Assessment of Environmental Evidence from 208490 – Outseats Farm Area E additional mitigation, Alfreton, Derbyshire
+ recommendations for analysis for 86560/1/2/3, T23726 and 208490

Acknowledgements
The samples were processed by Liz Foulston, Jenny Giddins and Samantha Rogerson. The flots were sorted by Nicki Mulhall and assessed by Inés López-Dóriga. This report was written by Nicki Mulhall and Inés López-Dóriga.

1 ENVIRONMENTAL EVIDENCE

1.1 Introduction

1.1.1 Seven bulk sediment samples were taken from a ditch, a kiln and a well of medieval chronology and were processed for the recovery and assessment of the environmental evidence. The potential of the evidence from this last stage of work at the Site is reviewed together with that of previous phases.

1.2 Aims and Methods

1.2.1 The purpose of this assessment is to determine the potential of the environmental remains preserved at the site to address project aims and to provide archaeobotanical data valuable for wider research frameworks. The nature of this assessment follows recommendations set up by Historic England (Campbell et al. 2011).

1.2.2 The size of the bulk sediment samples varied between 2 and 35 litres, and on average was around 23 litres. The samples were pre-soaked in a solution of water and hydrogen peroxide to aid in breaking up the clayey sediment, then processed by standard flotation methods on a Syraf-type flotation tank; the flot retained on a 0.25 mm mesh, residues fractionated into 5.6/4 mm and 1/0.5 mm fractions. The coarse fractions (>5.6/4 mm) were sorted by eye and discarded. A riffle box was used to split a large flot into a smaller flot subsample. The flots were scanned using a stereo incident light microscopy (Leica MS5 microscope) at magnifications of up to x40 for the identification of environmental remains. Different bioturbation indicators were considered, including the percentage of roots, the abundance of modern seeds and the presence of mycorrhizal fungi sclerotia (e.g. *Cenococcum geophilum*) and animal remains, such as earthworm eggs and insects, which would not be preserved unless anoxic conditions prevailed on site. The preservation and nature of the charred plant and wood charcoal remains, as well as the presence of other remains was recorded. Preliminary identifications of dominant or important taxa are noted below, following the nomenclature of Stace (1997) for wild plants, and traditional nomenclature, as provided by Zohary and Hopf (2000, Tables 3, page 28 and 5, page 65), for cereals. Abundance of remains is qualitatively quantified (A*** = exceptional, A** = 100+, A* = 30-99, A = >10, B = 9-5, C = <5) as an estimation of the minimum number of individuals and not the number of remains per taxa.

1.3 Results

1.3.1 The flots from the bulk sediment samples were mainly large (Table XXX). There were generally low numbers of roots and moderate numbers of modern seeds that may be indicative of some stratigraphic movement and the possibility of contamination by later intrusive elements.

1.3.2 Charred material comprised varying degrees of preservation. Wood charcoal was noted in generally varying quantities, particularly abundant in the deposits from the kiln, and was from mature and round wood, with some iron coating present. Coal and industrial waste were present in some samples. No other environmental evidence was preserved in the bulk sediment samples.

1.3.3 The majority of the bulk sediment samples were dominated by the charred remains of cereals, mainly *Avena* cf. *sativa* (large seeded, probably cultivated, oats, positively identified in a sample with husked grains). Other cereals included *Secale cereale* (rye), *Hordeum vulgare* (barley, including some sprouted grains), *Triticum* sp.(wheat), *Triticum aestivum/turgidum* (naked wheat) and grain fragments and culm nodes of Triticeae (poor preservation preventing further identification). The bulk sediment samples also contained charred remains of other potential crops such as *Linum* sp. (flax) and Vicieae (vetches, including some large seeded possibly cultivated), and wild plants, such as Poaceae (grasses), including *Avena/Bromus* (oats/brome), *Lolium/Festuca* (ryegrass/fescue) and *Poa/Phleum* (meadow grass/cat's tail), Asteraceae (daisy family), seed capsules of *Raphanus raphanistrum* (wild radish), Polygonaceae (knotweeds, including *Persicaria* sp. and *Rumex* sp.(dock)), *Valerianella* sp. (corn salad), Caryophyllaceae (pink family, including *Cerastium* sp. (mouse ear chickweed) and *Spergula arvensis* (corn spurry)), , *Plantago lanceolata* (ribwort plantain), *Galium* sp. (bedstraw), *Mercurialis* sp. (spurge), *Viola* sp. (violets), Chenopodiaceae (goosefoot family), Lamiaceae (mint family), *Sparganium erectum* (bur-reed), *Veronica* sp. (speedwell), *Corylus avellana* (hazel) nut shell fragments, and thorns, buds and seeds of indeterminate taxa.

1.3.4 Two bulk sediment samples contained no charred cereal remains but only small amounts of charred seeds of grasses (including oats and oats/brome), the daisy family and knotweeds.

