



Sizergh Castle Kettle Hole, Cumbria

Stratigraphic Survey Report



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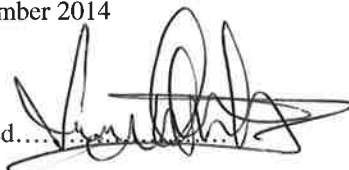
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CONTENTS

CONTENTS	1
SUMMARY	3
ACKNOWLEDGEMENTS	4
1. INTRODUCTION	5
1.1 Circumstances of Project.....	5
1.2 Location, Topography and Geology	5
1.3 The Sizergh Kettle Hole: The Environmental Context	6
2. ARCHAEOLOGICAL AND HISTORICAL BACKGROUND.....	7
2.1 Landscape History of Sizergh Castle and its Estate	7
3. METHODOLOGY	16
3.1 Project Design.....	16
3.2 Topographical Survey of the Kettle Hole and Burnt Mound	16
3.3 Environmental Probing / Coring Survey	18
3.4 Macrofossil and Palynological Assessment	19
3.5 Archive	20
4. TOPOGRAPHICAL SURVEY.....	21
4.1 Introduction	21
4.2 The Kettle Hole.....	21
5. STRATIGRAPHIC SURVEY RESULTS.....	23
5.1 Lithology	23
5.2 Radiocarbon Dating	23
6. POLLEN ANALYSIS	25
6.1 Introduction	25
6.2 Results	25
7. SUMMARY RESULTS: BURNT MOUND	29
7.1 Introduction	29
7.3 Chronology	30
8. DISCUSSION.....	32
8.1 The Sediment Sequence	32
8.2 Conclusion.....	34
9. BIBLIOGRAPHY.....	36
9.1 Primary Sources.....	36
9.2 Secondary Sources.....	36
9.3 On-Line Sources	40
APPENDIX 1: PROJECT BRIEF	41

APPENDIX 2: PROJECT DESIGN.....	49
APPENDIX 3: SIZERGH PALAEOENVIRONMENTAL ASSESSMENT RECOMMENDATIONS	62
APPENDIX 4: RADIOCARBON ASSAY CALIBRATION PLOTS.....	64
ILLUSTRATIONS	72
Figures	72
PLATES	
Plate 1: Surveying the burnt mound with a total station	17
Plate 2: Participants using a gauge auger to core the kettle hole.....	18
Plate 3: Contour survey in progress of the burnt mound and kettle hole	21
Plate 4: The wooden trough within the burnt mound, with a stone retaining its north-western side.....	29
Plate 5: Section through the burnt mound	30
TABLES	
Table 1: Details of lithology and sub-sampling for palynology	23
Table 2: Details of radiocarbon dates.....	24

SUMMARY

Oxford Archaeology North (OA North) was commissioned in July 2013 by Levens Local History Group and the National Trust to deliver a programme of community archaeological work at Sizergh Castle (SD 500 875). The project provided supervision and training for participants in a broad range of archaeological skills, which included archaeological excavation, topographical survey, geophysical survey, building survey and palaeoenvironmental work; the project was funded by the Heritage Lottery Fund (HLF). The work was undertaken in accordance with a project brief by the National Trust and a project design by OA North. The results of the two areas excavated, the deer park boundary and a burnt mound, and those of the topographical survey, geophysical survey and barn survey, were presented within a report in February 2014 and a popular publication in March 2014. A stratigraphic survey of a kettle hole associated with the burnt mound proved of potential considerable interest, but analysis was not within the remit of the HLF project. An application was therefore made to the Cumberland and Westmorland Antiquarian and Archaeological Society for a grant to undertake the palaeoenvironmental analysis of the Sizergh kettle hole, including obtaining radiocarbon dates. This work has been undertaken during the summer and autumn of 2014.

A hand-auger survey carried out within an area of boggy ground adjacent to the burnt mound at Sizergh revealed a small basin infilled with deposits typical of a kettle hole. These deposits included a succession of blue/grey silts and clays, overlain by shell marl ('gytta'), over which woody and humified peat deposits accumulated. A kettle hole is a small steep-sided depression in glacial boulder clays, formed as ice retreated following deglaciation. Kettle holes often became filled with water, forming small lakes or ponds, and were subsequently filled by peat deposits, leading to the development of small basin mires. The Sizergh kettle hole contains a typical Late glacial and early Holocene sequence of shell marls, clays and peat, which contains a pollen record that may date back to the Loch Lomond stadial (*c* 10,000-11,000 cal BC). An amelioration in climate during the early Holocene led to the eventual development of vegetation and mixed woodland. Successional changes in the lake basin culminated in the development of mire vegetation, and peat development from around 8200 cal BC.

The upper level of the peat sequence was indicated by a date from near the top of the peat in the centre of the kettle hole, which produced an early medieval (humic acid) date. Given the limited number of samples analysed, it is possible that a full stratigraphic sequence may be present in the kettle hole, but it is also possible that truncation of the peat may have taken place in the past. Further detailed palynological work, accompanied by further dating, could potentially resolve this issue.

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Oxford Archaeology North (OA North) would like to thank the Levens Local History Group for their considerable support and enthusiasm in commissioning and delivering this project, with special thanks due to Stephen Read and Allan Steward. Jamie Lund of the National Trust assisted in the delivery of the project and was supported by staff from the National Trust Sizergh Estate, including Tom Burditt, Lisa Hornby, Maria Fofanova, Georgina Ferguson and Kelley Sproston-Heath. We would also like to thank the Heritage Lottery Fund for their financial support for the fieldwork, and particularly the Cumberland and Westmorland Antiquarian and Archaeological Society for funding these analytical works. We especially thank the participants, whose support, help and enthusiasm was overwhelming, and without whom the success of the project would not have been possible.

The topographical survey was directed by Peter Schofield and Jamie Quartermaine; the environmental probing / coring survey was directed by Denise Druce and Peter Schofield. The radiocarbon dating was undertaken by the Scottish Universities Environmental Research Centre. The palaeoenvironmental assessment was undertaken by Denise Druce and Mairead Rutherford, who also wrote the report. The project was managed by Jamie Quartermaine, who also edited the report.

1. INTRODUCTION

1.1 CIRCUMSTANCES OF PROJECT

- 1.1.1 Oxford Archaeology North (OA North) was commissioned in July 2013 by the Levens Local History Group and the National Trust to deliver a programme of community archaeological work at Sizergh Castle in July 2013. The project provided training and supervision for participants in a broad range of archaeological skills, which included archaeological excavation, topographical survey, geophysical survey, building survey and palaeoenvironmental work; the project was largely funded by the Heritage Lottery Fund (HLF). The programme comprised several different archaeological activities, which centred around the excavation of a burnt mound (Fig 1) and a putative deer park boundary, the palaeoenvironmental examination of a kettle hole, along with an historic building survey of the Great Barn. The work was undertaken in accordance with a project brief provided by the National Trust (*Appendix 1*) and a project design compiled by OA North (*Appendix 2*). The results of the excavations on the deer park boundary and burnt mound, topographical survey, geophysical survey and barn survey were presented within a report in February 2014 (OA North 2014) and a popular publication in March 2014 (Gregory and Vannan 2014). The analysis of the stratigraphical survey of the kettle hole, however, was not undertaken at the same juncture, as it was beyond the remit of the project as originally designed. An application was therefore submitted to the Cumberland and Westmorland Antiquarian and Archaeological Society for a grant to undertake the palaeoenvironmental analysis of the kettle hole (SD 500 875), together with obtaining radiocarbon dates of the sequence of deposits within it.
- 1.1.2 In the course of the fieldwork programme in 2013, funded by the HLF, a detailed topographical survey of the surface of the kettle hole was undertaken, and a coring programme was carried out in transects across the mire. The burnt mound, which is in the north-western part of the mire, apparently on top of the peats of the kettle hole, was also partially excavated and dated. This report presents the results of the analysis of the stratigraphy of the kettle hole recorded by both the coring programme and the topographical survey, together with a summary of the results of the topographical survey and the excavation of the burnt mound (OA North 2014), as these are important for an understanding of the context of the kettle hole.

1.2 LOCATION, TOPOGRAPHY AND GEOLOGY

- 1.2.1 **Sizergh:** the Sizergh Estate is situated *c* 4km south-west of Kendal (Fig 1) in a predominantly rural and agricultural setting. The 633ha estate consists of pasture, woodland and parkland situated in rolling countryside sandwiched between the River Kent and the Lyth Valley. It is skirted by the A591 on the east side and lies between the villages of Brigsteer and Levens (English Heritage 2014a).
- 1.2.2 The estate lies within the area characterised by the Countryside Commission as Morecambe Bay Limestones, consisting of conspicuous limestone hills often with exposed limestone screes rising above low-lying pasture and wetlands (Countryside Commission 1998, 67-73). The landscape comprises undulating pastoral farmland, enclosed with drystone walls, interspersed with areas of enclosed woodland and plantations, which historically have been coppiced (OA North 2011a). The

surrounding lower wetlands were enclosed and improved in the nineteenth century, whilst the exposed limestone hills have been subject to quarrying for stone.

- 1.2.3 **The Kettle Hole:** the kettle hole is situated in the southern part of the post-medieval Sizergh Park, and is partly crossed by a north-west / south-east orientated ha-ha that marks the southern edge of the park; it is immediately to the east of Chapel Wood (centred SD 5001 3540). It is an irregularly shaped, but broadly elongated, mire (approximately 150 x 70m in extent), within an area of generally flat terrain, which is presently used as pasture. The excavated burnt mound lies within its north-western margins.
- 1.2.4 **Geology:** the solid geology of the Sizergh Estate comprises limestone, dated to the Dinantian phase of the Carboniferous period (British Geological Survey 1982). The overlying soil comprises typical Brown Earths of the Denbigh 1 Series (Lawes Agricultural Trust 1983).

1.3 THE SIZERGH KETTLE HOLE: THE ENVIRONMENTAL CONTEXT

- 1.3.1 A hand-auger survey, carried out within an area of boggy ground adjacent to the burnt mound at Sizergh, revealed a small basin filled with deposits typical of a kettle hole. The deposits included a succession of blue/grey silts and clays, overlain by shell marl ('gytta'), over which woody and humified peat deposits accumulated. A kettle hole is a small, steep-sided depression in glacial boulder clays, formed as ice retreated following deglaciation. Kettle holes often became filled with water, forming small lakes or ponds, and subsequently became filled by peat deposits, leading to the development of basin mires (Thomas *et al* 2006). There could be a time lag between the disappearance of the ice and the start of organic sedimentation within kettle holes, but typical Late glacial ages (*c* 13,500 BC) have been reported (Bridgland *et al* 2011; Rose 1985). The sequence of deposits recorded at Sizergh is typical of those described previously from kettle holes in Cumbria (for instance, at Sparrowmire, near Kendal, which also contained a burnt mound (Heawood and Huckerby 2002)). Basin mires, such as Church Moss and Silver Tarn on the west Cumbrian coast, also developed in kettle holes after the last glaciation (Hodgkinson *et al* 2000).

2. ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 LANDSCAPE HISTORY OF SIZERGH CASTLE AND ITS ESTATE

- 2.1.1 The following section presents a summary of the early archaeological and historical background of the general area. This is presented by historical period, and has been compiled in order to provide a wider archaeological context specifically for the formation and development of the kettle hole; it consequently omits the post-medieval history of the area, which is presented in a more comprehensive form in the earlier survey report (OA North 2014).
- 2.1.2 **Late Upper Palaeolithic to Mesolithic Periods (c 11,000–4000 BC):** there is no evidence of human activity in Cumbria prior to the Late Upper Palaeolithic period, between c 10,000 BC and c 9500 BC. Caves in the limestone of southern Cumbria have provided artefacts that have been dated to this period (Hodgson and Brennand 2006, 24), which may suggest evidence of early groups of hunters attempting to exploit the large mammals present beyond the edge of the ice sheet (Hodgkinson *et al* 2000, 33).
- 2.1.3 Following the ending of glacial conditions, the Cumbrian climate experienced rapid warming during the early Holocene and the southern part of the county was colonised by successive expansions of birch, hazel, pine, oak, elm and alder. The southern part of Cumbria has yielded archaeological evidence for settlement from the Mesolithic period onwards (Wimble *et al* 2000). OA North previously surveyed the archaeology of the Lyth Valley wetlands as part of the English Heritage-funded North West Wetlands Survey (Hodgkinson *et al* 2000), and the occurrence of charcoal, as seen in pollen profiles from Little Hawes Water in North Lancashire, dated to around 7531–6646 cal BC (c 9200–8200 BP; Taylor *et al* 1994), may suggest human influence on the landscape associated with small-scale woodland clearance.
- 2.1.4 By 6000 cal BC, mixed woodland (comparable to that in much of lowland England) was present in Cumbria, and possible woodland clearance by burning is evident from around the beginning of the sixth millennium BC (Hodgkinson *et al* 2000, 107). Three pollen samples from a 2.30m-thick section of peat from Birkrigg Bog (SD 537 866), to the east of Levens, were interpreted as suggesting that organic sedimentation at this site began possibly during the late Mesolithic period (*op cit*, 291). The pollen record suggested a development of mixed woodland at the site, with some evidence for woodland disturbance. Another pollen study, from the Roudsea Wood National Nature Reserve (near to Cartmel and to the west of Sizergh), confirmed the presence of forests during this period, with no evidence of local forest disturbance until the demise of elm (Elm Decline, which is currently dated to c 4000 cal BC; Birks 1982). Diatom records and sedimentary responses to sea-level change during the last 8000 years at Roudsea Wood have also been compiled (Zong 1997; 1998). A summary of marine transgressions affecting the Kent and Levens estuaries has also been made (Hodgkinson *et al* 2000, 34).
- 2.1.5 Evidence of burning, associated with clearance, has been recorded close to the upland Langdale axe factories (OA North 2004), dating to 5968–5732 cal BC (6965±30BP; KIA23485). There is also some evidence recorded for Mesolithic clearance activity at White Moss, near Grasmere (Hodgkinson *et al* 2000, 316–17).

