Archaeological Watching Brief at Carmountside Cemetery Abbey Hulton Stoke-on-Trent Staffordshire NGR SJ 9063 4945

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Contents

1.0	Introduction ……………………………………………………….…...	1
2.0	Archaeological and historical background …………………………	1
3.0	The watching brief ……………………………………………………	1
4.0	The results of the watching brief ……………………………………	2
	Test Pit 01 ……………………………………………………...	2
	Test Pit 02 ……………………………………………………...	2
	Test Pit 03 ……………………………………………………...	2
	Test Pit 04 ……………………………………………………...	3
	Test Pit 05 ……………………………………………………...	3
	Test Pit 06 ……………………………………………………...	3
	Test Pit 07 ……………………………………………………....	3
	Test Pit 08 ……………………………………………………....	4
	Test Pit 09 ……………………………………………………....	4
	Test Pit 10 ……………………………………………………....	5
	Trial Trench 1 …………………………………………………..	5
5.0	Discussion of the environmental assessment …………………………	5
6.0	Conclusions and recommendations for further work ………………..	6
7.0	Acknowledgements ………………………………………………….	7
8.0	References …………………………………………………………..	8

FIG 1: Site location ………………………………………………………… 9

FIG 2: Locations of test pits and trial trench within the PDA ……............. 10

PLATE 1: Test Pit 01, looking east …………………………………………… 11

PLATE 2: Test Pit 03, looking south …………………..…………………….. 11

PLATE 3: Test Pit 04, looking north west …..………………………..…… 12

PLATE 4: Test Pit 06, looking south east …..……………………………….. 12

PLATE 5: Test Pit 07, looking north east …………………………………… 13

PLATE 6: Trail Trench 01, looking south …………………………………… 13

APPENDIX 1: Environmental Assessment Report

Non-technical summary

Stoke-on-Trent Archaeology carried out an archaeological watching brief during a programme of geotechnical test-pitting at Carmountside Cemetery, Abbey Hulton, Stoke-on-Trent (NGR SJ 9063 4945). The proposed development area lies a short distance to the north of Hulton Abbey, a Cistercian monastery founded in 1219 and dissolved in 1538. It is possible that evidence for medieval activity related to the abbey may be found within the proposed development area. The site also sits within the Trent valley and, therefore, has the potential to provide palaeo-environmental evidence dating back more than 10,000 years to the end of the last Ice Age.

The watching brief was undertaken between the 26th February and the 2nd March 2009 and observed the excavation of ten test pits and one trial trench. Well-stratified peat and silty clay deposits were encountered at depths of between c.1.54m and 3.70m below ground level in four of the test pits (numbers 06, 07, 08 and 10) and in trial trench 1. From these, six soil samples, one each from contexts (007), (106), (605), (705), (808) and (809), were sent for environmental assessment to Worcestershire Historic Environment and Archaeology Service.

Analysis of the samples revealed that two, from (705) and (809), contained well-preserved plant remains and pollen grains, representing a mix of tree/shrub and herbaceous species. Seeds from these two contexts were subsequently dated by AMS (Accelerator Mass Spectrometer), producing date-ranges of 12,750BC – 12,000BC for the material from (705) and 11,870BC – 11,660BC for (809), placing the remains in the late-Glacial/early Holocene period. The plant and pollen remains suggested that the area was a semi-wooded, marshy floodplain during this time.

The environmental assessment report concluded that the deposits from Carmountside Cemetery have a high potential to provide a detailed palaeo-environmental record of the area during the late Glacial/early Holocene period.

1.0 Introduction

1.1 Stoke-on-Trent Archaeology (SOTARCH) was appointed by Stoke-on-Trent City Council to undertake an archaeological watching brief at Carmountside Cemetery, Abbey Hulton (NGR SJ 9063 4945) (Fig.1). In response to the proposed expansion of the existing burial ground towards the south-western quarter of the cemetery (adjacent to the junction of Leek Road and Woodhead Road), the Planning Archaeologist for Stoke-on-Trent recommended that a watching brief be maintained on a programme of geotechnical test pitting in the area (Boothroyd 2009).

1.2 The monitoring exercise took place between the 26th February and the 2nd March 2009, with the preliminary results of the project reported in an interim statement produced shortly after work on site ceased (Forrester 2009). The interim report included a methodology for the assessment of environmental samples collected from the site: this work has now been completed and a summary of the results is provided in section 5.0 (the full environmental assessment report is provided in appendix 1).

2.0 Archaeological and historical background.

2.1 The proposed development area (PDA) lies within Carmountside Cemetery, a *c*.25.7 hectare crematorium and burial ground opened in 1947. The PDA lies a short distance to the north of Hulton Abbey (Scheduled Monument no. 35857), a Cistercian monastery founded in 1219 and dissolved in 1538. The site of the abbey has been subject to archaeological investigation since 1884, with the most recent phase of excavations taking place between 1987 and 1994. The site also sits within the Trent valley and, therefore, has the potential to provide palaeo-environmental evidence dating back more than 10,000 years to the end of the last Ice Age.

3.0 The watching brief

3.1 Ten test pits and one trial trench were excavated during the watching brief, the deposit profiles of which were originally outlined in the interim report and are reproduced here in section 4.0. All test-pits and the single trial trench were excavated by mechanical plant with soil samples collected from the machine's bucket. Each cutting was backfilled on completion.

3.2 All work was undertaken in accordance with the Planning Archaeologists' project brief (Boothroyd 2009) and a Written Scheme of Investigation produced by Stoke-on-Trent Archaeology (Goodwin 2009). Written records were made during the watching brief, and digital and 35mm monochrome photographs taken. Soil samples were recovered where possible. This archive is now stored at The Potteries Museum & Art Gallery, Stoke-on-Trent (site code **CSC09**, museum accession no. **2009.LH.3**.).