1.4 Discussion

1.4.1 The charred plant remains assemblage is consistent with crop processing activities carried out in a domestic type of settlement of Medieval chronology, based on the presence of crops such as rye, oats and free-threshing or naked wheat. Other potential crops were flax and pulses and plant resource exploitation may have included wild nut gathering. The dominance of cereal grains over chaff suggests the last stages of crop processing activities. The abundance of wild plant seeds, many of them potential weeds, could be representative of local agricultural techniques and field conditions. The charcoal assemblage from the kilns may represent fuel selection for industrial activities.

1.5 Further potential

1.5.1 This section reviews the overall potential for further work from the samples from all phases of work at the site (see Table 1).

Areas A-C (86560)

1.5.2 No bulk sediment samples were taken during this phase of works.

Area D (86561)

1.5.3 Several samples in this area, particularly from undated features, included a small assemblage of charred plant remains which may be of significance, should they be radiocarbon dated. This charred plant remain evidence comprised a wheat (*Triticum* sp.) grain, onion couch (*Arrhenatherum elatius* subsp. *bulbosum*) tubers, parenchymatic tissue, and wild plant seeds including cornsalad (*Valerianella* sp.) and probably hemlock (cf. *Conium maculatum*). This assemblage is suggestive of a Bronze Age chronology: both *Valerianella*

and *Conium maculatum* are archaeophytes presumably introduced then (Preston et al. 2004) and onion couch is a perennial grass with an edible tuber, found in a wide range of open grassland habitats and in archaeobotanical assemblages from a diversity of archaeological deposits, but particularly prehistoric, and although the reason for its presence is still open to controversial interpretation it is often understood that it may have played an important role in past human subsistence (Roehrs 2013). Therefore, this assemblage is recommended for further analysis, including radiocarbon dating (four dates in total), as it has potential to contribute to general discussions about plant exploitation activities in the early prehistoric period, as well as help clarifying the chronology of the features and inform on the early phases of human activity at the site and the wider area (Monckton 2012).

Area E North (86562 and T23726)

1.5.4 The assemblage of charred plant remains from this area was relatively small and poor but consistent with domestic crop-processing activities in medieval times in the vicinity of the sampled areas. The assemblage is not significant given the rarity of environmental evidence preserved and given the more abundant and better-preserved evidence from features of the same phase in Area E south, where the domestic activities seem to have been focussed in medieval times.

Area E South (86853 and 208490)

1.5.5 Well preserved assemblages of charred plant remains were recovered in this site area, indicating the existence of a domestic settlement of medieval chronology. The analysis of a selection of the charred plant and charcoal samples from this site area, including radiocarbon dating, has the potential to provide information on the nature of the settlement, the exploitation of the local environment and local agricultural practices. Samples meeting a minimum number of remains for statistical analysis are recommended for further work. The analysis of well-preserved rural medieval assemblages is set up as one of the priorities in medieval research in the area (Monckton 2012) and in the wider context of Great Britain (van der Veen et al 2013).

Table 1. Summary of overall recommendations for analysis

	No. of bulk sediment samples taken	**No. of samples recommended for charred plant remain analysis**	**No. of samples recommended for charcoal analysis**	**C14**
86560	-	-	-	-
86561	5	3 (<301>, <1501>, <701>)	2 (<301> and <1501>)	4 (2x <301, 2x <701>)
86562	7	-	-	-
T23726	18	-	-	-
86563	4	-	-	-
208490	7	4 (<103>, <105>, <106> and <107>)	4 (<102>, <103>, <105>, <106> and <107>)	2 (2x <105>)
Whole scheme	41	7	7	6

1.5.6 In summary, the results of the analysis of a selection of samples could provide a comparison with the data from other sites in the area and would inform about plant exploitation activities in the prehistoric period and medieval times, providing information to potentially contribute to fill some gaps set up in the regional research framework (Monckton 2012).

1.5.7 The samples proposed for charred plant remain analysis are indicated with a "P" in the analysis column in Table XX. All identifiable charred plant macrofossils will be extracted from the <5.6/4 residues and the flot, which may be subsampled with the aid of a riffle box in the case of very rich assemblages. The analysis will involve the full quantification (Antolín *et al*. 2016) of the charred plant assemblages.

1.5.8 The samples proposed for charcoal analysis are indicated with a "C" in the analysis column in Table XX. Identifiable charcoal will be extracted from the 2mm residue together and the flot (>2mm). Larger richer samples will be sub-sampled. Fragments will be prepared for identification according to the standard methodology of Leney and Casteel (1975). Charcoal pieces will be fractured with a razor blade so that three planes can be seen: transverse section (TS), radial longitudinal section (RL) and tangential longitudinal section (TL). They will then be examined under bi-focal epi-illuminated microscopy at magnifications of x50, x100 and x40. Identification will be undertaken according to the anatomical characteristics described by Schweingruber (1990) and Butterfield and Meylan (1980). Identification will be to the lowest taxonomic level possible, usually that of genus and nomenclature according to Stace (1997), individual taxon (mature and twig) will be separated, quantified, and the results tabulated.