Such woodland clearances would have allowed the regeneration of plants and encouraged browsing animals (Hodgson and Brennand 2006, 25), therefore allowing humans to exercise a greater degree of control over the productivity of hunting grounds. Much of the artefactual evidence for the Mesolithic period in Cumbria derives from flint scatters found at coastal sites, with only one site having been identified in the central Lake District, comprising a small scatter of microliths from close to the Roman fort at Ambleside (*op cit*, 25–6).

- 2.1.6 ***The Neolithic Period (c 4,000 - 2500 BC)***: as with the Mesolithic period, palaeoecological information directly relevant to South Cumbria during the early Neolithic period is limited. There is some evidence for small-scale human activity from the coastal fringes of both High Furness (Smith 1958; 1959) and Low Furness (Oldfield and Statham 1963), suggested by the presence of open-ground indicators immediately prior to and after the Elm Decline (dated regionally to c 4034–3700 cal BC (5060±80 BP, Q-913; Hibbert *et al* 1971). The pattern of activity appears similar to that in the late Mesolithic period, with seemingly minor clearance events occurring, primarily to attract animals and improve browsing, but there is no evidence for early crop cultivation in this area. There thus appears to be some continuity between the late Mesolithic and early Neolithic periods in Cumbria, with typically Mesolithic tool types possibly continuing in use until the end of the fourth millennium BC (Cherry and Cherry 2002, 2–3).
- 2.1.7 Although Neolithic agricultural activity can be inferred from signals in pollen diagrams, and findspots of lithic and ceramic material, there is relatively little evidence for Neolithic settlement sites in Cumbria (Hodgson and Brennand 2006, 31–2). The Neolithic period did, however, see the introduction of monumental funerary and ritual architecture, with some of the earliest stone circles in Britain, including Castlerigg (near Keswick) and Swinside (on the south-west fells), being constructed in Cumbria (Burl 2000, 109).
- 2.1.8 The earliest evidence for human activity on the estate dates back to the Neolithic period and Bronze Age, the main concentration of prehistoric sites being on the south-facing hillside of Sizergh Fell (Fig 2). In the first years of the twentieth century, T McKenny Hughes excavated two mounds on Sizergh Fell (1904a; 1904b). The first of these mounds, Tumulus 1 (NTSMR 20052), was identified as containing a ‘Beaker’ burial of the Early Bronze Age (*Section 2.1.19*).
- 2.1.9 The second mound, Tumulus 2 (NTSMR 20053), was somewhat larger than Tumulus 1, having a diameter of c 17m, and took the form of a limestone cairn covering a central platform of slabs surrounded by a rubble bank (McKenny Hughes 1904b). The excavator recorded five burials, in small cairns or chambers associated with the central platform; however, no material culture was recorded. The funerary cairn was excavated again in 2003 by the University of Sheffield and the National Trust, as part of a research project concerned with the characterisation of landscape features and previously excavated cairns on the fell (Evans and Edmonds 2003). Re-examination of the skeletal material recovered from the cairn by McKenny Hughes revealed that there were in fact at least 13 individuals interred, of which eight were either pre-natal or up to six months of age (Start 2002). Radiocarbon dating was undertaken on several samples of the surviving skeletal material, and the process retrieved two successful dates for skeletal material dating to the Neolithic period and Iron Age (Evans and Edmonds 2007, 130).

- 2.1.10 A sequence of burial rites at this site has been suggested, with an origin in the Early Neolithic period as a place where the dead were laid to rest, possibly in an exposed state on the limestone pavement. Later, the site was reworked and bodies were placed on a boulder platform above the pavement, before being covered by a mound. The mound presumably then became a focus for later funerary activity, when Iron Age burials were inserted into it (*op cit*, 132).
- 2.1.11 The structural and depositional traditions identified in Sizergh Tumulus 2 share a number of common themes with two barrows excavated on Birkrigg Common on the Furness limestone, 25km to the south-west of Sizergh. Both of these cairns were multi-phased structures overlying earlier circular settings of stone, and both contained disarticulated human bones (Evans and Edmonds 2003).
- 2.1.12 Research undertaken by the University of Sheffield and the National Trust between 2002 and 2004 involved further investigation of the wider fellside. A trench to the south-west of Tumulus 1 revealed a small reworked and broken polished axe of Group VI (Langdale) tuff, which had been wedged into the limestone pavement. In addition, a polissoir (portable axe-polishing stone) was found inverted over a gryke in the limestone pavement, which contained a single Group VI flake (NTSMR 27783; Evans and Edmonds 2003, 2). Although polished stone axes can be difficult to date, the small reworked examples are relatively common in contexts such as henge ditches, and suggest that Sizergh Fell was a focus for activity during the Neolithic/Bronze Age transition (Evans and Edmonds 2003).
- 2.1.13 A perforated stone axe-hammer was found in Low Park Wood (NTSMR 24274), whilst a small bifacially worked fragment of white flint was found in a ploughed field at Rash Spring, Holeslack (NTSMR 181339), and several flint waste flakes were retrieved from the field south of Hare Park at Ash Bank (NTSMR 24247). Further afield, three flint scatters have been recorded less than 1.5km to the east of Sizergh. Two of these collections have been ascribed a late Mesolithic/Early Neolithic date (Cherry and Cherry 2002), and a third, smaller, scatter included a polished axe and Neolithic scrapers (Cherry and Cherry 1987, 254). All of these scatters have been found in association with barrows, with two from Levens Park. Significant numbers of chance finds of Neolithic date have been found in the area, including a number of polished and perforated stone axes, flint tools and a broken flint axe on Whitbarrow scar, to the west of Sizergh. A perforated stone axe-hammer (NWS 4089) was found on Helsington Moss, and a stone adze was found at Brigsteer (NWS 4070; Hodgkinson *et al* 2000, 26).
- 2.1.14 Further tantalising evidence for prehistoric activity includes a possible shell midden (NTSMR 24255), where a scatter of cockle shells has been disturbed and brought to the surface to the east of the gateway along the southern boundary of Chapel Wood. Shell middens tend to be found in coastal and estuarine contexts, and can be evidence of both food-processing sites and sometimes directly adjoined settlement sites, where they were effectively a rubbish dump (Thomas and Mannino 1998). However, it is also possible that the shell midden relates to a later period of activity.
- 2.1.15 ***The Bronze Age (c 2500-c700 BC)***: evidence for human impact on the vegetation in the early Bronze Age is found at Foulshaw Moss (to the south-west of Sizergh, adjacent to the Kent Estuary), where a small peak of cultural indicators and a fall in arboreal pollen probably represents a local clearance episode, which is dated by radiocarbon assay to 2570-2140 cal BC (3870±70 BP, CAR-544; Dresser 1985). These changes have been interpreted as being representative of a low level of

human activity in southern Cumbria (Hodgkinson *et al* 2000). Pollen evidence from early Bronze Age sites in the Lyth Valley has been interpreted as representing possible 'landnam' clearance events (which were short-duration events, with tree regeneration following abandonment, with little evidence for crop cultivation (Wimble 1986; Wells 1991)).

- 2.1.16 An episode of more extensive clearance, including some evidence for cereal cultivation, is described from both the Lyth Valley and the Duddon Estuary areas and has been dated to the middle to late Bronze Age, at 1592-1260 cal BC (3140 ± 70 BP, CAR-553), and 1158-820 cal BC (2805 ± 65 BP, CAR-598; Dresser 1985; Hodgkinson *et al* 2000, 27). At the close of the Bronze Age, regrowth of woodland resulted in a forested landscape around the South Cumbrian mosslands, with evidence of minor disturbance around *c* 800-500 cal BC (*c* 2500 BP), but no evidence of arable cultivation (Hodgkinson *et al* 2000). The most significant wetland archaeological structure recorded from South Cumbria is the corduroy trackway, stratigraphically positioned between two distinct peat types at Foulshaw Moss (SMR 2487; Hodgkinson *et al* 2000), and possibly of middle Bronze Age date (1592-1260 cal BC; 3140 ± 70 BP, CAR-553 (Dresser 1985; Hodgkinson *et al* 2000)). The construction of the trackway coincided with an increase in the number of clearance episodes in the woodland surrounding the mosses (Wells 1991; Hodgkinson *et al* 2000).
- 2.1.17 The limited environmental evidence that is presently available suggests that the pattern of clearances evident in the Neolithic period continued throughout the Bronze Age (Hodgson and Brennand 2006, 31). Upland marginal settlement in western Cumbria during the Bronze Age is suggested in many areas by the presence of burial mounds and cairnfields (Hodgkinson *et al* 2000, 76; Quartermaine and Leech 2012). In Cumbria, the most frequent form of prehistoric burial monument appears to have been the round cairn (*ibid*). The larger numbers of cairns reflect the ready availability of loose stone, and is therefore a local variant of the funerary mound style, in contrast to earthen tumuli, rather than being a culturally distinct class of monument (*ibid*). The few cairns from Cumbria that have been dated suggest construction during the Early Bronze Age (*ibid*), in common with the large number of cairns from south-west Scotland and the barrows of Cheshire (Hodgson and Brennand 2006, 43–4).
- 2.1.18 A scheduled round cairn (SM 35020) has been located to the east of Sizergh Park, and to the north of Berry Holme. It consists of an oval-shaped mound of stones covered with grass, measuring *c* 16m east/west by *c* 11m north/south, and is up to 1.3m high (English Heritage 2014b). A tanged dagger of presumably Bronze Age date was found in peat moss on Helsington Moss (NWS 4071, Hodgkinson *et al* 2000).
- 2.1.19 A beaker burial (NTSMR 20052) was retrieved from the excavations undertaken in 1902-3 of Tumulus 1 on Sizergh Fell (*Section 2.1.8*; McKenny Hughes 1904a, 71; Fell 1953, 1). Tumulus 1 was composed of a number of erratic stones arranged around the top of a small mound. Beneath this arrangement, placed in a limestone gryke or crevice and topped by a large boulder, were several sherds of a beaker, accompanied by a small amount of charcoal and burnt stones (McKenny Hughes 1904a).
- 2.1.20 Further sites on Sizergh Fell have previously been identified within the National Trust SMR as being possible prehistoric burial cairns (NTSMR 20057, NTSMR

20058), although these are now thought to be mis-identifications of natural mounds of geological origin (OA North 2011a). In fact, McKenny Hughes appears to have identified the only definite prehistoric burial sites on the fell.

- 2.1.21 A cairn (NTSMR 24242), to the south-west of Holeslack Spring, has a putative kerb, suggesting that it had a funerary function. Despite its prominence, however, there are no records of any antiquarian activity at this site. A circular structure and cairn (NTSMR 24282), to the south-east of Lane End Farm, comprises a small, circular bank, measuring 5.5 x 5m and 0.5m high; this is hollowed out in the middle, and has thus been interpreted as a robbed burial cairn. A kidney-shaped burnt mound (NTSMR 181421) survives in Sizergh Park, located on the edge of an area of soft, boggy, ground to the south-west of the ha-ha (*Section 2.1.42*) and was excavated as part of the present project (OA North 2014).
- 2.1.22 A copper-alloy fragment of an axe (NTSMR 181340) was found by a metal detectorist at Sizergh Castle. Only the lower part of the blade and cutting edge survive from the axe and there are insufficient remains to identify the precise type of axe or palstave. The findspot was recorded as being relatively near to the burnt mound, which was identified during the earlier landscape survey of the estate (OA North 2011a; NTSMR 181421).
- 2.1.23 **Iron Age Activity:** Guy Wimble carried out a detailed programme of pollen analysis and dating from peat deposits at Foulshaw Moss and Helsington Moss (Wimble *et al* 2000). The results of this work concluded that small-scale disturbance had occurred within the area throughout the prehistoric period; however, it was only in the late Iron Age that sustained, large clearances of woodland occurred (*ibid*). The first episode of extensive clearance, leading to prolonged open conditions recorded from South Cumbria, dates from *c* 700-400 cal BC (*c* 2400 BP) in the Duddon Valley and *c* 350-200 cal BC (2200 BP) in the Lyth Valley (Wells 1991); these clearances appear to be increasingly associated with cereal cultivation (Hodgkinson *et al* 2000). These data are comparable with pollen and plant macrofossil evidence from Fenton Cottage, situated in North Lancashire, across Morecambe Bay from the South Cumbrian mires, which has been interpreted as indicating a major deforestation signal beginning at the end of the first millennium BC (Middleton *et al* 1995).
- 2.1.24 The nature of the archaeological evidence demonstrates a marked change, from the relative abundance of archaeological material on the marginal land that typified the Middle Bronze Age, to a lower density of sites that were characterised by defended enclosures, and hillforts (Hodgson and Brennand 2006), such as Castle Crag near Haweswater, or the multivallate hillfort of Castlesteads (SM 23684), at Natland near Kendal. Castlesteads is *c* 2km to the east of Sizergh Park, on the summit of The Helm (Hodgson and Brennand 2006). It includes an enclosure *c* 39m long by 17m wide at the southern end, which widens to 25m at the northern end. Three artificially levelled areas within the enclosure are thought to be house platforms. To the north, the enclosure is defended by two earth and stone banks, both measuring up to 2m high and separated by an 8.5m-wide ditch. To the south, the enclosure is defended by a single earth and stone bank that is 6.5m wide and 1m high (English Heritage 2014c).
- 2.1.25 Overall, the period is not well represented within the archaeological record in the region due, at least in part, to the lack of identifiable material culture making it difficult to date sites (Hodgson and Brennand 2006, 52). The only clearly Iron Age

evidence is to the south Sizergh Park, but within Sizergh Estate (Fig 2), and comes from the radiocarbon dating of a sample of skeletal material recovered from Tumulus 2 on Sizergh Fell (NTSMR 20053; *Section 2.1.9*). The material presumably came from a later secondary deposit, where an interment was inserted into the structure of the mound. This appears to indicate that the mound had become the focus for later funerary activity (Evans and Edmonds 2007, 132). In addition, the enclosed settlement on Sizergh Fell cannot be discounted as being from a period earlier than Roman; other ‘scooped’ settlements in the region appear to have been occupied in the Iron Age (Quartermaine and Leech 2012).