4.0 The results of the watching brief

4.1 The following deposit profiles were recorded during the watching brief:

Test Pit 01 - *c*.4.60m E-W x *c*.0.70m N-S x *c*.4.50 deep (Plate 1).

100 Turf and black/dark grey loamy topsoil, 0.00m – *c*.0.25m below ground level (bgl).

101 Brown sandy clay loam with occasional medium (20-60mm) rounded pebbles, *c*.0.25m – *c*.0.70 bgl.

102 Dark brown/grey gravely sand, *c*.0.70m – *c*.1.40m bgl.

103 Friable, mottled light brown and yellow sandy clay with rare small (<20mm) rounded pebbles, *c*.1.40m – *c*.2.00m bgl.

104 Dark grey sandy clay loam with rare small rounded pebbles, *c*.2.00m – *c*.3.50m bgl.

105 Friable, red/brown sandy clay, *c*.3.50m – *c*.4.50 (to the limit of excavation) bgl.

Test Pit 02 - *c*.4.90m E-W x *c*.1.60m N-S x *c*.1.76m deep

200 Turf and black/dark grey loamy topsoil, 0.00m – *c*.0.20m bgl.

201 Loose, brown/orange sand, *c*.0.20m – *c*.1.00m bgl.

202 Loose, red sand, *c*.1.00m – *c*.1.76m (to the limit of excavation) bgl.

Test Pit 03 - *c*.4.10m N-S x *c*.0.70m E-W x *c*.4.50m deep (Plate 2).

300 Turf and black/dark grey loamy topsoil, 0.00m - *c*.0.15m bgl.

301 Dark grey clay loam with rare small pebbles and coal fragments, *c*.0.15m – *c*.1.70m bgl.

302 Light brown/orange sandy/gritty clay, *c*.1.70m – *c*.2.70m bgl.

303 Pinkish sandy loam with abundant angular sandstone fragments and medium rounded pebbles, *c*.2.70m – *c*.3.60m bgl.

304 Dark grey band of compacted sand, *c*.3.60m – *c*.3.80m bgl.

305 Friable purple sandy clay, *c*.3.80m – *c*.4.50m (to the limit of excavation) bgl.

Test Pit 04 - *c*.4.40m NW-SE x *c*.0.68m NE-SW x *c*.4.50m deep (Plate 3).

400 Turf and black/dark grey loam topsoil, 0.00m – *c*.0.20m bgl.

401 Friable, light brown sandy clay with common small to medium rounded pebbles, *c*.0.20m – *c*.0.50m bgl.

402 Friable, blue/grey clay, *c*.0.50m – *c*.0.80m bgl.

403 Friable, purple/grey clay, *c*.0.80m – *c*.1.50 bgl.

404 Friable, grey shale and mudstone, *c*.1.50m – *c*.4.50m (to the limit of excavation) bgl.

Test Pit 05 - *c*.3.60m N-S x *c*.0.70m E-W x *c*.4.00m deep.

500 Turf and black/dark grey loamy topsoil, 0.00m – *c*.0.25 bgl.

501 Dark brown sandy clay with abundant small rounded pebbles and medium rounded sandstone fragments, *c*.0.25m – *c*.0.75m bgl.

502 Light brown sandy clay with abundant small to medium rounded pebbles and sub-angular sandstone fragments, *c*.0.75m – *c*.1.95m bgl.

503 Friable, dark grey sandy clay, *c*.1.95m – *c*.2.30m bgl.

504 Loose, friable, light grey sandy clay, *c*.2.30m – *c*.3.20m bgl.

505 Friable, dark grey mudstone, *c*.3.20m – *c*.4.00m (to the limit of excavation) bgl.

Test Pit 06 - *c*.4.90m E-W x *c*.0.65m N-S x *c*.3.30m deep (Plate 4).

600 Turf and black/dark grey loamy topsoil, 0.00m – *c*.0.20m bgl.

601 Light brown sand with pockets of grey clay with rare small rounded pebbles, *c*.0.20m –*c*.1.30m bgl.

602 Friable, grey sandy clay, *c*.1.30m – *c*.1.80 bgl.

603 Brown sand, *c*.1.80m – *c*.2.50m bgl.

604 Grey sand, *c*.2.50m – *c*.2.80m bgl.

605 Brown Peat, *c*.2.80m – *c*.3.30m bgl.

606 Hard grey gritty clay, *c*.3.30m – *c*.4.50m (to the limit of excavation) bgl.

Test Pit 07 - *c*.4.60m N-S x *c*.0.62m E-W x *c*.4.50m deep (Plate 5).

700 Turf and black/dark grey loamy topsoil, 0.00m – *c*.0.30m bgl.

701 Dark grey sandy loam, *c*.0.30m – *c*.0.50m bgl.

702 Brown sandy clay, *c*.0.50m – *c*.1.54m bgl.

703 Firm, mid – dark grey silty clay, *c*.1.54m – *c*.1.60m bgl.

704 Light grey and yellow streaky sandy clay, *c*.1.60m – *c*.2.75m bgl.

705 Dark grey silty clay with lenses of light brown peat, *c*.2.75- *c*.3.40m bgl.

706 Mid grey sandy clay with coal flecks, *c*.3.40m – *c*.4.50m (to the limit of excavation) bgl.

Test Pit 08 - *c*.3.30m E-W x *c*.0.70m N-S x *c*.4.50m deep.