1.5.9 A total of 6 short-lived radiocarbon samples will be submitted to the 14CHRONO Centre, Queen's University, Belfast. The dates will be calculated using the IntCal13 calibration curve (Reimer et al. 2013) and the computer program OxCal (v4.2.3) (Bronk Ramsey and Lee 2013) and cited at 95% confidence.

1.5.10 The samples not recommended for analysis have little potential and may be discarded, whilst the samples for analysis are recommended for deposition with the remainder of the archive after the conclusion of the project.

1.6 Task list

1.6.1 Text

Table 1: Task list table

Task ID	Task	Resource	Duration
1	Extraction of Charred Plants and Wood Charcoal (13 samples)	ES	6.5
6	Analysis of Charred Plant Remains (7 samples)	SPO	5
7	Analysis of Wood Charcoal (7 samples)	Ext.	4
15	Environmental Illustration Requirements	SPO	0.5
17	Costs per Date (inc. admin)	SPO	£450
18	Overview and Palaeo-environmental Summary	SPO	1
19	Environmental Management	SPO	0.5

2 REFERENCES

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3 APPENDICES

3.1 Appendix 1: Environmental Data

Table 2: Assessment of the charred plant remains and charcoal

Feature	Context	Group	Sample	Vol (l)	Flot (ml)	Sub-sample	Bioturbation proxies	Grain	Chaff	Cereal Notes	Charred Other	Charred Other Notes	Charcoal >2mm (ml)	Charcoal	Other	Comments (Preservation)
137	386	363	107	17	400		<1%, A, I, F	A**	C	*Avena* cf. *sativa* (A**), *Secale cereale* (C), Triticeae grains and culm nodes	A*	Lamiaceae, *Linum* sp., *Sparganium erectum*, Asteraceae, *Rubus* sp., *Plantago lanceolata, Corylus avellana, Veronica* sp., *Spergula arvensis, Persicaria* sp.	220	Mature + roundwood, some iron coating	Coal, industrial waste	Fair
335	337	363	104	2	15		5%, B, F, I	-	-	-	B	Poaceae (*Avena/Bromus*), Asteraceae, Polygonaceae	10	Mature	-	Poor
335	338	363	103	35	675		10%, A, F	C	-	*Avena* cf. *sativa* (A**), cf. *Secale cereale* (C), Triticeae	A	*Cerastium* sp., Asteraceae, thorns, *Raphanus raphanistrum* capsule, bud, indet.	260	Mature + roundwood	Industrial waste, coal	Fair
335	339	363	102	14	500		5%, A, F, I	A	-	*Avena* cf. *sativa* (A), *Secale cereale* (C)	C	Poaceae, Asteraceae	300	Mature + roundwood, some large pieces	Coal	Heterogenous

Feature	Context	Group	Sample	Vol (l)	Flot (ml)	Sub-sample	Bioturbation proxies	Grain	Chaff	Cereal Notes	Charred Other	Charred Other Notes	Charcoal >2mm (ml)	Charcoal	Other	Comments (Preservation)
363	364	363	105	31	2000	25%	1%, A, F	A***	C	*Avena* cf. *sativa* (inc. husked grains) (A**), *Secale cereale* (A), *Triticum aestivum/turgidum* (B), *Hordeum vulgare* (inc. sprouted) (C), Triticeae culm nodes	A*	Poaceae *(Poa/Phleum Lolium/Festuca), Valerianella* sp., Caryophyllaceae, Asteraceae, Vicieae, *Plantago lanceolata, Spergula arvensis, Galium* sp., *Linum* sp., *Mercurialis* sp., *Persicaria* sp., *Corylus avellana, Viola* sp., Chenopodiaceae, *Rumex* sp.	330	Mature + roundwood	-	Good
323	324	389	101	29	175		80%, A	-	-	-	C	*Avena* sp.	2	Mature, some iron coating	Coal	Poor
358	385		106	31	500		<1%, A*, I, F	A*	-	*Avena* cf. *sativa* (A*), *Hordeum vulgare* (B), *Triticum* sp. (C), *Secale cereale* (C)	A	Poaceae, *Galium* sp., *Plantago lanceolata,* Vicieae (large seeded), Asteraceae, indet. bud	70	Mature	Coal (about 60% of flot), industrial waste	Fair

Key: Scale of abundance: A*** = exceptional, A** = 100+, A* = 30-99, A = >10, B = 9-5, C = <5; Bioturbation proxies: Roots (%), Uncharred seeds (scale of abundance), F = mycorrhyzal fungi sclerotia, E = earthworm eggs, I = insects.