- 2.1.26 **The Roman Period:** the vegetation in South Cumbria appears to have been relatively intensively exploited during the Roman period, with a decline in activity in the post-Roman period (Wimble *et al* 2000). Pollen diagrams from the Lyth and Duddon areas record the pre-Roman establishment of cereal cultivation in the area (Hodgkinson *et al* 2000). A reduction in activity in, and just after the end of, the Roman period is based on pollen diagrams showing high values for tree pollen and low non-arboreal values (*ibid*).
- 2.1.27 In the years following the Roman invasion of Britain in AD 43, the army advanced as far as a line between Wroxeter and Lincoln, but the frontier of the empire was not extended beyond this until the reign of Vespasian (AD 69-79). In the early AD 70s, the Romans, led by Petillius Cerialis, crushed the *Brigantes*, and thereafter developed a military infrastructure across the North West, based upon a north / south road between Carlisle and Chester (Shotter 1997). In *c* AD 90, a fort was built at Watercrock, Kendal (SM CU273), in the loop of the River Kent (Potter 1979), *c* 1.7km to the east-north-east of the north extent of the Sizergh Estate. The Roman road to Watercrock ran from the fort at Burrow in Lonsdale and passed some 3-4km to the east of Sizergh (Margary 1973).
- 2.1.28 The earliest evidence of pastoral agriculture on the estate dates from this period and is associated with an enclosed settlement near Lane End Farm on the western edge of Sizergh Fell (NTSMR 20050). The settlement enclosure, with its scooped interior, is typical of sites in the region that can on occasions be found in proximity to cairnfields or areas of field clearance (Quartermaine and Leech 2012). A mound containing a crouched inhumation was excavated on the west side of the settlement and finds associated with this burial, including a fibula, ring and melon bead, have been interpreted as being of Roman date. The sunken or scooped interiors of such enclosures might suggest that they were used for the wintering of stock, and that the repeated removal of manure-rich soil for deposition on farmland resulted in the dropping of the level of the interiors. While it is evident that there was occupation of the site during the Roman period, the possibility exists that the settlement had its origins in the Iron Age. The enclosed settlement was surveyed and described by the RCHME in 1936 (RCHME 1936).
- 2.1.29 A potential clearance cairnfield lay to the south of this settlement; however, evaluation revealed (Evans and Edmonds 2004), that the investigated ‘clearance cairns’ are probably of natural origin. The remaining sites dating to this period comprise findspots including several quernstone fragments, several Roman coins found in the seventeenth century, and some pottery identified through fieldwalking.
- 2.1.30 The remaining Romano-British sites within the Sizergh estate are findspots, and include a number of quernstones. An unfinished beehive quern (NTSMR 26406) was found to the south of Park Lodge Cottage; the upper part of a rotary quern was

discovered south-west of Holeslack Spring (NTSMR 20049); and a further quernstone (NTSMR 24260) was found near Low Sizergh Farm within a dry-stone wall. According to Thomas Machell (Ewbank 1963), several Roman coins (NTSMR 20056) were found at Sizergh Castle in the seventeenth century: '*Two silver coins were found on the South East side of the house [Sizergh Hall] while digging the garden about fifteen years ago [c 1677]*'. Putative Roman glass was also recovered during fieldwalking in fields on the west side of Nether Wells Farm (NTSMR 24248).

- 2.1.31 **The Early Medieval Period:** clearances characterised by reduction in ash and elm and a rise in values of non-arboreal pollen have been recorded at Foulshaw Moss and White Moss (in the Duddon Estuary), the latter being dated to cal AD 690-1000 (1160±60 BP, CAR-694; Dresser 1985). The peak of early medieval clearance was short-lived and regeneration occurred by approximately cal AD 1050-1270 (c 800-900 BP), although there are indications of some small but persistent clearings (Wells 1991; Hodgkinson *et al* 2000, 47).
- 2.1.32 As is the case throughout Cumbria, evidence for early medieval activity is extremely limited. Following the withdrawal of Roman governance in the early fifth century, it seems that the region fragmented into a number of small kingdoms. It is generally assumed that the British kingdom of Rheged was centred on the Solway, and may well have incorporated most or all of the Lake District (Higham 1986). The seventh century saw the expansion of the kingdom of Northumbria, which had incorporated the area of modern-day Cumbria by the middle of the century (Kirby 1962). In AD 685, King Ecgfrith of Northumbria made grants of land to St Cuthbert, offering territory in Cartmel and Carlisle (Crowe 1984). Northumbrian crosses have been found at Kendal and Heversham, but few settlements have been located to date, possibly because those on the fertile lowlands were destroyed by later ploughing (Rollinson 1996). Place-names indicated by the name elements of –ham and –ing(a)ton, such as Helsington and Heversham, may provide evidence of Anglian settlement in the region (*op cit*, 35). No early medieval sites have been identified from the study area.
- 2.1.33 Political destabilisation increased in the ninth century, seemingly in part linked to the pressure of Viking incursions. The place-name, 'Sizergh' is formed partly by the –erg element, which has been traditionally accepted as meaning a 'shieling or hill pasture' in Old Norse, and derives from Old Irish (Higham 1986, 38). It has been suggested that, since a great proportion of the place-names with this element are not found in upland contexts, the –erg element may reflect a pre-Conquest vaccary or stock farm, with special characteristics (Higham 2007, 7). They could indicate stock farms held of the lord under a system of *daer-stock* tenancy, which consisted of the lord giving cattle to the tenants (often his kinsman); the tenants paid a low rent and were subject to fines if they were neglectful. If the *daer-stock* tenants continued to hold the tenancy for three generations, they became *adscriptus*, or not bound to the soil of the lord, but were bound to receive the lord's stock to raise (*ibid*). The original demesne of Sizergh has always lain outside, and as a separate entity to, the manorial demesne and holdings of the rest of Helsington parish (Farrer and Curwen 1923), which could suggest such an original pattern of ownership as a stock farm.
- 2.1.34 **Medieval Period:** by late medieval times, the area of the Lyth and Duddon valleys had been extensively cleared and predominantly open conditions prevailed. In the Duddon area, between approximately cal AD 1000 and cal AD 1200, non-arboreal

pollen included a diversity of arable indicators such as hemp or hops (*Cannabis/Humulus*-types) (Hodgkinson *et al* 2000). The mosses of the Lyth Valley were intensively exploited, especially during the seventeenth and eighteenth centuries (*ibid*). Formerly extensive mires, such as Helsington Moss in the centre of the Lyth Valley, were by this date represented only by remnant peat (*ibid*).

- 2.1.35 In the tenth and eleventh centuries, the political situation in Cumbria was volatile, with the emergent kingdom of Strathclyde to the north and the growing power of England to the south competing for political control (Kirby 1962). The fringes of Morecambe Bay, including *Ken[t]dale*, *Lonsdale*, and *Furness*, were incorporated into England by the time of the Domesday Book (1086; Faull and Stinson 1986), which described the vill of Helsington as comprising the hamlets of Brathelaw (now Bradleyfield), Cunswick, Tranthwaite, Routheworth, Sizergh, part of Brigsteer, and the demesne of Greenriggs (*ibid*). Sizergh was within the Barony of *Kendale*, which was granted to Ivo de Taillebois by William II (1087-1100). There is some evidence to suggest that the newly created barony was formed out of a pre-Norman landholding, as the Norman motte was located within half a mile of the church of Kirkby Kendal, which had been a religious site, seemingly from at least the period of Northumbrian influence (Winchester 1987, 14-22; Rollinson 1996, 74).
- 2.1.36 Sizergh was granted by William de Lancaster II, Lord of Kendal, to Gervase Deincourt between 1175 and 1180 (Farrer and Curwen 1923, 130). It then passed down the Deincourt family until it was acquired by the Strickland family between 1251 and 1271, as a result of the marriage in 1239 of Elizabeth Deincourt to Sir William de Strikeland (National Trust 2001, 38 and 40). The Stricklands were probably of Norman descent and originally had lands in Castle Carrock, in the north of Cumberland, and from the late twelfth century had lands in Great Strickland. Sir Walter de Strikeland (the son of Elizabeth and William, died *c* 1343) was the first member of the family to make Sizergh his principal seat. After Walter served in the Scottish war of Edward I, he was rewarded in 1307 by the king with a charter of free warren, which gave him sole right to kill the game on his land. In 1336, Walter was authorised by Edward III to enclose his demesne lands at Sizergh forever and to make a park there. In 1361, for his zeal in service of the Crown, particularly in the French Wars, Sir Thomas de Strickland was given a licence by the king to empark his woods and lands in Helsington, Levens and Hackthorpe, containing 300 acres (Hornyold 1928, 235).
- 2.1.37 The earliest surviving element of Sizergh Castle (NTSMR 20051) is the solar tower, which was constructed in *c* 1310, by Walter's son, Sir Thomas (died 1376). Sizergh Castle, which is a Grade I Listed Building, consists of a hall range, the crenellated, four-storey high solar tower, and a service block; a detached kitchen and other outbuildings may also have existed (Goodall 2000).
- 2.1.38 The Stricklands had become one of the most important families in Westmorland by the mid-fourteenth century (Farrer and Curwen 1923), and the family continued to prosper during the sixteenth century, with important building works being carried out at Sizergh during the 1550s and 1560s. Work by Walter Strickland (1516-69) on the house included the construction of a first-floor hall over the medieval hall and other additions, so that it tripled in size and took on the appearance of a fashionable Elizabethan residence (National Trust 2001, 4 and 43; Goodall 2000).
- 2.1.39 *Medieval Deer Parks*: in 1336, Walter was authorised by Edward III to enclose his demesne lands at Sizergh forever and to make a park there. In 1361, for his zeal in

service of the crown, particularly in the French Wars, Sir Thomas de Strickland was given a licence by the king to empark his woods and lands in Helsington, Levens and Hackthorpe, containing 300 acres (Hornyold 1928).

- 2.1.40 The limits of the medieval Deer Park (Low Park Wood) at Sizergh were defined using evidence from the sixteenth-century map of Hawes Farm (CRO(K)WD/D; and shown on the interpolated medieval parkland plan (OA North 2011a). There is no surviving evidence for the wall surrounding the north side of the park, as marked on this map; however, a significant ditched and banked boundary was identified parallel, and on the internal side of, the current western boundary of Low Park Wood (NTSMR 181408; Fig 2). The earthwork consists of a large bank and internal ditch, measuring 150m long by, in total, 9.2m wide, with the ditch up to 1m deep. Such boundaries, of this size and with an internal bank, are typical of many surviving park enclosures found in Britain (Lasdun 1991). The deer park was presumably disparked for use as managed woodland in the seventeenth century, and is labelled as 'Sizergh Low Park' as opposed to the 'deer park' on a plan of 1798 (Hornyold-Strickland Family Archive 1798).
- 2.1.41 The limits of the medieval Brigsteer Deer Park, probably that emparked in *c* 1361 (*Section 2.1.39*), is likely to have included what is now referred to as Brigsteer Park Wood, Back Spring and Holeslack Spring Woods, and may have also included Park Moss. Archaeological evidence of the early use of the park is limited to a 190m-long section of large earthen lynchet, which follows the line of the parish boundary (and original demesne boundary) on the south side of the park (NTSMR 181492). The lynchet may have formed part of the park pale for Brigsteer Park. There may have been little need for a substantial bank at this location, as the lower side of the steep lynchet is internal to the park, and it is therefore more likely that a substantial wall was built on the top edge of the lynchet to prevent deer escaping. The line of Park End Lane, running through the park, probably formed an original longitudinal sub-division of the deer park and was a common lane for access between Cotes and Brigsteer. At the southern end of the park, on the end of the earthen lynchet, a gateway survives, which has been constructed of two large limestone gate piers and may once have held a large deer-proofed gate, forming an imposing entrance into the park.
- 2.1.42 The present deer park, centred on the castle, was referred to in *c* 1691-3 by the antiquary Thomas Machell, who described Sizergh Hall as being '*surrounded with woods with a Park at the door*' (Ewbank 1963). The ha-ha at the southern extent of the park was first depicted on an estate map of 1771, and this extends across the area of the kettle hole (Hornyold Archives 1771 estate map).

METHODOLOGY

3.1 PROJECT DESIGN

- 3.1.1 A project design (*Appendix 2*) was submitted in May 2012 by OA North in response to a brief prepared by Levens Local History Group and the National Trust (*Appendix 1*) for a programme of community archaeological work at Sizergh Castle designed to provide training for volunteers in a broad range of archaeological skills. These included topographical survey and palaeoenvironmental coring. The fieldwork was carried out in accordance with the project design. Following on from the fieldwork, a rapid palaeoenvironmental assessment (*Appendix 3*) was undertaken of peats beneath the burnt mound (presented in the earlier report (OA North 2014)) and that on the kettle hole (presented below). This present study was intended to examine the character of the kettle hole and its stratigraphic development, and to present an environmental context for the burnt mound.