800 Turf and black/dark grey loamy topsoil, 0.00m – *c*.0.30m bgl.

801 Brown sandy clay with abundant small to medium rounded pebbles, *c*.0.30m – *c*.0.75m bgl.

802 Orange sand, *c*.0.75m – *c*.0.90m bgl.

803 Stiff grey clay with abundant sub-angular pebbles, *c*.0.90m – *c*.1.30m bgl.

804 Dark brown sand with abundant sub-angular and rounded pebbles, *c*.1.30m – *c*.1.70m bgl.

805 Hard, mixed blue, grey and yellow sandy clay with abundant small pebbles, *c*.1.70m – *c*.2.50m bgl.

806 Hard, mixed brown, grey and yellow sandy clay, *c*.2.50m – *c*.2.90m bgl.

807 Firm grey silty clay, *c*.2.90m – *c*.3.10m bgl.

808 Grey sandy, silty clay, *c*.3.10m – *c*.3.50m bgl.

809 Friable black peat, *c*.3.50m – *c*.4.50m (to the limit of excavation) bgl.

Test Pit 09 - *c*.4.60m NE-SW x *c*.0.64m NW-SE x *c*.4.50m deep.

900 Turf and black/dark grey loamy topsoil, 0.00m – *c*.0.25m bgl.

901 Firm, mixed brown, yellow and grey sandy clay with coal flecks and rare rounded pebbles *c*.0.25m – *c*.1.05m bgl.

902 Dark grey sandy clay with black flecks and rare large rounded sandstone cobbles, *c*.1.05m – *c*.1.30m bgl.

903 Friable, light grey sandy clay, *c*.1.30m – *c*.1.80m bgl.

904 Plastic, light grey/yellow sandy clay, *c*.1.80m – *c*.2.30m bgl.

905 Plastic, mid grey sandy clay, *c*.2.30m – *c*.3.30 bgl.

906 Dark grey silty clay with frequent rounded cobbles, *c*.3.30m – *c*.4.50m (to the limit of excavation) bgl.

Test Pit 10 - *c*.3.90m E-W x *c*.0.72m N-S x *c*.4.20m deep.

1000 Turf and black/dark grey loamy topsoil, 0.00m – *c*.0.10m bgl.

1001 Firm, light brown/grey sandy clay with occasional medium rounded pebbles, *c*.0.10m – *c*.0.60m bgl.

1002 Friable, grey/mid brown clay with common small to medium sub-rounded pebbles and large (>60mm) sandstone cobbles, *c*.0.60m – *c*.1.40m bgl.

1003 Soft, mid-brown/grey sandy clay, *c*.1.40m – *c*.1.95m bgl

1004 Stiff grey/blue sandy clay with common small sub-angular sandstone and coal fragments, *c*.1.95m – *c*.2.90m bgl.

1005 Blue/grey sandy clay similar to (104) but with the absence of sandstone fragments, *c*.2.90m – *c*.3.70m bgl.

1006 Grey silty clay/mudstone, *c*.3.70m – *c*.4.20m (to the limit of excavation) bgl.

Trial Trench 1 - *c*.6.00m N-S x *c*.0.70m E-W x *c*.3.20m deep (Plate 6).

001 Turf and black/dark grey loamy topsoil, 0.00m – *c*.0.33m bgl.

002 Brown sandy loam with common small to medium rounded pebbles, *c*.0.33m – *c*.0.60m bgl.

003 Plastic, brown/grey sandy clay with rare small rounded pebbles, *c*.0.60m – *c*.1.00m bgl.

004 Friable, light brown/orange sandy clay loam with frequent large rounded pebbles, *c*.1.00m – *c*.1.80m bgl.

005 Friable, dark grey clay loam, *c*.1.80m – *c*.2.10m bgl.

006 Light brown/orange and grey streaky sandy clay with abundant small rounded pebbles, *c*.2.10m – *c*.2.80m bgl.

007 Mid-dark grey peat, *c*.2.80m – *c*.3.20m (to the limit of excavation) bgl.

5.0 Discussion of the environmental assessment

5.1 Well-stratified peat and silty clay deposits were encountered at depths of between *c*.1.54m and 3.70m in test pits 06, 07, 08 and 10, and in trial trench 1. From these, six soil samples, one each from contexts (007), (106), (605), (705), (808) and (809), were sent for environmental assessment to Worcestershire Historic Environment and Archaeology Service.

5.2 The full environmental assessment report for the project is provided in appendix 1, but in summary, a 1 litre sub-sample of each context sample was subjected to macrofossil analysis and material from (705) and (809) examined for pollen grains (Pearson & Daffern 2009, 2). The macrofossil analysis revealed well-preserved waterlogged plant remains within samples from (705) and (809). Plant species common to marshy environments were present within these groups, including pondweed, alternate water milfoil, bog bean, bulrush and sedge. Seeds from these two contexts were subsequently dated by AMS (Accelerator Mass Spectrometer), producing date-ranges of 12,750BC – 12,000BC for the material from (705) and 11,870BC – 11,660BC for (809) (a 95.4% probability applies to both sets of results) (Pearson & Daffern 2009, 2-3).

5.3 The pollen analysis of samples from (705) and (809) identified varying quantities of tree/shrub and herbaceous species. The latter group was dominant in (705), with examples of grasses, meadow buttercup, stinging nettles and mugwort. Some trees/shrubs were present within the material from (705), notably birch, willow and Scot's pine (Pearson & Daffern 2009, 4). The material from (809) demonstrated a more even split between tree/shrub and herbaceous pollen, with the former group represented by birch, willow, alder, hazel, oak, rowan and elm, and the latter by examples of grasses, meadowsweet and sedge. Aquatic species, such as pondweed, alternate water milfoil and spiked water milfoil were also identified (Pearson & Daffern 2009, 3-4). The pollen evidence from (705), the earlier of the two dated samples, suggests that during the late Glacial/early Holocene period, the PDA sat within a relatively clear landscape, characterised by grasses and other herbaceous species. The evidence provided by the later sample (809), however, appears to indicate a shift towards a more wooded, although still predominantly open landscape, denoted to some extent by the presence of light-loving species such as birch. The environment at this time is also likely to have been a marshy flood plain, featuring areas of standing water which provided a habitat for pondweed, alternate water milfoil and spiked water milfoil, with willows growing around the margins (Pearson & Daffern 2009, 4-5).

