible	7037	131; 227	*	*
C	3003	Layer	Alluvial layer below (3002), not excavated	4	*	Unlikely	7037	131; 227	*	*
D	4000	Layer	Test Pit 1 Spit 1	5	*	Possible	*	*	*	5000
D	4001	Layer	Test Pit 1 Spit 2	4	*	Possible	*	*	*	5001
D	4002	Layer	Test Pit 1 Spit 3	3	*	Possible	*	*	507; 508	5002
D	4003	Layer	Test Pit 1 Spit 4	3	*	Possible	*	*	520; 521; 522; 523; 524; 525	5003
D	4004	Layer	Test Pit 1 Spit 5	3	*	Possible	*	*	*	5004; 5006
D	4005	Layer	Test Pit 1 Spit 6	2	*	Possible	*	*	*	5005; 5007
D	4006	Layer	Clayey layer below topsoil, poss dumped or alluvial	4	*	Unlikely	7010; 7011; 7012	111; 112; 120; 122; 139; 213; 214; 216; 236	*	*
D	4007	Layer	Layer, upper of two layers (with (4008)) poss forming bank behind wall (4032)	3	*	Unlikely	7010; 7011; 7012	111; 112; 120; 122; 139; 141; 213; 214; 216; 236; 237	513; 579; 580; 592; 593; 594; 595; 596; 597; 598	5030
D	4008	Layer	Layer, lower of two layers (with (4007)) poss forming bank behind wall (4032)	2	*	Unlikely	7010; 7011; 7012; 7042	111; 112; 120; 122; 139; 140; 141; 213; 214; 216; 236; 237	572; 599	5031
D	4009	Layer	Silt & rubble layer	4	4014?; 4015?	Unlikely	7010; 7041	111; 112; 214	*	*
D	4010	Layer	Clayey layer, poss silting up of pond	4	4020	Unlikely	7010; 7041	111; 112; 214	*	*

Trench	Context	Type	Description	Phase	Same as	Contamination	Drawing nos.	Photo nos.	S F nos.	Sample nos.
D	4011	Layer	Clayey layer, poss silting up of pond	3	4017	Unlikely	7010; 7041	111; 112; 214	*	*
D	4012	Layer	Clayey layer, poss silting up of pond	3	4018	Unlikely	7010	111; 112; 139; 140; 141; 214; 236; 237	528; 546; 547; 548; 576	5039
D	4013	Layer	Topsoil	5	*	Unlikely	7010; 7011; 7012	111; 112; 120; 122; 139; 213; 214; 216; 236	*	*
D	4014	Layer	Silt & rubble layer	4	4009?; 4015?	Unlikely	7012	122; 216	*	*
D	4015	Layer	Silt & rubble layer	4	4009?; 4014?	Unlikely	7012	122; 216	*	*
D	4016	Layer	Lens layer	3	*	Unlikely	7012	122; 216	*	*
D	4017	Layer	Clayey layer, poss silting up of pond	3	4011	Unlikely	7012	122; 216	*	*
D	4018	Layer	Clayey layer, may post-date robbing of wall (4032)	3	4012	Unlikely	7012	122; 216	*	*
D	4019	Layer	Clayey layer, poss silting up of pond	3	*	Unlikely	7012	122; 216	*	*
D	4020	Layer	Clayey layer, poss silting up of pond	4	4010	Unlikely	7012	122; 216	*	*
D	4021	Layer	Test Pit II Spit 1	4	*	Possible	*	128; 222	*	5009
D	4022	Layer	Test Pit II Spit 2	4	*	Possible	*	128; 222	*	5010
D	4023	Layer	Test Pit II Spit 3	4	*	Possible	*	128; 222	*	5011
D	4024	Layer	Test Pit II Spit 4	4	*	Possible	*	128; 222	*	5012; 5021
D	4025	Layer	Test Pit II Spit 5	4	*	Possible	*	128; 222	*	5013; 5022; 5032
D	4026	Layer	Test Pit II Spit 6	3	*	Possible	*	128; 222	*	5014; 5023; 5033
D	4027	Layer	Test Pit II Spit 7	2	*	Possible	*	128; 222	*	5016; 5024; 5034
D	4028	Layer	Test Pit II Spit 8	2	*	Possible	*	128; 222	*	5017; 5025; 5035
D	4029	Layer	Test Pit II Spit 9	2	*	Possible	*	128; 222	*	5018; 5026; 5036
D	4030	Layer	Test Pit II Spit 10	1	*	Possible	*	128; 222	*	5019; 5027; 5037
D	4031	Layer	Test Pit II Spit 11	1	*	Possible	*	128; 222	*	5020; 5028; 5038
D	4032	Masonry	Wall: chamfered facing for dam	2	*	N/A	7010; 7012; 7041; 7042; 7043	111; 112; 122; 139; 140; 141; 214; 216; 236; 237	*	*