3.2 TOPOGRAPHICAL SURVEY OF THE KETTLE HOLE AND BURNT MOUND

- 3.2.1 A detailed survey of the kettle hole was undertaken as part of the HLF project (Fig 4), and this provided an appropriate context for the excavation of the burnt mound and the subsequent coring of the kettle hole (Fig 5); the results were combined with the palaeoenvironmental survey in a CAD system. The detailed topographical survey of the environs of the kettle hole and burnt mound has been undertaken to Level 3 (as defined by English Heritage (Ainsworth *et al* 2007)).
- 3.2.2 The approach has been to combine a broad range of techniques to examine the archaeological and landscape context of the kettle hole and burnt mound, and the survey was undertaken, as far as possible, with volunteer support, to facilitate an effective training programme. In order to look at the wider context of the park, a series of LiDAR tiles was acquired, which were incorporated into the base survey (Fig 3). An instrument survey was undertaken by the project participants, who recorded the burnt mound and kettle hole. In addition, an aerial photogrammetric survey was undertaken of the burnt mound and surrounding kettle hole, and the combined data were then used to generate a detailed contour plan. In conjunction with a palaeoenvironmental survey of the mire, instrument transects were recorded through the mire (Fig 4), intended to provide profiles across the area of the kettle hole. The results of all the techniques were combined within a CAD system to provide an over-arching record of the physical landscape.
- 3.2.3 **Instrument Survey:** the instrument survey was intended primarily to serve as a training exercise for the project participants, so the technique was devised to be as easy to understand as possible, and to allow for visualisation of the data in the field. The technique adopted was to use a Leica 805 total station linked to a pen computer; this allowed the volunteers to understand the overall process, to undertake the survey work, and to see the results as they were being generated. The survey was based on survey control established using a Leica 1200 survey-grade GPS, which provided accuracies of 30mm with respect to the OS National Grid. The emphasis of the survey was to provide effective training and there was a regular change in

volunteer personnel in order to provide experience of archaeological survey to as many of the volunteers as possible.

- 3.2.4 The instrument survey provided a high density of survey points across the burnt mound in advance of the excavation, sufficient to provide a contour model of the burnt mound's topographical form (Plate 1; Fig 4). Similarly, a high density of points was generated across the upper surface of the kettle hole, to establish its profile, and also a series of transects was taken, with a special probe through the peat, to establish the depth of the kettle hole. Alongside the instrument survey, a gazetteer and photographic record were compiled.



Plate 1: Surveying the burnt mound with a total station

- 3.2.5 **Aerial Photography:** the excavation site and its immediate environs were also recorded by means of aerial photography, which, using specialist photogrammetric software, was able to create accurate three-dimensional models of the site and its topographical surface. This was achieved in two ways: by means of an extendable mast, which was appropriate for recording the burnt mound and the individual trenches; and a multi-rotor Unmanned Aerial Vehicle (UAV), which was used to record the burnt mound, as well as the area surrounding the kettle hole. With both techniques, a series of control targets was established over the ground, and these were clearly visible from the air, being located using the survey-grade GPS.
- 3.2.6 The photogrammetric processing was undertaken using Agisoft software, which provided detailed modelling using the overlap of up to 50 photographs, and created a very detailed DTM (Digital Terrain Model) across the site. The photographs could then be digitally draped over the model to create an accurate three-dimensional model of the ground surface. The primary output, however, was an accurate two-dimensional image, which could be used to generate accurate plans. In addition, a Digital Elevation Model (DEM) was output from Agisoft into a GIS and this was used to generate detailed contouring of the burnt mound and kettle hole.
- 3.2.7 **Final Draughted Output:** the data from the instrument survey were drawn up in the field as plots, and these were scanned and incorporated into the base CAD drawing.

The survey drawings were then incorporated, together with the current Ordnance Survey 1:10,000 mapping, historical first edition Ordnance Survey mapping, two 1m-resolution LiDAR tiles, the aerial photogrammetric plots from the UAV, and the contour data from the photogrammetric survey, the survey instrument profiles, the instrument surveyed trench locations and, finally, the geophysical survey plots. The combined, broad and distinct, and diverse, datasets have provided an insight in the archaeology of the wider landscape of the parkland.

3.3 ENVIRONMENTAL PROBING / CORING SURVEY

- 3.3.1 A process of environmental coring was also undertaken by experienced palynologists with the help of volunteers (Plate 2), which examined the palaeoecological potential of the area around the burnt mound. The aim of the survey was to reconstruct the extent of the former tarn / standing water and demonstrate the relationship between the burnt mound and the local water table and waterlogged soils. This was undertaken by two methods: probing; and transect coring (Plate 2). The former technique recorded the shape of the underlying basin and the second examined the stratigraphic development which resulted in the infilling of the tarn. The burnt mound was also subject to topographical survey (*Section 3.2*) and the results were then combined.



Plate 2: Participants using a gouge auger to core the kettle hole

- 3.3.2 **Stratigraphic Survey:** an auger survey was carried out using a hand-held gouge auger, which enabled the recovery of 1m-length cores, which were cleaned and recorded in the field. Cores were taken in two linear transects, one north to south (Fig 4) along the length of the basin, and one west to east across its width. Cores were taken at intervals of roughly every 4m; however, the actual interval was adjusted depending on the variability of the deposits and also as a result of restrictions, such as stones/boulders or areas of disturbance. The stratigraphic data were entered into a geological modelling program, Rockworks v 2004, which plots three-dimensional geo-referenced borehole logs. The plots generated by Rockworks were subsequently edited using CAD software, in order to produce the results visually (Fig 5).
- 3.3.3 The deepest deposits recorded in the kettle hole were sampled with a Russian auger, which allows for the recovery of cores suitable for radiocarbon dating and palynological studies. These cores were examined microscopically in the laboratory for plant macrofossils to confirm field identification, and some were assessed for pollen sampling. Larger samples from basal deposits were assessed for radiocarbon dating, to provide inception dates for the waterlogged deposits. By means of the dating of selected cores, the palaeoenvironmental methods were used to help establish the chronology of the mire and provide a chronological context for the burnt mound.

3.4 MACROFOSSIL AND PALYNOLOGICAL ASSESSMENT

- 3.4.1 **Macrofossil Assessment:** samples from the cores were assessed for plant remains and charcoal. At least ten litres of each sample were processed using hand flotation, where the flots were collected on a 250µm mesh, and air-dried if no waterlogged preservation was apparent. Any organic material still retained in the residue was also extracted and kept with the flot. Each flot was examined using a binocular microscope, during which any surviving charred plant remains (cpr) and waterlogged plant remains (wpr) were quantified, as was other material, such as charcoal, coal, heat-affected vesicular material (havm), bone, mortar, and ceramic building material (cbm). Preliminary seed/fruit identifications were made with the aid of standard texts (Cappers *et al* 2006; Stace 2010) and a reference collection. The presence of modern contaminants, such as roots, insect eggs and modern seeds, was also noted. Material was quantified on a scale of + to +++++, where + is rare (one to five items); ++ is frequent (less than 50 items); +++ is common (51–100 items); and +++++ is abundant (greater than 100 items).
- 3.4.2 The diversity and type of charcoal was also recorded and, if warranted, several fragments from the charcoal-rich samples were radially split for preliminary identification. Identifications were made with the aid of standard texts (Schweingruber 1990; Hather 2000) and a small reference collection. The suitability of any of the plant remains or charcoal for providing radiocarbon dating material was also noted.
- 3.4.3 **Palynological Assessment:** the 3.5m of sediments collected by the Russian auger were cleaned and described prior to sub-sampling for pollen. Given financial constraints, volumetric samples were taken from only nine sub-samples. The samples were prepared using a standard chemical procedure (method B of Berglund and Ralska-Jasiewiczowa 1986), using HCl, NaOH, sieving, HF, and Erdtman's

acetolysis, to remove carbonates, humic acids, particles greater than 170µm, silicates, and cellulose, respectively. The samples were then stained with safranin, dehydrated in tertiary butyl alcohol, and the residues mounted in 2000cs silicone oil. Slides were examined until at least 300 total land pollen taxa (including tree, shrub and herb pollen and fern spores) were counted. Pollen identification was made following the keys of Moore *et al* (1991), Faegri and Iversen (1989), and a small modern reference collection. Plant nomenclature follows Stace (2010). Charcoal particles greater than 5µm were recorded (Peglar 1993). Nomenclature for non-pollen palynomorphs (NPP) follows van Geel (1978). Of the nine sub-sample processed, the seven most promising were selected for pollen analysis; the remaining two contained little or no pollen. The pollen data are presented in tabular form, rather than graphically, as the sub-samples are representative of spot samples rather than of a continuous sequence.

3.5 ARCHIVE

- 3.5.1 A full professional archive has been compiled in accordance with the project design (*Appendix 2*), and with current IfA (2008) and English Heritage guidelines (English Heritage 2006). The paper and digital archive will be deposited with the Cumbria Record Office. The palaeoenvironmental material archive is typically archived in-house, but can be deposited with Kendal Museum if requested by the landowner and subject to agreement with the museum.

4. TOPOGRAPHICAL SURVEY

4.1 INTRODUCTION

- 4.1.1 The topographical survey of the Sizergh parkland incorporated a broad range of datasets from instrument survey, LiDAR, contours from aerial photogrammetry, and historical mapping. Together, this has given an insight into the archaeological resource within the area and the development of the landscape, and has provided the all-important context for the intrusive explorations that were also undertaken as part of the project (OA North 2014). The surveys recorded the burnt mound, along with the associated kettle hole, allowing an understanding of the development of the landscape across an extended period, potentially from the end of the last glaciation, through to the medieval period, demonstrating the complex development of this landscape.

4.2 THE KETTLE HOLE

- 4.2.1 A survey was undertaken of the kettle hole and the associated burnt mound. The results of the excavation of the burnt mound have been reported elsewhere (OA North 2014; *Section 7*). The kettle hole was subject to survey by instrument (Plate 3), and photogrammetry. The lithologies from a series of boreholes across the kettle hole have been recorded in two main transects, running approximately south-west/north-east (C1-C16) and south-east / north-west (C25-C20; Fig 4).



Plate 3: Contour survey in progress of the burnt mound and kettle hole

- 4.2.2 **Description:** the kettle hole was an irregularly shaped hollow, with, in places, clearly defined edges, and was, at its longest, 161m, and 97m at its widest (Fig 5). Typically, a kettle hole is formed when a large, surviving block of glacial ice remains after the retreat of the ice sheets, and over time the weight of the ice results in it sinking into soft clay ground. Then the ice eventually melts, leaving a small, steep-sided depression in the glacial boulder clay, which fills with water, and then ultimately peat (Thomas *et al* 2006). At nearby Sparrowmire Farm, Kendal, a burnt mound was also identified adjacent to a kettle hole, and the earliest levels within that kettle hole were dated, on the basis of pollen evidence, to the Late Devensian II period, typically *c* 10,000-9000 cal BC, and a radiocarbon date for the lowest peat deposits there was dated to 10,993-9979 cal BC (10,440±90 BP, AA-34507; Heawood and Huckerby 2002, 42).
- 4.2.3 The kettle hole was crossed by the ha-ha defining the southern edge of the deer park, and the ditch on the southern side has substantially drained the mire (OA North 2014). The burnt mound was situated in a narrow north-western arm of the depression, and close to the north-western end of the kettle hole. Its proximity to the mire, or what may at the time have been open water, would have provided an adequate water supply for the operations of the burnt mound, in addition to the numerous natural springs within the immediate area.
- 4.2.4 The borehole survey examined the waterlogged depression to the north of the ha-ha and discovered thin topsoil directly on top of the clay subsoil deposits, demonstrating that there was no evidence of any peat (C17; Figs 4 and 5). Although, topographically, this is part of the same, low-lying, and poorly drained depression, it was not part of the original kettle hole, which seems to have only been present to the south of the ha-ha. The western side of the kettle hole, and to the south of the burnt mound, was found to have moderately sloping shale margins and was characterised by a substantial number of limestone boulders. This perhaps reflects its proximity to a steep-sided scarp slope within the now adjacent woodlands. By contrast, the eastern side had a steeply sloping edge, such that there were deep deposits of peat close to this.

5. STRATIGRAPHIC SURVEY RESULTS

5.1 LITHOLOGY

5.1.1 Two detailed stratigraphic sections across the kettle hole were undertaken (Fig 4), the core, C23, taken by a Russian corer also being located on the east-west transect. This has been sub-sampled for palynology. The stratigraphic survey revealed a small ovoid basin that was up to 3m deep at its centre, which was extremely steep sided on all apart from the northern edge. The basin was cut into boulder clay, and the deepest deposits consisted of up to 2m of intercalated blue-grey clay and shell marl (or gyttja), overlain by up to 1.5m of peat (Table 1). Fine laminations of clay and marl were evident in some of the cores, and are likely to represent seasonal changes of lake deposition. Organic-rich deposits of shell marl with snail shells appear to be concentrated in the western half of the basin, which may be due to an increased organic accumulation, perhaps inwash, on this side (Fig 5). The fine shell marl and silty clay are characteristic types of deposit in kettle holes (Hodgkinson *et al* 2000) and provide a strong indicator that this feature was formed as a result of glacial action.

Depth (m)	Lithological description	Sub-sampling (m)
3.50-3.40	Very fine-grained blue silt with blue/grey clay	
3.40-3.05	Pale cream gritty clay / gyttja*	3.30
3.05-3.00	Disturbed sediments, mix of blue/grey clay and black silty organics, the latter possibly contamination	
3.00-2.91	Pale cream gyttja	
2.91-2.74	Blue/grey silty clay	2.80
2.74-2.55	Pale cream gyttja	
2.55-2.50	Mix of gyttja and black silty organics (contamination)	
2.50-2.00	Pale cream gyttja with black organics (contamination)	
2.00-1.86	Pale cream gyttja, gastropod-rich	
1.86-1.55	Variable lighter-darker gyttja, silt/clays, sand with common shell debris	1.65
1.55-1.50	Black silty peaty organics with shell debris	1.55
1.50-0.00	Peat, variably woody, humified, fibrous towards top	1.40, 1.10, 0.80, 0.55, 0.20

*Gyttja is a fine detrital mud, usually deposited in open freshwater conditions (Hodgkinson *et al* 2000).