6.0 Conclusions and recommendations for further work

6.1 The environmental assessment report concludes that the deposits from Carmountside Cemetery have a high potential to provide a detailed palaeo-environmental record of the area during the late Glacial/early Holocene period (Pearson & Daffern 2009, 6). In the wider context of the Trent Valley, this is a period for which such records are rare. The material from (705) and (809) would also appear to compare favourably to late-Glacial deposits from the King's Pool area of Stafford (Pearson & Daffern 2009, 5-6). Given the quality of the late-Glacial/early Holocene material from Carmountside, it is possible that well-preserved material from later periods, notably the Neolithic and early Bronze Age, could also survive within the site's depositional sequence. These are again periods for which the palaeo-environmental record of the Trent is poor (Pearson & Daffern 2009, 6).

6.2 Given the potential significance of the Carmountside deposits, the assessment report recommends that the following elements be considered in the planning of any future archaeological work on site (Pearson & Daffern 2009, 6):

- Sampling (monolith and spit sampling) by an Environmental Archaeologist undertaken from within a shored trench.

- Further work on plant macrofossil and pollen remains. Plant macrofossil results should be fully quantified and pollen report should include counts of 300 to 500 grains.

- Deposit modelling by a geoarchaeologist using the data from the watching brief and from any further boreholes.

6.3 Although no evidence relating to the nearby Hulton Abbey was found during the geotechnical investigations, the possibility remains that elements of the monastic complex may survive within the PDA.

7.0 Acknowledgements

7.1 This report was written by Jonathan Goodwin of Stoke-on-Trent Archaeology. Valuable assistance was provided by Richard Greenhalsh of Scott Wilson and Andy Suominen of Geotechnics Ltd. Thanks are due to Dr Elizabeth Pearson of Worcestershire Historic Environment and Archaeology Service; Tony Sutton Team Manager Structural Engineering, Highways, Policies and Programmes Group, Stoke-on-Trent City Council; and to Noel Boothroyd, Planning Archaeologist, Stoke-on-Trent City Council.

8.0 References

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Forrester, D. 2009. *Interim Report for an Archaeological Watching Brief at Carmountside Cemetery, Abbey Hulton, Stoke-on-Trent, Staffordshire NGR SJ 9063 4945*. Stoke-on-Trent Archaeology Report No. 247.

Pearson, E. & Daffern, N. 2009. *Assessment of Environmental Remains from Carmountside Cemetery, Abbey Hulton, Stoke-on-Trent, Staffordshire*. Historic Environment and Archaeology Service, Worcestershire County Council, Report No. 1715.

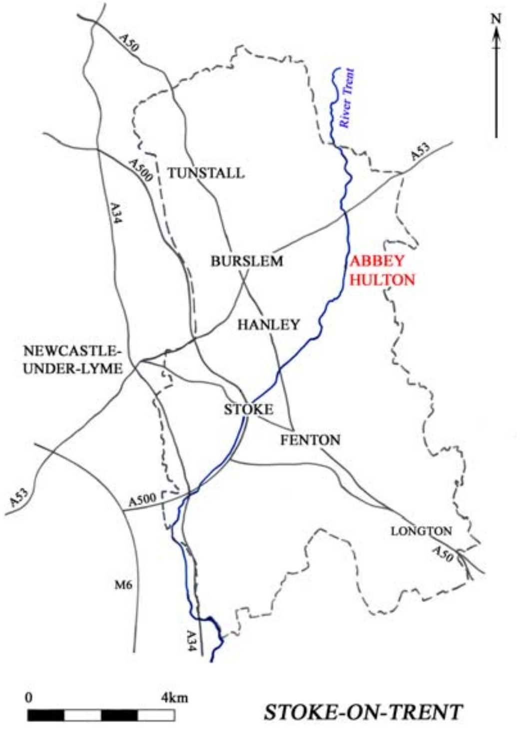
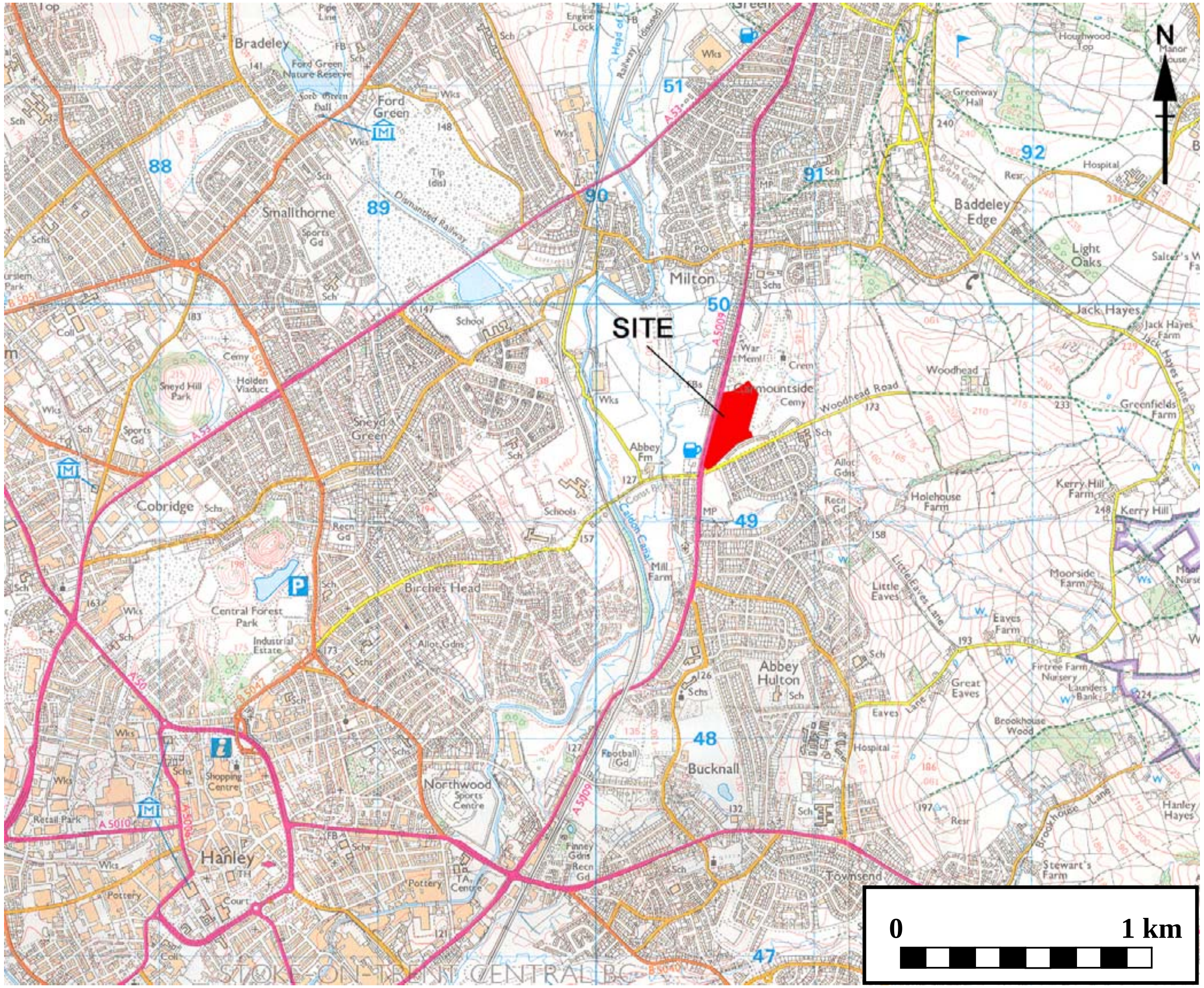