APPENDIX II: ARCHIVE SUMMARY

The project archive consists of the following:

Context Records	121
Deposits	95
Cuts	9
Masonry	13
Voided	4
Drawings	46 on 60 sheets of draughting film
Photographs	464
Black & white print	185
Colour transparency	184
Digital	95
Individually recorded object (small find) records	97
X-rays	4
Environmental Samples	87
Coarse-sieved samples for finds recovery	19
Flotation samples	16
Specialist: monolith	7
Specialist: general biological analysis	8
Specialist: pollen	19
Specialist: scientific dating (C14)	14
Specialist: diatoms	4

APPENDIX III: EVALUATION NOTES ON TEST PIT SAMPLES

Gill Campbell

Thirty litres of each sample were wet sieved onto a mesh of 500 microns. The fraction greater than 4mm was sorted in its entirety for finds including worked wood. A few Petri dishes of the material below 4mm were scanned to determine content, including the concentration and preservation of any biological remains.

Test pit 2, Trench D

Sample 5021 (context 4024, spit 4)

Little evidence of waterlogged preservation.

Sample 5022 (context 4025, spit 5)

Lots of detritus. Remains are fragmentary but include *Ranunculus* Subgen. *Ranunculus* (buttercup) seeds and *Carex* sp (sedges). Earthworm eggs are common.

Sample 5023 (context 4026, spit 6 containing sandstone fragments)

Lots of *Ranunculus* Subgen. *Ranunculus* (buttercup) seeds and *Carex* sp(p.). Small grasses noted, also *Glyceria* sp. (sweet grass), and *Urtica dioica* (nettle). Few insects were noted. Preservation appears average and while wet conditions are indicated true aquatics appear absent.

Sample 5024 (context 4027 spit 7)

The concentration of insects and waterlogged plant remains is reasonable. The presence of fairly robust woody seeds such as *Ranunculus acris*/ *repens*/ *bulbous* (buttercup), *Rumex* sp(p). (dock), small Poaceae (grasses) and *Stellaria media* gp. (stitchwort) suggests that preservation whilst moderately good is not exceptional. Aquatics appear absent and overall the plant assemblage suggests the presence of grassland and disturbed ground. It could be derived from flooding deposits. Vivianite and orange patches within the clay matrix suggest some oxidation has occurred. A small amount of charcoal was also noted.

Sample 5025 (context 4028, spit 8, fibrous bit?)

Lots of fibrous material and fragmentary herbaceous material is present in the sample. Daphne eggs and possible caddis fly cases were noted showing the deposit is at least partly aquatic. Both plant and insect remains are rather fragmentary although concentrations of material are not too bad. *Carex* sp. (sedge) seeds and an acorn cupule, and possible *Sparganium* sp. seed suggest a drying out pond surrounded by some trees.

Sample 5026 (context 4029, spit 9 black clay)

Lots of dark fibrous material. *Potamogeton* sp(p.) (pondweed) seeds are common and well preserved. *Hippuris vulgaris* (mare's tail) and *Carex* sp seeds were also noted. Insect remains are fragmentary and in low concentration. Molluscs include *Lymnea* cf. *pereger* and a fish scale was also noted. The deposit is forming in water at this stage. The odd leaf fragment and acorn cupule suggest that trees are present in the vicinity.

Sample 5027 (context 4030, spit 10-clayey silt)

Not much in the way of plant remains. Moncot stem /root, Cyperaceae indet. and moss, which could be modern. Also *Epilobium* sp. seed (willow-herb).The sample also produced a 2000AD 2p coin. Fossil shell, coral and belemnites present from the Oxford clay.

Sample 5028 (context 4031, spit 11, clay ? into natural sub-soil)

Belemnites and fossil shells present. Very few plant macroscopic remains and no insects. Only plant remains are mono-root/stem and a single modern *Rumex* sp. Jurassic Oxford clay. A single fragment of wood was present in the >4mm fraction.

Test pit 1, Trench D

Sample 5039 (context [4012], other side of dam)

Residue contained occasional resistant seeds including *Sambucus nigra*, (elder), *Carex* sp(p.) (sedges), *Viola* Subgenus *Viola* (violet), *Medicago* type (medick etc.), *Ranunculus* Subgen *Ranunculus* (buttercup). Some bone (++ -not picked out)? Rodent and amphibian present.