Table 1: Details of lithology and sub-sampling for palynology

5.2 RADIOCARBON DATING

5.2.1 Four sub-samples were submitted to the Scottish Universities Environmental Research Centre (SUERC) for radiocarbon dating (Table 2). Each were dated on

both the humin and humic acid content (*Appendix 3*). The calibration plots are presented in *Appendix 4*.

Depth (m)	Lithology	Fraction	Date cal BC / AD 2 Sigma (95.4% confidence)	Date BP	Age	SUERC number	GU-lab number
0.08-0.10	peat	humin	347-538 cal AD	1625±35	late Roman - early medieval	53872	34300
0.08-0.10	peat	humic acid	588-677 cal AD	1396±35	early medieval	53873	34301
1.48-1.50	peat	humin	8452-8289 cal BC	9156±30	early Mesolithic	54704	34701
1.48-1.50	peat	humic acid	8289-8231 cal BC	9026±30	early Mesolithic	54703	34700

Table 2: Details of radiocarbon dates

- 5.2.2 The two dates are potentially very significant. The first was from a sample from the upper peat horizon, and provided a late Roman / early medieval date. While it is possible that peat stopped forming in the mire of the kettle hole at this date, it is more probable that the peat horizon has been truncated, possibly from peat cutting, at a much later date.
- 5.2.3 The second dated the lower horizon of the peat, and indicated an early Mesolithic origin. This is not, however, the base of the core, since beneath the peat is a further 1.9m of inorganic soils that could not be dated by radiocarbon assay. This would imply that the lowest deposits of the kettle hole were considerably earlier.

6. POLLEN ANALYSIS

6.1 INTRODUCTION

- 6.1.1 The core sampled for pollen (C23, Fig 5) is from the area within the kettle hole that contained the deepest peat deposits, as shown from the stratigraphic transect taken on a roughly north-west / south-east alignment (C20-C25; Fig 5) across the kettle hole.

6.2 RESULTS

- 6.2.1 The results of the pollen assessment are described from the base of the core upwards and are interpreted on a sample-by-sample basis. This reflects the fact that the few samples analysed represent snap-shots of the vegetation, rather than providing a continuous history of vegetation change, as would be available if detailed analysis was undertaken. The depths are measured from the surface.
- 6.2.2 **Sample at a depth of 2.80m:** pollen recovery was relatively sparse and comprises mainly the pollen of grasses (Poaceae) and sedges (Cyperaceae). Significant herb pollen includes that of meadow-rues (*Thalictrum*), mugworts (*Artemisia*) and docks/sorrels (*Rumex*). Tree and shrub pollen are limited to willow (*Salix*), pine (*Pinus*), hazel-type (*Corylus*-type) and birch (*Betula*). Single pollen grains of the aquatic plants pondweed (*Potamogeton*) and bog-bean (*Menyanthes*) are recorded. Non-pollen palynomorphs are dominated by the freshwater algal type, *Pediastrum* (HdV-760), with occurrences, also, of another freshwater alga, *Botryococcus* (HdV-766). High frequencies of micro-charcoal particles were also recorded.
- 6.2.3 Although only 50 pollen grains were counted at this level, non-pollen palynomorphs were present in relative abundance, and together enable a palaeoenvironmental interpretation. The data strongly indicate the presence of a body of freshwater, supporting aquatic or semi-aquatic plants such as pondweed and bog-bean (respectively), which may have been floating or have submerged leaves (Stace 2010). The pollen of grasses, sedges, meadow-rues and willow also support the presence of nearby wet or damp ground (*ibid*). The pollen of grasses and sedges may also represent possible tundra-like conditions following deglaciation, with the presence of more open-ground taxa of taller plants, such as mugworts, meadow-rues and docks/sorrels, which are typical of conditions as the soils became increasingly stable (Bridgland *et al* 2011).
- 6.2.4 The pollen data tentatively support the possibility that these deposits, between 2.80m and 3.50m in C23, date from the Late glacial age or Loch Lomond Stadial (the last Late glacial cold event), and that this supports the interpretation of the feature as a kettle hole. A possible Loch Lomond Stadial date (*c* 10,000-11,000 cal BC), at 2.80m, is cautiously based on the presence of pollen of pioneering plant species only (although the numbers counted are very low) and, importantly, the absence of birch, juniper (*Juniperus*) and meadowsweet (*Filipendula*), which are characteristic of the preceding Late glacial (Windermere) Interstadial (*c* 11,000-12,000 cal BC; *ibid*). A feature of the Loch Lomond Stadial is the presence of high frequencies of microscopic charcoal (*ibid*), as seen in the Sizergh assemblage, at this depth. It may be that aridity during the Stadial, as suggested by high values of

pollen of mugworts, may have promoted natural fires (Lowe *et al* 1994). It is presumed that the climatic conditions were too severe to have encouraged human activity during this period, although occupation of cave sites may have continued. Gale and Hunt (1985) described Palaeolithic flint artefacts in sediments with a Stadial pollen assemblage from Kirkhead Cave in Cumbria, although this pollen assemblage was also limited (Hodgkinson *et al* 2000). There are no radiocarbon dates available for the Sizergh kettle hole deposits at this depth, as the blue/grey silty clays do not contain sufficient organic material from which to retrieve plant macrofossils, or humin/humic fractions, for dating.

- 6.2.5 **Sample at a depth of 1.55-1.40m:** pollen recovery enabled identification of approximately 300 pollen grains per slide. The assemblages are overwhelmingly dominated by hazel-type pollen, with birch, pine, willow, elm (*Ulmus*) and oak (*Quercus*) also present. The herb assemblage is much reduced and is dominated by pollen of grasses and sedges, with evidence also for the presence of docks/sorrels and cinquefoils (*Potentilla*). Pollen of aquatic plants, such as yellow water-lilies (*Nuphar*) and white water-lilies (*Nymphaea*), are recorded within both sub-samples and, at 1.40m, pollen of spiked water-milfoil (*Myriophyllum spicatum*) is present, along with occurrences of the algal taxa *Pediastrum* (HdV-760) and *Botryococcus* (HdV-766). A few fern spores are present at 1.40m, including polypody ferns (*Polypodium*) and bracken (*Pteridium*). Micro-charcoal counts are very low.
- 6.2.6 The lithologies suggest that peat deposition was initiated at this depth as the kettle hole began to fill with organic sediments. The opening of the Holocene in the North West was marked by rapid amelioration of the climate and the development of shrubby mixed woodland on newly forming soils. Locally, the presence of pollen of aquatic plants and freshwater algae suggests that there was still some open freshwater at the site. The pollen assemblages also suggest a local palaeoenvironment covered by dense hazel-type and birch shrub, with evidence for possible regionally developed stands of deciduous trees such as elm and oak. Pine pollen is also present, but this can only be placed in the surrounding region as pine pollen can carry a great distance on the wind, and so its presence at Sizergh does not necessarily indicate pine trees in the local environs (Stace 2010). There is very little evidence for human exploitation of the landscape at this time, as counts for microscopic charcoal are very low and there is no evidence for clearance activity (within either of the two sub-samples analysed). The rise of hazel pollen and the absence of alder pollen form a marker event within the early part of the Holocene; hazel becomes dominant after c 9000-8000 cal BC (c 9500-9000 BP; Hodgkinson *et al* 2000). In the North West, pine then succeeded in dominance, followed by oak, elm, and finally alder (*ibid*). Mixed woodlands of the early Mesolithic period in Cumbria comprised largely hazel, elm and oak, with pine locally important (Quartermaine and Leech 2012). A radiocarbon date (based on the humic acid fraction) of 8289-8231 cal BC (9026±30 BP; SUERC 54703) from the base of the core, supports an early Mesolithic age at 1.48-1.50m (Table 2).
- 6.2.7 **Sample at a depth of 1.10–0.80m:** insufficient pollen was recorded in the sub-sample at this depth, to allow any palaeoenvironmental interpretation.
- 6.2.8 **Sample at a depth of 0.55m:** the pollen assemblage demonstrated abundant woodland types, including pine as the dominant species, followed by hazel-type, oak, birch, and very low counts for elm and alder (*Alnus*). Grass and sedge pollen comprise the most common herbs recorded, with a presence also of devil's bit

scabious (*Succisa pratensis*), ribwort plantain (*Plantago lanceolata*), meadowsweet (*Filipendula*), pollen of the goosefoot family (Amaranthaceae, a large family comprising plants such as fat-hen, good-king Henry and red goosefoot) and of the carrot family (Apiaceae, also a large family comprising, for example, pennyworts, burnet-saxifrages and water-dropworts). Monolete fern spores (Pterospida) are abundantly recorded and spores of bracken and polypody ferns are also present. Non-pollen palynomorphs include occurrences of the algal types *Zygnema* (HdV-58), *Spirogyra* (HdV-130) and *Closterium* (HdV-60). Micro-charcoal particles are present in high frequencies.

- 6.2.9 The palynological data suggest a landscape comprising pine, oak and birch woodland, with hazel-type scrub. Open areas or clearings in the woodland are apparent from relatively high counts for pollen of grasses and sedges, and a variety of other herb taxa, which together suggest a range of habitats including waste, wet or marshy ground, wood-borders and grassland. The overwhelming abundance of fern spores also testifies to the presence of open areas, since these are rapidly colonised by ferns (Stace 2010). That wet areas still existed locally may be inferred from the non-pollen palynomorphic record, which suggests the presence of algae typical of shallow, possibly stagnant, water conditions (van Geel 1978).
- 6.2.10 The striking difference between this pollen assemblage and that at 1.40m is that the values for hazel-type pollen are greatly reduced, but those for pine show an obvious increase. Without a clear palynological record between 1.40m and 0.55m, however, it is not possible to interpret the vegetational history that led to the assemblage obtained at 0.55m. The pollen assemblage at 0.55m does, though, provide evidence for clearance, both from the micro-charcoal record and from counts for pollen of grasses/sedges and fern spores, suggesting that human activity was occurring at or near the site. It is likely that people used the area to collect seeds and nuts, potentially to hunt and possibly to graze animals, and that they utilised fire in the pursuit of these activities, for example, to create open areas within the woodlands.
- 6.2.11 **Sample at a depth of 0.20m:** a significant change in the component of the woodland vegetation is clear from the pollen preserved in this sample. Pollen of birch and pine is drastically reduced, whereas that for hazel-type, and in particular alder, is increased. There is also an increase in pollen of heather (*Calluna*). Pollen of herbs is more diverse than previously seen and grass pollen is especially abundant; pollen of cinquefoils, meadowsweet, dandelion-type (*Taraxacum*-type), devil's bit scabious, ribwort plantain, the goosefoot family and carrot family, as well as the pea family (Fabaceae, including, for example, vetches, bird's-foot-trefoils and everlasting sweet-peas), is recorded. Fern spores are commonly present and bog moss (*Sphagnum*) spores are also recorded in relatively high numbers. Non-pollen palynomorphs include the fungal spores *Glomus* (HdV-207), *Gelasinospora* (HdV-1) and *Sordaria* (HdV-55A/B). Micro-charcoal particles are present in high frequencies.
- 6.2.12 The pollen data suggest that hazel-type scrub dominated the palaeoenvironment, with regional stands of oak and elm, and much-reduced birch and pine. Given the quite large sampling gap, it may be that the pollen of the various tree types are recording the regeneration of trees, rather than a natural arboreal succession. High counts for grass pollen suggest areas of open ground, with pollen of meadowsweet, dandelion-type, devil's bit scabious, and cinquefoils suggesting a possible development of meadows, or areas of rough pastureland or wayside areas (Stace

2010). The record of wood vetch (*Vicia sylvatica*) suggests open woods or wood borders (*ibid*). The rise of the pollen of heather, together with sedges and bracken, suggests the possible advance of acid moorland or heathland. The micro-charcoal data suggest that the landscape may have been used in a similar way to that seen at 0.55m, in that fires may have been deliberately used, for example, to clear areas of hazel scrub. The occurrence of rare fungal spores such as *Gelasinospora* (HdV-1) may support possible fire activity (van Geel 1978), whereas *Glomus* (HdV-207) suggests possible disturbed ground and *Sordaria* (HdV-55A/B) may support animal grazing. A radiocarbon date (humic acid fraction) indicates an early medieval date of cal AD 588-677 (1396±35 BP; SUERC 53873) at 0.08-0.10m (Table 2). Given the increase of heather pollen, this would be consistent with the development and spread of acid moorland at the site; however, this relatively early date at the upper level of the peat would suggest that the peat has been severely truncated.

7. SUMMARY RESULTS: BURNT MOUND

7.1 INTRODUCTION

- 7.1.1 The burnt mound is situated towards the edge of an area of soft, churned-up boggy ground to the south-west of the ha-ha defining the park (Fig 3), and is close to the site of at least two natural springs. The feature has a classic kidney shape, with a depression or concavity on the south-west side, and stone exposed on the upper surface has the appearance of having been burnt.
- 7.1.2 Excavation demonstrated that a wooden trough (1.44 x 1.05m in size) had been placed into a peat matrix, within a shallow north-east/south-west-aligned cut (Plate 4). Fire-cracked stone was then deposited, creating a typical kidney-shaped mound, *c* 0.4m high, 7.55m long and 6.3m wide, partially surrounding the trough. The burnt and fractured stones are probably glacial erratics of Silurian slates and shales that have been collected from the local area, in preference to the underlying limestone. A more charcoal-rich and less stony layer was deposited on top of the earlier stone mound and over the fill of the trough; above this was another dump of burnt stone, 5-50mm in size, which sealed the top of the mound (Plate 5).