FIG. 1

Site location



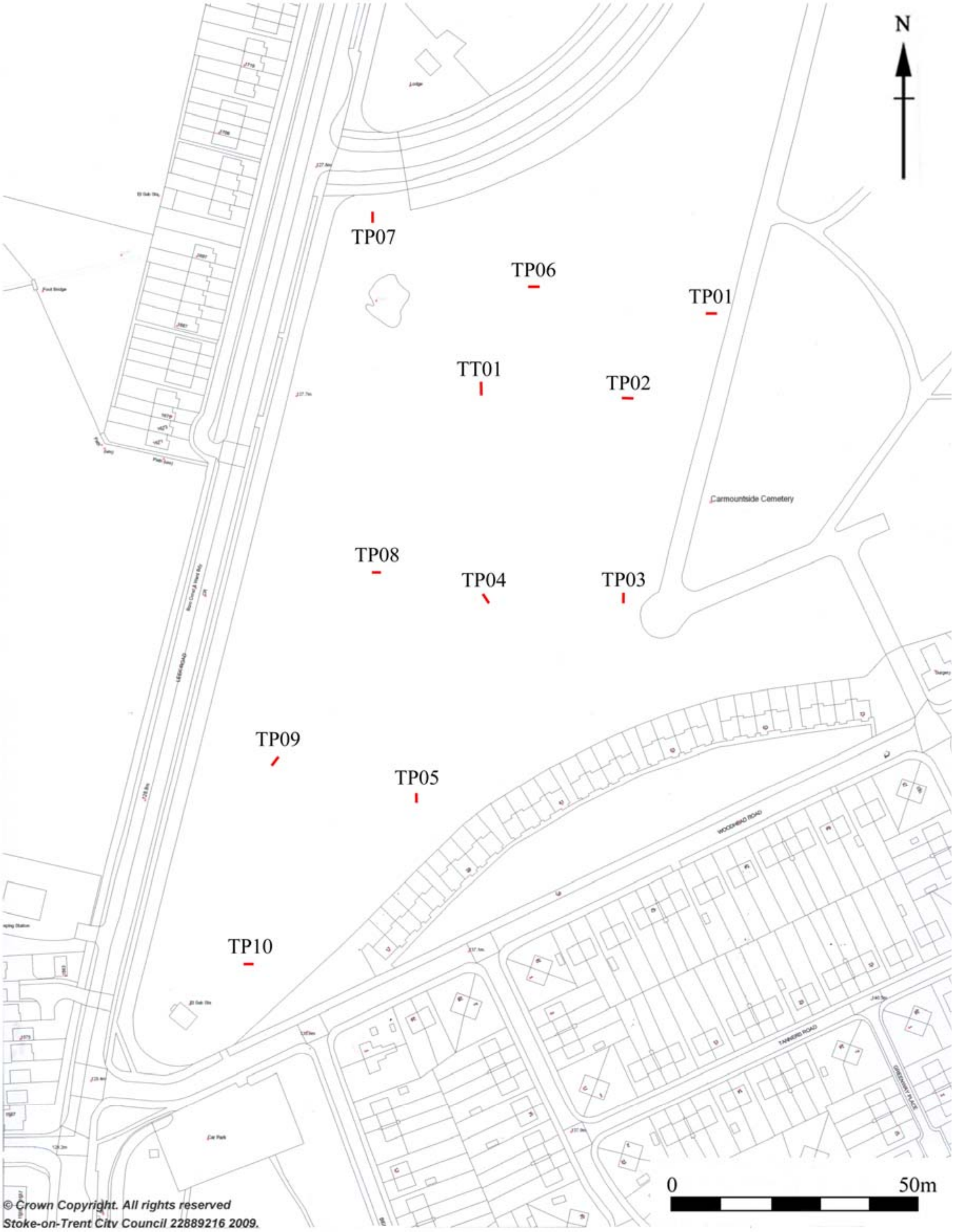


FIG. 2

Locations of test pits and trial trench within the proposed development area.