Flot contained similar seeds eg (*Rubus* section *Glandosus* (bramble), buttercup and *Potentilla erecta* type, *Solanum* type (nightshade), *Cirsium*/ *Carduus* sp (thistle), and one *Alisma plantago-aquatica* (water-plantain). Earthworm eggs, but few or no insect remains

Some differential preservation is inferred.

APPENDIX IV: REMEDIAL CONSERVATION OF SMALL FIND 576

Karla Graham

This short report covers the remedial conservation of Small Find 576 [Context 4012], a worked wood object.

Condition

The wood was recovered waterlogged but in a stable and good condition. Some soil deposits had been left in place (see Figure 24).

Method

The wood was cleaned with a soft brush and running water. The wood was then assessed by the project Finds Officer, Sandra Rowntree and preliminary illustration undertaken by Chris Evans. It was placed into a two-stage Polyethylene glycol (PEG) treatment from 6 June 2011 to 25 August 2011(Table 20).

Table 20: Small Find 576 Conservation treatment regime

Stage	Polyethylene glycol (PEG)	Duration
1	20% PEG400	20 days
2	30% PEG4000	20 days

Once removed wood from the last PEG solution, the excess PEG was removed by dabbing with tissue paper and it was wrapped in cling film and placed in the freeze dryer chamber with wood from Barking Abbey. All the wood was frozen for one week inside the chamber (the chamber contained larger items hence the time for freezing). The cling film was removed and the vacuum freeze drying started on 2 September 2011 and completed on 24 October 2011, after 52 days, once the weight had stabilised (see Figure 25), indicating that the drying had completed.

Start weight: 359.2g End weight: 166.3g

The illustration of the wood was then completed by Chris Evans (see Figure 21).

APPENDIX V: NOTE ON A PLANK FRAGMENT (SMALL FIND 576)

Damian Goodburn

All the edges of the fragment have been substantially altered by decay although one face survives with only moderate weathering and is shown in Figure 21. The fragment is *c* 0.31m long by *c* 100-125mm wide and 15-32mm thick. The grain and macroscopic character shown that it is tangentially faced, rather knotty and of one of our two oaks or a hybrid. The parent tree was fairly fast-grown which is typical of much late medieval timber. At first, from a view of the drawing it looked as if the opposed sloping marks on the best preserved face where those left by the later medieval practice of see-sawing (Goodburn 1992, 115). However, on close examination the saw marks were seen to be fine cut marks such as would have been left by using the plank fragment as a cutting board. Another explanation might have been the use of the fragment as a support to hew another timber on in a carpenter's yard. The thin straight marks could also have been left by a broad axe.

Traces of two partial holes also survived along one broken edge and a broken end. As no iron staining was seen it is probable that they held small wooden pegs originally. Such a piece of planking could have had many functions, but most likely perhaps, are that it was originally part of a revetment or cover for a drain. If it was originally part of a knotty, sawn oak plank secured with pegs it could date to any period after the medieval reintroduction of sawing between *c* 1180 and *c* 1200. It had too few annual rings for tree-ring dating.

ENGLISH HERITAGE RESEARCH AND THE HISTORIC ENVIRONMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for the protection and sustainable management of the resource, and to promote the widest access, appreciation and enjoyment of our heritage. Much of this work is conceived and implemented in the context of the National Heritage Protection Plan. For more information on the NHPP please go to http://www.english-heritage.org.uk/professional/protection/national-heritage-protection-plan/.

The Heritage Protection Department provides English Heritage with this capacity in the fields of building history, archaeology, archaeological science, imaging and visualisation, landscape history, and remote sensing. It brings together four teams with complementary investigative, analytical and technical skills to provide integrated applied research expertise across the range of the historic environment. These are:

* Intervention and Analysis (including Archaeology Projects, Archives, Environmental Studies, Archaeological Conservation and Technology, and Scientific Dating)
* Assessment (including Archaeological and Architectural Investigation, the Blue Plaques Team and the Survey of London)
* Imaging and Visualisation (including Technical Survey, Graphics and Photography)
* Remote Sensing (including Mapping, Photogrammetry and Geophysics)

The Heritage Protection Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support community engagement and build this in to our projects and programmes wherever possible.

We make the results of our work available through the Research Report Series, and through journal publications and monographs. Our newsletter *Research News*, which appears twice a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities.

A full list of Research Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

For further information visit www.english-heritage.org.uk

ENGLISH HERITAGE

ISSN 2046-9799 (Print)
ISSN 2046-9802 (Online)