Plate 4: The wooden trough within the burnt mound, with a stone retaining its north-western side



Plate 5: Section through the burnt mound

7.2 NATIONAL CONTEXT

- 7.2.1 Nationally, burnt mounds are a widely recorded monument type, although, morphologically, there is considerable variance, in both size and form, of those identified in the county, and in the country at large (Nixon 1990; Ehrenberg 1991; Banks 1998-9; Hodgson and Brennand 2007). To date, sites of this kind have been rarely excavated in Cumbria, with only seven existing at the time of writing: Drigg (Brown 2014); Garlands Hospital, Carlisle (LUAU 1996; Neighbour and Johnson 2005); Sparrowmire Farm, Kendal (Heawood and Huckerby 2002); Aldingham, near Barrow in Furness (Morecambe Bay Archaeological Society 2006); Stainton West, near Carlisle, where four or five mounds were clustered in a small area (OA North 2011b); and Eastwaite Farm, Nether Wasdale (OA North forthcoming). However, growing numbers are being detected through survey (Hodgson and Brennand 2006), often within uplands, near cairnfields, or other areas of Bronze Age activity, and they may actually be relatively common within the region; as such, their investigation has been identified as a research priority (Hodgson and Brennand 2007).

7.3 CHRONOLOGY

- 7.3.1 The radiocarbon dates from the burnt mound at Sizergh seem to indicate extended or multiple phases of use, over several hundred years. The earliest date was from the peat immediately beneath the burnt mound, which provided a date of 2575-2460 cal BC (3980±29 BP; SUERC-50357). This and a radiocarbon date from the backfill of the trough in the burnt mound (2456-2145 cal BC (3871±30 BP; SUERC-49748)), closely agree with each other and suggest that the earliest phase of the mound had a short period of usage, at the Neolithic / Bronze Age transition (OA North 2014). A third radiocarbon date, from material from the uppermost part of the mound sequence, dates to 2200-1981 cal BC (3871±30 BP; SUERC-49748),

towards the end of the early Bronze Age. In comparison with other Cumbrian burnt mounds, the Sizergh example is of almost identical radiocarbon age to that at Drigg, which was in use at 2430-2210 cal BC (3940 ± 50 BP; GU-5890), and it is very close in age to both Burnt Mound 6 at Stainton West (2570-2290 cal BC (3891 ± 26 BP; SUERC-42017) and the earliest date from the burnt mound at Garlands Hospital (2580-2200 cal BC (3910 ± 60 BP; GU-8009)). These are all fairly early in the sequence of Cumbrian burnt mounds, which as a group have been radiocarbon dated at Stainton West, as having a *c* 1400-year currency, between 2890 cal BC (4178 ± 26 BP; SUERC-42008) and 1430 cal BC (3240 ± 26 BP; SUERC-42014), with the radiocarbon date of 1408-1121 cal BC (3020 ± 50 BP; AA-34791) from Sparrowmire Farm possibly suggesting that they remained in use into the later Bronze Age.

- 7.3.2 The date from the upper level of the Sizergh burnt mound was up to 200 years later than the date for the filling of the trough, which raises a number of questions. Firstly, does this later date indicate that the burnt mound had an extended period of use, or does it demonstrate a later reuse? Secondly, if the mound was being built up some time after the trough was filled, how was the mound being operated, and could there be a second trough that has yet to be revealed?

8. DISCUSSION

8.1 THE SEDIMENT SEQUENCE

- 8.1.1 Five of the seven samples that were analysed for palynology provide snap-shots of the changing palaeoenvironment through a 3.5m-thick deposit from the Sizergh kettle hole. The succession of tree pollen through the pollen profile is generally used to chart vegetational changes at a site (Berglund and Ralska-Jasiewiczowa 1986), but it is difficult to obtain any reliability for the kettle hole, as it was possible to analyse only a few elements of the core. The sample interval therefore had to be too large for successional interpretation. Two broad interpretations must thus be given equal weight: samples analysed may either reflect the natural vegetation succession, or could equally represent secondary regrowth or regeneration of trees.
- 8.1.2 Pollen assemblages from the deepest sample, at 2.80m, tentatively suggest a possible Late glacial, Loch Lomond Stadial (*Section 6.2.4*), age at this depth, but no radiocarbon dating was feasible to confirm this. The sediment sequence recorded is similar to that from other small lake basins in Cumbria, which have formed in kettle holes. The sediments filling the kettle hole at Sparrowmire Farm, Kendal (Heawood and Huckerby 2002), for example, like Sizergh, consisted of up to 1.35m of peat, overlying a minerogenic deposit of shell marl and silty grey clay (with pebbles) that was roughly 0.75m in depth. Although the minerogenic deposits were much shallower at Sparrowmire (0.75m as opposed to over 2m at Sizergh), the date of the base of the overlying peat was up to 1500 years older: 10,933-9979 cal BC (10,440±90 BP; AA-34507 (GU-8435)). It appears that peat started to develop much earlier in the kettle hole at Sparrowmire, possibly due to differences in the morphology of the basin, and perhaps also to local climatic and groundwater conditions. The shift from minerogenic deposition to organic accumulation in the kettle hole reflects the evolution of the lake from when it was initially surrounded by bare ground, with no vegetation or soil (the shell marls and clays), through the development of plant communities and soils (organic marl), to the development of basin mires (peat) (Thomas *et al* 2006).
- 8.1.3 The dominance of hazel-type vegetation at 1.55-1.40m may be indicative of early Mesolithic woodland, of a type that has previously been described at various Cumbrian sites (Hodgkinson *et al* 2000; Quartermaine and Leech 2012). The pollen assemblages from these two sub-samples do not provide any evidence to support human exploitation of the landscape, for example, clearance or burning activities, at this time. An early Mesolithic age is supported by radiocarbon dates for both the humic and humin fractions at 1.48-1.50m (Table 2).
- 8.1.4 The pollen assemblage at the depth of 0.55m is difficult to place in a vegetational succession, due to the paucity of sub-samples (including two non-productive sub-samples) between 1.10m and 0.55m. However, the assemblage at 0.55m may be interpreted as showing some evidence for human exploitation of the landscape at this time, including the use of fire, which may have been used both to manage animals and to create openings in the woodland canopy.
- 8.1.5 Pollen from the topmost sample of Core 23, at 0.20m, shows that alder had colonised the area, but that hazel-type also remained a common component of the vegetation, and that large, open grassy areas existed at, or adjacent to, the site.

These may have been used for pasturing animals. No cereal-type pollen has been identified, suggesting that the area surrounding the site was probably not used for arable cultivation. The initiation of a transformation of the landscape from woodland to acid moorland is marked by a rise in heather pollen, a feature that is characteristic of vegetational changes seen during the medieval period (Hodgkinson *et al* 2000). A radiocarbon date (humic acid fraction) at 0.08-0.10m provides an early medieval age of cal AD 588-677 (1396±35 BP, SUERC 53873) at the top of the core.

- 8.1.6 It is interesting to note that the uppermost dated peat sample at Sparrowmire, taken at a depth of 0.315-0.325m, produced a Mesolithic date of 4667-4350 cal BC (5645±60 BP; AA-34508 (GU-8434)), which is significantly earlier than the age of the top of the peat from the Sizergh kettle hole. This suggests that either the peat ceased to develop at a much earlier time at Sparrowmire, or that the peat had been severely truncated there, perhaps as a result of peat-cutting.
- 8.1.7 **Comparison of Core 23 and the Sediment Sequence underneath the Burnt Mound:** a snap-shot of the regional and local vegetation may also be gleaned from an assessment of the pollen from beneath the burnt mound, which was situated approximately 200m to the north-west of core C23 (Figs 4 and 5). The stratigraphy of the kettle hole deposits underneath the burnt mound consists of roughly 1.30m of wood peat, overlying nearly 2.5m of intercalated shell marl and silty grey clay. In the horizon immediately beneath the burnt mound, hazel-type pollen is predominant, which provides evidence for mixed woodland, either locally or regionally (the pollen derived either from the local environs or could have been carried on the wind from a much greater distance). Grass and sedge pollen provide some evidence for the presence of small open areas, which could have been opened up as a result of animal browsing/trampling, or have been natural areas on the edges of woodland. Ferns may have proliferated in these open, possibly cleared, areas. The dated peat samples from immediately below the burnt mound (both humic and humin fractions) closely match the dates obtained from charcoal from the base of the mound (OA North 2014). For instance, a date of 2565-2460 cal BC (3980±29 BP; SUERC 50357; GU 32733) has been obtained from the humic fraction, and one of 2565-2346 cal BC (3954±29 BP; SUERC 50358; GU 32734) from the humin fraction (*ibid*) from the peat, whilst the lower charcoal-rich deposits of the burnt mound have provided a date of 2466-2212 cal BC (3871±30 BP; SUERC 49748; GU 32313; OA North 2014), indicating activity in the early Bronze Age.
- 8.1.8 However, although the surface of the peat underlying the burnt mound is at a similar elevation to that elsewhere in the kettle hole (46.77m OD, as opposed to 46.95m OD at Core 23), this Bronze Age date for the peat underlying the burnt mound is over 2000 years older than that obtained from the peat sample from near the top of Core 23, in the centre of the kettle hole. This gave dates suggesting that this formed in the early medieval period (Table 2).
- 8.1.9 These dates suggest that, although peat ceased to develop directly at the site of the burnt mound, it continued to develop within the centre of the kettle hole. Apart from a slightly drier peaty layer (recorded as peaty topsoil in the lithology), which is to be expected near the surface of a mire, there was no obvious stratigraphic change or break in the peat deposits within the kettle hole. It is possible, however, that there has been a cessation in peat development, which may have occurred possibly between the early Bronze Age and the early medieval period, although further

dating of the peat in both the burnt mound and the kettle hole would be necessary to establish the precise stratigraphical relationship. Alternatively, peat may have continued to develop away from the burnt mound, which was cut or somehow truncated after the early medieval period.

8.1.10 Although the pollen study at Sizergh was limited in its scope, a change in the vegetation surrounding the site is recorded between 0.55m and 0.20m in Core 23, and also between the development of peat **3007**, below the burnt mound, and the peaty topsoil (**3002**) overlying the burnt mound. At both sites, the pollen data suggest a potential decline in woodland and the concomitant spread of acid moorland, which, through stratigraphic association, occurred after the burnt mound had fallen out of use, the radiocarbon dates indicating perhaps two millennia later. However, as the pollen data from the burnt mound only represent an assessment, without the benefit of a suite of radiocarbon dates, a direct correlation between the two stratigraphical units must remain uncertain.

8.1.11 In summary, the pollen and the stratigraphic data:

- support the interpretation of the basin as a kettle hole;
- pollen data from the lowest sample, at a depth of 2.80m, suggest aquatic or semi-aquatic conditions, with a possible tundra-like landscape. There was a correlation with Sparrowmire, suggesting a possible Late glacial date (*Sections 1.3.1, 7.2.1*);
- samples at depths of 1.55m and 1.40m, dated to the early Mesolithic period (*Section 6.2.5*), indicated a palaeoenvironment of dense hazel-type scrub and mixed woodland, with a locally aquatic environment;
- the pollen assemblage from a depth of 0.55m in the kettle hole suggests that a wooded landscape, comprising predominantly pine, oak and birch, existed at or near the site, with cleared areas providing some evidence for possible human activity. The vegetation change recorded at this depth, however, is undated;
- the peat sequences directly beneath the burnt mound reveal a dominance of hazel-type scrub and mixed woodland, with evidence for some open areas in the environment. This was dated to the early Bronze Age (*Section 8.1.7*);
- the uppermost sample from the kettle hole, at a depth of 0.20m, shows alder was the dominant woodland type, with evidence also for the presence of possible acid moorland environments. A sample of peat taken at *c* 0.10m above this (*Section 6.2.12*) was dated to the early medieval period.

8.2 CONCLUSION

8.2.1 The stratigraphic survey, pollen study, and radiocarbon dating carried out in the area of the burnt mound at Sizergh all indicate the presence of a small basin mire, which has developed in a kettle hole. The kettle hole contains a typical Late glacial and early Holocene sequence of shell marls, clays and peat, containing a pollen record which may date back to the Loch Lomond Stadial (*c* 10,000-11,000 cal BC). The amelioration in climate during the early Holocene led to the eventual development of vegetation and mixed woodland. Successional changes in the basin culminated in the development of mire vegetation and peat development from

around 8200 cal BC. While there is evidence that the peat directly underlying the burnt mound formed in the early Bronze Age, a date from near the top of the peat in the centre of the kettle hole, at roughly the same elevation, produced an early medieval (humic acid) date (Table 2), and suggests a truncation episode. In any case, it is probable that further truncation of the peat occurred subsequent to the early medieval period. The stratigraphic sequence would require detailed palynological work, accompanied by additional dating, in order to answer the questions raised by this study.

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APPENDIX 1: PROJECT BRIEF

Invitation to Tender: Provision of archaeological support and community training services at Sizergh Castle, Cumbria

Introduction

Levens Local History Group and the National Trust jointly invite tenders to deliver various archaeological themed services as part of a Heritage Lottery Funded community project at Sizergh Castle, property located 3 miles south of Kendal. These services include on-site supervision and training for volunteers in field archaeology, topographic and geophysical survey, environmental sampling, along with off-site archaeological skills training workshops for volunteers and the creation of information packs for schools.

The community project at Sizergh Castle will focus on two archaeological sites discovered and recorded during the recent Historic Landscape Survey of the National Trust's Sizergh Estate undertaken by Oxford Archaeology North and volunteers from Levens Local History Group and Sizergh Castle in 2009 (OAN 2011b). The sites to be investigated by the project include a small burnt mound and a putative deer park boundary located in the southern eastern quarter of Sizergh Park.

Given the intention to undertake the proposed program of field archaeology as part of a community project, we feel it prudent to have a number of other archaeological themed activities on 'stand by' in case it proves impossible to access these sites for whatever reason (the burnt mound might be difficult to investigate after a period of prolonged wet weather). The 'stand by' activities include the survey of the substantial seventeenth century barn associated with the former High Sizergh Farm, along with survey of a possible prehistoric funerary mound in Brigsteer Park.