PLATE 1

Test Pit 01, looking east.

PLATE 2

Test Pit 03, looking south.

PLATE 3
Test Pit 04, looking north west.

PLATE 4
Test Pit 06, looking south east.

PLATE 5

Test Pit 07, looking north east.

PLATE 6

Trail Trench 01, looking south.

APPENDIX 1:

Environmental Assessment Report

ASSESSMENT OF ENVIRONMENTAL REMAINS FROM CARMOUNTSIDE CEMETERY, ABBEY HULTON, STOKE-ON-TRENT, STAFFORDSHIRE

Elizabeth Pearson and Nick Daffern

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Contents

1.	Introduction	1
1.1	Aims	1
2.	Methods	1
2.1	Fieldwork and sampling policy	1
2.2	Processing & analysis	2
2.2.1	Macrofossil analysis	2
2.2.2	Pollen analysis	2
3.	Macrofossil remains (Elizabeth Pearson)	2
3.1	Results	2
3.2	Discussion	3
4.	Pollen analysis (Nick Daffern)	3
4.1	Test Pit 8, Context 809	3
4.2	Test Pit 7, Content 705	4
4.3	Discussion	4
5.	Overview	6
6.	Recommendations	6
7.	The archive	6
8.	Discard Policy	6
9.	Acknowledgements	7
10.	Bibliography	7

Tables:

1	List of environmental samples
2	Comparison (% TLP) of selected species between Abbey Hulton and Kings Pool, Staffordshire
3	Comparison (% TLP) of selected species between Abbey Hulton and Kings Pool, Staffordshire

Assessment of environmental remains from Carmountside Cemetery, Abbey Hulton, Stoke-on-Trent, Staffordshire

Elizabeth Pearson and Nick Daffern

1. Introduction

An analysis of environmental remains from a watching brief (NGR SJ 9063 4945) at Carmountside Cemetery, Abbey Hulton, Stoke-on-Trent, Staffordshire was undertaken on behalf of Stoke-on-Trent Archaeology.

1.1 Aims

The aims of the assessment were to determine the state of preservation, type, and quantity of environmental remains recovered, from the samples and information provided and to retrieve material suitable for radiocarbon dating from one peaty and one silty clay sample. This information will be used to assess the importance of the environmental remains.

2. Methods

2.1 Fieldwork and sampling policy

Samples were taken by the excavator from deposits considered to be of high potential for the recovery of environmental remains. A total of six samples (three from peaty layers, three from silty clay layers) were selected by Stoke-on-Trent Archaeology for assessment (Table 1). Two sub-samples were taken from bulk samples of context (705) and (809) for pollen analysis.

Context	Sample	Context type	Description	Sample volume (L)	Volume processed (L)	Residue assessed	Flot assessed
007	011	Layer TT 1	Mid-dark grey peat, 2.80-c.3.20m bgl	20	1	Y	Y
106	001	Layer TP 1	Friable, red/brown sandy clay, c3.50-c4.50m bgl	20	1	Y	Y
605	004	Layer TP 6	Brown peat, c2.50-c3.30m bgl	20	1	Y	Y
705	008	Layer TP 7	Dark grey silty clay with lenses of peat, c2.75-c3	20	1	Y	Y
808	009	Layer TP 8	Grey sandy, silty clay, c3.10-c3.50m bgl	20	1	Y	Y
809	010	Layer TP 8	Black, friable peat c3.50-c4.50m bgl	20	1	Y	Y

Table 1: List of environmental samples

2.2 Processing and analysis

2.2.1 Macrofossil analysis

For each of the samples a sub-sample of 1 litre was processed by the wash-over technique as follows. The sub-sample was broken up in a bowl of water to separate the light organic remains from the mineral fraction and heavier residue. The water, with the light organic faction was decanted onto a 300μm sieve and the residue washed through a 1mm sieve. The remainder of the bulk sample was retained for further analysis.

The residues were partially scanned by eye and the abundance of each category of environmental remains estimated. The flots were scanned using a low power MEIJI stereo light microscope and plant remains identified using modern reference collections maintained by the Service, and a seed identification manual (Cappers *et al* 2006). Nomenclature for the plant remains follows the *New Flora of the British Isles*, 2nd edition (Stace 1997).

2.2.2 Pollen analysis

The chemical preparation is based on the techniques outlined in Barber (1976) and Moore *et al* (1991). Sediment samples of 2cm^3 were measured volumetrically and were digested by potassium hydroxide for 20mins in a boiling water bath to break up the soil matrix and dissolve any humic material, sieved through a 120μm mesh, washed onto a 10μm mesh, and the residue collected.

The samples were then washed several times and centrifuged to remove humic acids. A solution of 10% hydrochloric acid was added in order to remove any calcium carbonate and digested using hydrofluoric acid in a hot water bath for 20mins to remove any silicaceous material. As the samples were primarily organic in nature, they were acetolysed for 3mins to break down the cellulose material. Finally the pollen pellet was stained with safranine, washed in alcohol to dehydrate the sample, and preserved in silicon oil.

Pollen grains were counted to a total of 150 land pollen grains (TLP) for assessment purposes on a GS binocular polarising microscope at 400x magnification, and identification was aided by using the pollen reference slide collection maintained by the Service, and the pollen reference manual by Moore *et al* (1991). Nomenclature for pollen follows Stace (1991 and 1997) and Bennett (1994).

3. Macrofossil remains (Elizabeth Pearson)

3.1 Results

Test pit 1, Context 106

Only unidentifiable fine herbaceous fragments were identified in this sample, along with small coal fragments.

Test Pit, Context 605

Preservation of environmental remains was poor, consisting only of humified wood fragments.

Test Pit 7, Context 705

Waterlogged plant remains were well preserved and abundant, consisting predominantly of seeds of pondweed (*Potamogeton* sp), unidentified herbaceous material (mostly stem fragments) and unidentified seeds or spores. Woody material (stem fragments) was also moderately abundant, and occasional seeds of plants found in marshes and on the banks of ponds and watercourses included crowfoot (*Ranunculus* sbgen *Batrachium*), sedge (*Carex* sp), bulrush (*Schoenoplectus lacustris*) and possible alternate water milfoil (cf *Myriophyllum* *alterniflorum*). Occasional common nettle (*Urtica dioica*) seeds and insect remains were also noted.

Seed remains from this context were dated by AMS (Accelerator Mass Spectrometer) dating to 12,750 BC – 12,000 BC at 95.4% probability (SUERC-24835 (GU-19014)), which falls within the late Glacial/early Holocene period.

Test Pit 8, Contexts 808 and 809

Only humified wood fragments were noted in context 808. However, plant remains were well preserved in the underlying peat (809) consisting predominantly of seeds of aquatic plants such as pondweed, alternate water milfoil and bogbean (*Menyanthes trifoliata*). Crowfoot and sedge are likely to have been growing at the water's edge or in marshy areas.

Seed remains from this context were dated by AMS (Accelerator Mass Spectrometer) dating to 11,870 BC – 11,660 BC at 95.4% probability (SUERC- 24654 (GU-19015)) which falls within the late Glacial/early Holocene period.

Trial Trench 1

Only humified wood fragments were noted.

3.2 Discussion

The deposits recorded during the watching brief (Stoke-on-Trent Archaeology 2009) show much variation between test pits. It would be difficult to determine a generalised sequence of deposition of alluvial and sand deposits that is consistent across the site at this stage without using deposit modelling. Preservation of environmental remains is also variable from deposit to deposit, suggesting that there may have considerable fluctuation in water levels in the past.

However, it has been possible to date two deposits from the base of the test pits to the early Holocene, although there seems to be an inversion in the dates. The deepest deposit sampled for AMS dating (809) was later in date (11,870 BC – 11,660 BC at 95.5% probability, see Section 3.1 above) than an overlying deposit (Context 705 dated to 12,750 BC – 12,000 BC at 95.4% probability, see Section 3.1 above). This may have resulted from natural movement of deposits in a rapidly changing landscape, or that some mixing of deposits occurred during sampling as the bulk samples were taken by machine because of problems with accessibility.

Where plant remains were well preserved they suggest aquatic and waterside conditions, as would be expected in this environment. More useful results reflecting the wider environment, however, are likely be obtained by processing larger volumes of material (presently retained in store).

4. Pollen analysis (Nick Daffern)

4.1 Test Pit 8, Context 809

This layer (the lower of the two samples), contained equal percentages of tree/shrub and herbaceous pollen. The dominant tree and shrub species was *Betula* (birch) which represented 24% TLP with *Salix* (willow) the second highest contributor (14% TLP). In addition to these species, grains of *Alnus* (alder), *Corylus avellana*-type (hazel), *Quercus* (oak), *Sorbus*-type (whitebeam/ rowan) and *Ulmus* (elm) were also identified.

Poaceae indet (grasses) was the predominant herbaceous species representing 27% TLP. The remaining herbaceous pollen included species such as *Filipendula* (meadowsweet/dropwort), Rosaceae sp (rose family), Apiaceae sp (carrot family) and Cyperaceae sp (sedges) were identified in low concentrations (<10% TLP).

Aquatic species were well represented in the sample with grains of *Potamogeton* (pondweed), *Myriophyllum alterniflorum* (alternate water-milfoil), *Myriophyllum spicatum* (spiked water mil-foil) and *Stratiotes aloides* (water soldier). In addition, *Polypodium* and *Pteropsida* (mono) indet (ferns) and *Pteridium aquilinum* (bracken) spores were present in low concentrations.

4.2 Test Pit 7, Context 705

This sample was dominated by herbaceous species at 86% TLP with *Poaceae* indet contributing 54% TLP. The remaining herbaceous species, as was the case in the previous sample, are present in low concentrations (10% TLP or less) and included *Urtica dioica* (stinging nettle), *Ranunculus acris*-type (meadow buttercup), Cyperaceae sp, and *Artemisia*-type (mugwort).

Tree and shrub pollen was present in lower concentrations than the previous sample, representing 14% TLP. *Betula* and *Salix* were once again the dominant species within this group although they only represent 6% and 5% TLP respectively. Additional species were *Alnus*, *Corylus avellana*-type and *Pinus sylvestris* (Scot's pine).

Potamogeton, *Myriophyllum alterniflorum*, *Myriophyllum spicatum* and *Stratiotes aloides* were once again identified although in lower frequencies than in the previous sample. In contrast to this, the spores of *Pteropsida* (mono) indet and *Pteridium aquilinum* were present in higher concentrations than context (809).

4.3 Discussion

As the two sub-samples came from larger bulk samples taken by machine, the exact depth of the samples from within the sequence is difficult to ascertain. In addition, this methodology has a potential for contamination of samples, therefore, the results must be viewed tentatively for the time being.

Despite this, both samples contained pollen in a good state of preservation and in high concentrations allowing the 150 grains to be counted with ease and identifications to be secure. Species diversity was not significantly high yet the species that were present are excellent indicators of conditions within the environs, particularly the aquatic species such as the two water-milfoil species.