The proposed program of field archaeology will form the centrepiece of an archaeological event taking place in July 2013 advertised as part of the Festival of British Archaeology and witnessed by the visitors to the National Trust's Sizergh Castle. To help visitors to Sizergh Castle to engage with the event the contractor will be required to deliver various interactive activities aimed at families including hands-on finds handling and geophysical survey. The contractor will also be required to produce interpretation suitable for outdoor display on the project themes and archaeological techniques to inform the casual visitor.

In addition to the on-site archaeological works the contractor will be required to design and deliver a set of archaeological skills training workshops at a local venue in advance of the on-site works. The aim of these workshops will be to introduce project participants without prior experience of archaeology to the main techniques used in field archaeology. The contractor will also be required to deliver a presentation on the project at a local venue at the end of the project.

The contractor shall also be required to undertake any post excavation works required and create an appropriate site archive. A full site report will be required, along with a popular report produced which as a brighter 'designed' appearance which includes a well illustrated summary of the results written using simple language that can be passed on to all project participants.

Location

Sizergh Estate is situated c 4km south-west of Kendal in a predominantly rural and agricultural setting (SD 4938 8798 approx centre). The 633ha (6.3 sq.km.) estate consists of pasture, woodland and parkland situated in rolling countryside sandwiched between the River Kent and the Lyth Valley. It is skirted by the A591 on the east side and lies between the villages of Brigsteer and Levens.

The proposed community themed archaeology project at Sizergh Castle will take place within the bounds of Sizergh Park, an area of grazed pasture immediately in front of Sizergh Castle. Sizergh Park is outside the pay barrier for regular visits to Sizergh Castle, with free public access all year round.

All regular visitors to Sizergh Castle arrive via Sizergh Park, which means that an activity taking place within its boundaries would be visible and easily assessable for the 200,000 annual visitors. This makes Sizergh Park an ideal location to stage a community project that aims to encourage local people to participate and engage visitors to the property.

If it became necessary to 'shift' the focus of the project onto the 'stand by' activities as a result of prolonged wet weather, the focus would move closer to Sizergh Castle and within the current pay barrier, in order to access the seventeenth century barn associated with the former High Sizergh Farm, as well as into neighbouring Brigsteer Park to access the possible prehistoric funerary mound.

Archaeological background

The recent Historic Landscape Survey of the Sizergh Estate (OAN 2011b) identified a rich archaeological resource within the estate that dates back to the Neolithic and Bronze Age periods. Notably, there are at least two funerary cairns on Sizergh Fell, along with a seemingly ritual deposition of Neolithic axe fragments found nearby within the grykes of limestone pavement. Other putative prehistoric funerary mounds exist on the higher ground within the former estate. A small Bronze Age burnt mound was also identified in Sizergh Park.

A Romano – British enclosed settlement site exists on land near Lane End Farm on the western edge of Sizergh Fell, which has a scooped interior, and contained burials of Roman date. There were also a number of finds spots dating to this period, including quernstone fragments, several Roman coins and some pottery.

Sizergh was granted by William de Lancaster II, Lord of Kendal, to Gervase Deincourt between 1175 and 1180. It passed down the Deincourt family until it was acquired by the Strickland family between 1251 and 1271, as a result of the marriage of Elizabeth Deincourt and Sir William Strickland in 1239. Sir Walter de Strickland was the first member of the family to make Sizergh his principal seat and the earliest substantial house at Sizergh was probably constructed in c 1310.

In 1336, Walter was authorised by Edward III to enclose his demesne lands at Sizergh forever and to make a park there. The limits of Sizergh Park (now Low Park Wood) were defined using a sixteenth century map of Hawes Farm, whilst a section of the western boundary of the former deer park was found to survive as a large bank and ditch. This Medieval deer park was disparked in the seventeenth to eighteenth century and a new landscape park was established around the castle which afterwards became known as Sizergh Park. .

Evidence survives for another Medieval deer park on the estate at Brigsteer. This was probably emparked c 1361, and a boundary consisting of a 190m long section of earthen lynchet survives on its southern end, which follows the line of the parish boundary between Helsington and Levens. The line of Park End Lane running through the park probably may have formed originally a longitudinal sub-division of the deer park, which was later rationalised and reduced, possibly in the early 1700s, shrinking in size to only contain the land on the east of Park End Lane with a large park wall around it.

The first available map showing the gardens is from 1771 and depicts a terrace to the east of the house, two areas marked 'gardens' to the south of the terrace, and an extensive deer park surrounding the terrace and gardens. Between 1771 and 1827 the gardens to the north of the house had almost doubled in extent. The kitchen garden was extended and a probable ornamental pond was constructed in the wooded area to the south. A garden was constructed to the south of the main lawn and was linked to it by an urn-surmounted gateway.

Modernisation works were undertaken to the house and gardens at Sizergh by Sir Gerald Strickland, using the Kendal architect JF Curwen, between 1897 and 1902, which included a new drive, known as the Middle Drive, which ran west from the main Lancaster to Kendal road to the house, with a long triangular pond created downslope of the drive. A series of new gardens were commissioned by Sir Gerald Strickland's second wife, Margaret Hulton between 1926 and 1928.

In 1950 Henry and the Hon. Mary Hornyold-Strickland and their son Thomas donated the house, contents and adjoining lands to the National Trust. In the sixty years of National Trust ownership many changes have taken place on the estate, in particular to restore and maintain the house and gardens and provide more comfortable access to the general public. The rock garden was restored in the 1980s, the Dutch garden was recreated in a simpler form in 1984 and landscaping was undertaken around the lake in 1994.

Relevant designations

The proposed community project at Sizergh Castle will take place within Sizergh Park which is a Grade II* Registered Park and Garden (GD 1849).

The seventeenth century barn located a short distance to the south west of Sizergh Castle is a Grade II Listed Building (LBS 75287).

Project aims

Our aim is to provide a set of meaningful and memorable learning experiences for all participants in the proposed archaeology themed community project, while also offering an enjoyable learning opportunity for those who simply witness or encounter the archaeological events as a visitor to Sizergh Castle.

A detailed break down and description of the project aims is contained within the application form recently submitted to the Heritage Lottery Fund. The contractor is requested to read this and develop a good understanding of the project aims before producing a tender.

Description of work to be undertaken

The contractor will be required to undertake the following:

- design and deliver four archaeological skills workshops,
- to direct and supervise the excavation and recording of a small burnt mound and putative deer park boundary located in Sizergh Park by project participants who may have little or no previous archaeological experience,
- to direct and supervise the detailed survey of the seventeenth century barn adjacent to Sizergh Castle, along with the detailed survey of a putative prehistoric funerary mound in Brigsteer Park.
- undertake the washing and processing of any finds recovered on-site with the assistance of project participants, while also engaging with visitors on the subject of archaeological finds, providing opportunities for them to touch and handle archaeological finds,
- to undertake a geophysical survey within the bounds of Sizergh Park with the assistance of project participants, while also engaging with visitors on the subject of geophysical survey, providing opportunities for them use the equipment themselves,
- to undertake environmental sampling and probing of the waterlogged ground surrounding the small burnt mound feature with the assistance of project participants,
- to produce large format posters for outdoor display on the aims of the project, the archaeology being investigated and the various archaeological techniques being employed,
- to prepare a presentation on the event and aims of the investigations suitable for young people, before visiting the nearby schools at Dallam and Levens, and the Young Archaeologists Club based at Kendal Museum, to introduce the project to the children in preparation for their visit to site and participation. It is anticipated that the presentation will be followed by some hands-on activity suitable for older school aged children. A follow up visit to the two schools and Young Archaeologists Club will be undertaken in the autumn of 2013 will be carried out to update those who took part on the results.
- to design and deliver a presentation on the project at a local venue at the end of the project,
- to undertake any post excavation works required and create an appropriate site archive,
- to produce a full excavation report, along with a popular report produced which as a brighter 'designed' appearance which includes a well illustrated summary of the results written using simple language that can be passed on to all project participants at the end of post-excavation work.

Archaeological skills workshops

During the period leading into the event all registered participants will be offered the opportunity to attend workshops on archaeological techniques and skills to be designed and delivered by the contractor. The contractor will provide all necessary tools and visual aids required to deliver the workshops.

These workshops will cover various techniques of field archaeology including; excavation and site recording, geophysical survey, finds processing and environmental analysis. These workshops will be delivered by experienced and professional field archaeologists and aimed at the novice. The aim will be to allow participants to learn something of the techniques they will be using during the event in a warm and relaxed setting, as well as providing a forum for the different groups and volunteers to meet each other.

The provisional date for the delivery of these workshops is June 2013. It is expected that they would take place on one or two Saturdays (depending on the final number of participants and the preferred approach of the Contractor) prior to the start of the event. It is planned that all four workshops can be delivered in a single day, and the approach would be to keep the presentations short and light (45 minutes on each theme) and that the day would include at least two activities for participants.

These workshops will be delivered at the National Trust's property at Sizergh Castle or at a venue close by, such as Levens Village Institute. It will be the responsibility of the client to ensure that a suitable venue is available for the workshops and that project participants are invited.

The contractor should assume that the workshops will be attended by between 30 and 50 people.

Schools and YAC

The Client will make arrangements for groups from the nearby schools at Dallam and Levens to visit the site to take part in the event (including the excavations) on one day between the 16th and 19th July 2013. The Contractor should prepare a set of activities for the group to undertake on the day, including excavation, geophysical survey and finds handling, suitable for the age of the group.

The Client will also make arrangements for an archaeologist from the Contractor's staff to visit pupils at Dallam and Levens schools prior to their visit to site. This will provide an opportunity for the Contractor to deliver a presentation on the proposed event and what will be involved.

The Contractor will also be asked to return to Dallam and Levens schools with an update on the results of the project in the form of an illustrated presentation.

The Client will make arrangements with the Kendal Young Archaeologist Club to visit the site to take part in the event (including the excavations) on one day during the two weekends of the project. The Contractor should prepare a set of activities for the group to undertake on the day, including excavation, geophysical survey and finds handling, suitable for the age of the group.

The Client will also make arrangements for an archaeologist from the Contractor's staff to visit Kendal Young Archaeologist Club members at Kendal Museum on one Saturday prior to their visit to site. This will provide an opportunity for the Contractor to deliver a presentation on the proposed event and what will be involved. The Contractor will also be expected to deliver a hands-on session for the club members on a particular archaeology theme or topic in order to fill the session.

The Contractor will also be asked to return to provide the group with an update on the results of the project in the form of an illustrated presentation. Once again the Contractor will be expected to deliver a hands-on session for the club members on a particular archaeology theme or topic in order to fill the session.

Excavation of the dairy or stable building

The contractor will be required to deliver a professionally organised and supervised archaeological excavation of a small burnt mound and putative deer park boundary located in Sizergh Park. This will be undertaken while providing training and instruction for project participants who may have no previous experience of archaeology or who might have physical limitations.

The contractor will be required to supply adequate staff (we suggest a team of four) to direct and supervise the two separate excavations. It should be remembered that progress will be slow and that the contractor will be expected to teach the project participants aspects of excavation and recording, including site photography and section/ plan drawing. It is proposed that the ratio of professional staff to volunteers be around 1 to 3 and that we will aim to have approximately 12 volunteers involved in the excavation each day.

It should be remembered that the contractor's priority will be to encourage project participants to learn new skills and feel encouraged in doing so. It must be made clear that it is the quality of the experience for the participant that is the client's primary concern, rather than the complete excavation of the two sites under investigation.

The contractor will make provision for participation on site by members of the Kendal Young Archaeologists Club and parties from Dallam and Levens schools. These three groups should be given an opportunity to take part in the excavation and finds processing under the direct supervision of the Contractor. The Client will be responsible for arranging these visits and will ensure that only one group visit on any one day to avoid overloading the site.

The contractor will work over the two weekends of the project (13th and 14th and 20th and 21st July). It is anticipated that these are likely to be the busiest days for casual visitors to Sizergh Castle, and that the Kendal Young Archaeology Club will plan a visit on one of those weekends.

The Contractor will also be required to engage with the casual visitors and be available to answer questions and engage when required. It is anticipated that the National Trust Archaeologist, along with members of the project Steering Group will attempt to take the lead in this role.

The area to be excavated should be tailored to match the needs and numbers of anticipated participants.

It is the contractor's responsibility to ensure that the work is carried out according to best practice and the guidelines for archaeological field work as set out by the I.F.A. In addition to this the contractor should develop an appropriate scheme of sampling during the excavation and identify the need for specialist reports and services.

The contractor should provide all equipment necessary to undertake excavation and recording of the former dairy or stable building including trowels, spades, shovels, buckets, wheel barrows, mattocks, drawing boards, drawing frames, paper, film, cameras, recording sheets, line levels and pencils etc.

The contractor will be expected to supervise and assist with the removal of turf by hand from the two excavation sites at the start of the excavation. The turf and topsoil should be moved by hand and stored nearby on large tarpaulins ready for backfilling.

The contractor will also be required to assist in making good the site (including backfilling and laying the turf by hand) at the end of the project. This should take place on the 22nd July after the end of the two week long event. If possible the National Trust will assist with the backfilling operation using a tractor mounted mechanical arm.

On-site finds processing and handling

The contractor will be required to undertake all basic archaeological finds identification and processing on-site in such a way that it provides an opportunity for training and instruction in finds processing to project participants, as well as providing opportunities for basic finds handling for young people and families visiting Sizergh Castle.

The contractor will be required to supply adequate staff with suitable knowledge (we suggest a single person) to undertake this activity.

The contractor should provide all equipment necessary to undertake this activity such as washing up bowls, brushes, water carrier, chairs and tables, bags, boxes, labels, pens etc. The contractor will also be required to provide a gazebo or shelter suitable for use inside Sizergh Park (to be agreed by the National Trust).