The lower of the two contexts (809) appears to indicate a predominantly open or semi-wooded landscape, indicated by the grasses and other herbaceous species, with sparse pockets of willow occupying the wettest locations, possibly overhanging or in very close proximity to the deposit. The high percentage of willow is somewhat surprising for an insect pollinated species and it may be the case that the pollen-producing catkin had become a constituent of the vegetation forming the deposit (Moore *et al* 1991, 90) thus accounting for this high concentration. Alternatively, this may be a reflection of willow acting as the dominant species within the landscape which would not be surprising within a late glacial environment (as indicated by the radiocarbon dates for both contexts) due to the climate being suitable for very hardy species such as dwarf willow (*Salix herbacea*) which dominate modern tundra and sub-arctic landscapes.

Alder was not present in high quantities as would usually be expected from a prolific producer of robust grains although this again may be indicative of the climate during this period.

This suggestion of an open or lightly wooded landscape is supported by the high percentage of birch, a light-loving pioneer species. It is unclear which species of birch was identified, that is, *Betula pendula* (silver birch) or *Betula pubescens* (downy birch). Both species tolerate a range of habitats and, therefore, their location within the landscape is difficult to ascertain. Alternatively, the grains may represent *Betula nana* (dwarf birch), a species that is now only present in arctic and cool temperate climates but was relatively abundant in Britain during the late Devensian.

The presence of *Sorbus*-type is undiagnostic as it includes a range of wild species although taking into account the radiocarbon date, it is likely that these grains indicate rowan, a species that is very tolerant of cold and a range of soil conditions.

Oak and elm are also identified although, as proposed by Godwin (1975, 244, 279), it is likely that, for the late glacial date, these two species are either derived from reworking of earlier deposits or their presence can be attributed to long distance pollen rain.

Pondweed, alternate water-milfoil, spiked water mil-foil and water soldier indicate that the deposit was forming in an area where water was either standing or slow-flowing, possibly an abandoned channel or "hollow" within the wet floodplain. Godwin (1975, 212-214) indicates that both species of water milfoil show a peak in numbers in the late glacial, a trend that appears to be exhibited in the samples from Abbey Hulton.

Context 705 shows a much clearer landscape with increases in grasses and herbaceous species such as mugwort, meadow buttercup and stinging nettle. The increased presence of bracken spores supports this interpretation, as it is often invasive of open ground or located on wooded margins although, as with the oak and elm in context 809, bracken spores are susceptible to long distance transport (Godwin 1975, 91)

The results from Abbey Hulton match favourably with pollen assemblage zones ST1 and ST2 from Kings Pool, Stafford (Bartley and Morgan 1990) both of which are assigned a late glacial date as a result of palynological, sedimentological and radiocarbon dating.

Context 809 contained high levels of grasses, birch, meadowsweet and willow. This is highly reminiscent of zone ST1 which was only lacking the high percentage of willow although zone ST1 did have a far greater presence of sedges. This higher percentage may be explained on taphonomic grounds due to sedges resistance to decay in wetland conditions.

Species	(809) Abbey Hulton	ST1 at Kings Pool, Stafford
Birch	**24%**	**~ 27%**
Grass	**27%**	**~ 27%**
Sedges	**2%**	**~ 30%**
Willow	**14%**	**~ 5%**
Meadowsweet	**7%**	**~ 8%**

Table 2 Comparison (% TLP) of selected species between Abbey Hulton and Kings Pool, Staffordshire

Context 705 exhibits the same dominant species as Kings Pool ST2, with birch declining from the previous zone and grasses increasing in quantity. Sedges are once again the exception to this remaining at a far higher level at Kings Pool than at Abbey Hulton. An additional difference from the previous zone is the increase of mugwort which has a marked rise at both sites.

Species	(705) Abbey Hulton	ST2 at Kings Pool, Stafford
Birch	**5%**	**~ 10%**
Grass	**54%**	**~ 35%**
Sedges	**4%**	**~ 40%**
Willow	**4%**	**~ 5%**
Meadowsweet	**<1%**	**~ 1- 2%**
Mugwort	**4%**	**~6%**

Table 3 Comparison (% TLP) of selected species between Abbey Hulton and Kings Pool, Staffordshire

Bartley and Morgan (1990, 185) propose that "ST1 is of Windermere interstadial age and ST2 is of Loch Lomond stadial age" suggesting that the palynological and sedimentological dating is correct but there are problems with the radiocarbon dating. Whether this is the case at Abbey Hulton is unclear and only further analysis would be able to confirm whether the two sequences match and if in both cases, depositional or taphonomic factors may have caused anomalous results in regards to the radiocarbon dating.

5. Overview

Because of the date and the quality of environmental remains, the significance and potential of the deposits should be considered as high. Knight and Howard (2004, 24) state that "in the Trent Valley, palaeoenvironmental records from the late glacial period are rare" and further work on this material should therefore be considered of importance. They also state that for the Neolithic and early Bronze Age, when compared to the lower Trent "the environmental history of the Upper Trent is poorly documented" (Knight and Howard 2004, 53) and the sequence identified at Abbey Hulton has the potential to address this disparity if the upper deposits were also studied in detail.

6. Recommendations

The following recommendations are made for consideration when designing any further archaeological project for this site.

- If further fieldwork is planned, sampling (monolith and spit sampling) by an Environmental Archaeologist is recommended and should be undertaken from within a shored trench
- Further work on plant macrofossil and pollen remains is recommended. Plant macrofossil results should be fully quantified and pollen report should include counts of 300 to 500 grains
- As deposits appear to be very variable across the site, deposit modelling by a geoarchaeologist using the data from the watching brief and from further boreholes is recommended

No further work is recommended on the samples considered as part of this report.

7. The archive

The archive consists of:

6	bulk samples
2	pollen pellets
2	pollen slides
6	flot record sheets AS21
2	pollen record sheets

8. Discard Policy

The samples selected for this assessment will be discarded after a period of 3 months after the submission of this report, unless there is a specific request to retain them.

9. Acknowledgements

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