It is very likely that there will be very few finds of note recovered during the excavations given the nature of the sites to be investigated. As such we ask the Contractor to put together a collection of finds that could be brought to site for use as a handling collection. Ideally this collection of finds would compliment the on-site interpretation.

Geophysical survey

The contractor will be required to undertake a geophysical survey of Sizergh Park while the main program of field archaeology is ongoing. The geophysical survey should be undertaken in such a way that it provides an opportunity for training and instruction to project participants, as well as providing opportunities for casual visitors Sizergh Castle to use the equipment.

The contractor will be required to supply adequate staff (we suggest a single person) for this activity with suitable knowledge to undertake this activity in addition to the field archaeologists working with participants on the excavation of the burnt mound and the putative park pale.

The contractor should provide all equipment necessary to undertake this activity such as tapes, strings, geophysical survey equipment, data logger, computer and printer.

On-site interpretation

The contractor will be required to produce approximately six large format posters for outdoor display on the aims of the project, the archaeology being investigated and the various archaeological techniques being employed by the project participants. The interpretation should have a high design quality to be both attractive and engaging, and be aimed at those visitors who perhaps wish to know a little more about the project, its aims and the techniques being used.

The contractor may need to work with National Trust staff to ensure internal National Trust guidelines for interpretation and presentation are followed. These will be supplied to the Contractor by the National Trust on request.

End of project presentation

The contractor will be required to design and deliver a PowerPoint presentation on the project at a local venue to be booked by the Client at the end of the project. This should include a full account of the results of the excavations, as well as the results of the geophysical survey and finds post excavation work.

Post-excavation work and archive production

The contractor will be required to undertake all necessary post excavation works required to examine any finds and environmental samples taken, and to produce a full written report of the excavation and other investigations, and will be required to create an appropriate project archive to be handed to the National Trust at the end of the project.

Report writing

At the conclusion of the project the contractor will provide the following products:

Ten bound paper copies of the full excavation report along with ten complete digital copies of the full excavation report on CD with jewelled cases. The digital report should appear as a locked PDF format and as a Word file that allows easy extraction of blocks of text, images and maps etc for uploading to the NTSMR. Copies of any digital survey information should also be supplied in a CAD compatible format as a dwg.file and as a tab.file compatible with MapInfo Version 6. Copies of all digital photographic files should also be supplied as individual J.pgs.

The contractor will also be required to produce fifty copies of the short site report along with twenty complete digital copies of the short report on CD with jewelled cases. This will take the form of a shorter version of the excavation report (running to approximately 24 to 30 pages). This shorter report should be fully illustrated with helpful plans and photographs, and describe the results of the excavation using simple language. The intention is to pass on copies of the short report to all participants at the end of the project.

The contractor will allow for significant consultation with the client on the content of the long and short reports.

Monitoring

The contractor will allow access to the site at any time for National Trust staff and the County Archaeologist, Mark Brennand (or his representative).

Current site conditions

The survey area is unenclosed and has open public access. The contractor will need to ensure that the site is secure throughout the duration of the project, including during the normal hours of work when the property is open to the public and at night when intrusion is possible.

Fencing will be the responsibility of the Contractor after consultation with the National Trust. It is recommended that crash barrier style fencing is used, as opposed to herras fencing or soft orange plastic fencing.

Contract Conditions

Levens Local History Group and the National Trust will retain copyright over the information produced during the course of these investigations and all information that appears in the final report. Levens Local History Group and the National Trust fully recognise the originator's moral right to suitable accreditation in any subsequent publication of the results.

It is National Trust policy to deposit copies of all reports with the relevant regional archives, in this case the offices of the Cumbria County Archaeologist based at County Hall in Kendal and the National Monument Record in Swindon.

Insurance and Health and Safety

The Contractor will take sole responsibility for all Health and Safety requirements arising from the event. The Contractor will also be expected to supply a suitable risk assessment and to provide evidence of adequate public liability insurance prior to the start of work.

It is critical that the Contractor can demonstrate that they have previous experience of working and interacting with volunteers, community groups and the general public, children and young people and that the Health and Safety implications of this have been fully understood.

Separate risk assessments should be produced for all activities undertaken by the Contractor that involve working with volunteers, community groups, school groups, Young Archaeologist Groups, and the general public, including family groups and young people.

It is assumed that any children under the age of 16 will only be allowed to participate in the event if accompanied by a parent or guardian. As such the Contractor will not be asked to assume 'responsibility' for young people taking part in the event, although they will be expected to ensure their safety while on-site like any other participant.

The Kendal Young Archaeologist Club will be required to bring their own supervisors and staff as appropriate for their visit to site.

The schools groups from both Dallam and Levens will similarly be required to bring their own supervisors and staff as appropriate for their visit to site.

Sizergh Park is open to the general public at all times, the health and safety, comfort and enjoyment of visitors to the National Trust's property at Sizergh Castle must be a priority at all times.

Timescales

The provisional date for the delivery of the archaeological skills workshops is during June 2013. It is expected that they would take place on one or two consecutive Saturdays prior to the start of the event.

The archaeological excavation, on-site finds processing work and geophysical survey will run from the 15th July and the 28th July 2013 inclusive. This will provide a total of fourteen working days on-site which would be available for active participation and visitor enjoyment.

The 14th July would be available for the contractor to set up and undertake any necessary site safety work. Similarly the 29th July will be available to the contractor to dismantle the site infrastructure and restore the ground.

The post excavation work should be undertaken soon after the end of the on-site work and a final project report, along with a shorter project report which can be printed and made available to all project participants should be completed by the start of October.

The contractor will be required to produce and deliver a presentation on the results of the project at a venue close to Sizergh Castle during October on a date convenient to the project participants (likely to be a Saturday or weekday evening). The copies of the long and short project report should be available to hand out on this day.

Tenders for the above project (including a detailed breakdown of costs set out in line with the sub-headings used in the invitation to tender for easily comparison) should be returned to Allan Stewart by the end of May 2012.

The Contractor will be informed that they have been chosen as the preferred contractor by the end of July 2012. Final confirmation that the project is going ahead (or has been turned down for funding) will be passed onto the Contractor as soon as the project steering group receives notification from the Heritage Lottery Fund.

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APPENDIX 2: PROJECT DESIGN

1. INTRODUCTION

1.1 INTRODUCTION TO THE PROJECT

- 1.1.1 The National Trust and The Levens Local History Group are proposing to undertake a programme of community archaeological work at Sizergh Castle (SD 499 879) for July 2013. This would be intended to provide training for volunteers in a broad range of archaeological skills, which will include archaeological excavation, topographic survey, geophysical survey, building survey; the work would be funded by the Heritage Lottery Fund. The proposal is to excavate a burnt mound and a putative deer park boundary. In addition, as an option, there will also be a survey undertaken of a seventeenth century barn and a detailed topographic survey of a prehistoric burial mound in Brigsteer Park. This project will be the centrepiece of a celebration of archaeology that will be undertaken as part of the Festival of British Archaeology events. While the archaeological investigations would provide the focus there would also be a number of open days or school days when there would be events staged to highlight archaeological techniques and the heritage of the area that would be enjoyable and would be targeted at a younger audience.
- 1.1.2 Oxford Archaeology North (OA North) has been invited to submit a proposal to provide supervision and oversee the community archaeology project and the wider interpretation and presentation that will provide an archaeological focus for both a select number of volunteers but also the wider visiting public. OA North will provide supervision and guidance for the excavation of the putative deer park boundary and the burnt mound, the detailed topographic survey, geophysical survey and the building survey.
- 1.1.3 In addition there will be a series of outreach events, which will entail talks and demonstrations of archaeological techniques, the use of interpretation panels, and also a series of interactive training events that will appeal to the younger generation. The interactive events will, where possible, work be tied to a wider theme, and given the Bronze Age burnt mound excavation and the very rich Bronze Age finds from the Sizergh area, it is suggested that where possible the broader theme should be the Bronze Age. Child / young person friendly interactive events for example would include finds handling with Bronze Age or late prehistoric artefacts, the making of Bronze Age type urns using air drying clay. Other possible options include the creation of crouched burials using a plastic skeleton. In addition, if required, it would be possible to stage a low key medieval reenactment that would accord with that period. Guided tours could be provided to give the visitors an insight into the heritage of the Sizergh Estate, which would include the burial mound in Brigsteer Park.
- 1.1.4 As part of the presentations it is proposed to establish temporary interpretation areas, which would use either the lower section of the seventeenth century barn or under gazebos adjacent to the excavation sites. These would include display panels that would provide background to the themes and the excavations and would provide a focus for the wider outreach. The barn would have electrical power and can be used to present the results of survey work using a power point projector.
- 1.1.3 A principle aim of the project is to involve the local community as widely as possible, and to provide new information on the wealth of archaeological remains in the Sizergh estate. This will entail providing a presentation of the results and guided walks to the volunteers make them aware of the rich heritage in the region. It will entail getting them directly involved in undertaking field surveys, excavations, geophysical surveys and building surveys and to ultimately disseminate that information in reports, and updated records for the Cumbria Historic Environment Record and the National Trust SMR.
- #### 1.2 SIZERGH SURVEY
- 1.2.1 A programme of archaeological survey (OA North 2011) has been undertaken of Sizergh Estate, which identified a rich archaeological resource and the present programme of archaeological work will develop from this. The survey identified an archaeological resource that dates back to the Neolithic and Bronze Age periods; and includes two funerary cairns on Sizergh Fell, and a seemingly

ritual deposition of Neolithic axe fragments found nearby within the grykes of limestone pavement. A Bronze Age burnt mound was also identified in Sizergh Park.

- 1.2.2 In the Roman period there was an enclosed settlement near Lane End Farm on the western edge of Sizergh Fell, which has a scooped interior, and contained burials of Roman date.
- 1.2.3 Sizergh was granted by William de Lancaster II, Lord of Kendal, to Gervase Deincourt between 1175 and 1180. It passed down the Deincourt family until it was acquired by the Strickland family between 1251 and 1271, as a result of the marriage of Elizabeth Deincourt and Sir William Strickland in 1239. In 1336 the demesne lands at Sizergh were emparked and the limits of Sizergh Park (now Low Park Wood) were defined using a sixteenth century map of Hawes Farm, whilst a section of the western boundary of the former deer park was found to survive as a large bank and ditch. This medieval deer park was disparked in the seventeenth to eighteenth century and a new landscape park was established around the castle which afterwards became known as Sizergh Park.
- 1.2.4 The proposed project will examine the following sites:
 - **Site 181421 - Burnt Mound** in Sizergh Park located on the edge of an area of soft, churned up boggy ground to the north west of the park ha-ha. The feature is a classic 'burnt mound' being kidney shaped with a depression or concavity on the western side. The stone work exposed in the upper surface has the appearance of having been burnt. The site is today surrounded by wet boggy ground and is close to the site of at least two natural springs.
 - **Site 181425 - Putative Pale:** a double bank and ditch earthwork curving through parkland to the south of Sizergh Castle. The western corner disappears under the south western corner of the present garden, while the eastern end runs out at a point to the south of the southernmost extent of the pond. The abrupt end of the eastern end of the bank and ditch earthwork may suggest recent disturbance. This is further supported by the existence of a mound of redeposited earth against the inner edge of the earthwork which could have resulted from any work to break through the bank to create a clear view into the parkland. The function of the earthwork is difficult to understand. Its function as a former ha-ha, park pale or driveway are all possible.

1.3 OXFORD ARCHAEOLOGY NORTH

- 1.3.1 **Outreach:** OA is committed to outreach. As an educational charity, OA seeks to promote an active public relations policy in relation to archaeology, and has a publications department that is experienced and fully equipped to provide general interest text and graphics for release to the press and general public in a wide variety of forms including display boards, leaflets and popular books. In certain circumstances it is possible to hold open days or install public viewing galleries on major sites. OA has considerable experience in the establishment of community based projects, and includes numerous training surveys and excavations. OA North has been providing the professional support for a programme of archaeological investigation into Lathom Park, nr Ormskirk, funded by Local Heritage Initiative. This involved the provision of expertise, training, and resources for surveys, excavations and documentary studies into the landscape associated with the major fourteenth century palace Lathom House. OA North has also been involved providing the consultancy and supervision for the excavation and survey of a complex enclosed settlement at Ingleton in conjunction with the Ingleborough Archaeology Group, and the supervision and of a survey of a nineteenth century designed landscape at St Catherine's Park, Windermere, on behalf of the National Trust, and the local community. OA North is presently undertaking a community excavation of a nineteenth century church, that was demolished when Stocks Reservoir was constructed in the early part of the twentieth century, and is being undertaken on behalf of United Utilities and the Forest of Bowland AONB. OA North is also undertaking a community survey of woodlands and fulling mills with the catchment of Lake Windermere.
- 1.3.2 **Holwick:** more recently OA North has undertaken a major survey of Holwick village and valley landscape in the North Pennines on behalf of the AONB and also Natural England. This entailed a broad range of survey techniques from specially flown oblique aerial photography, LiDAR, Documentary Studies, Identification Surveys, detailed surveys using a theodolite and Disto. The latter technique was designed to allow cheap, but efficient survey techniques that would be within the pocket of amateur groups (the maximum budget for equipment was £300.00) and which would result in the plotting / draughting of the survey drawings on site.

- 1.3.3 OA North employs an experienced and qualified archaeological land surveyor, Jamie Quartermaine, who has considerable experience in training survey techniques. He has the expertise to train local teams in a broad and diverse range of low tech survey techniques that will be appropriate for the volunteers who do not have access to modern equipment.
- 1.3.4 **Landscape Archaeology:** OA North has considerable experience in the field of landscape survey work, particularly in the uplands of Northern England and Wales. Numerous surveys have been undertaken across the region and North Wales, and has taken the form of rapid identification surveys of large areas of unimproved land as well as detailed surveys of specific landscapes.

2. AIMS OF THE PROGRAMME

- 2.1 The primary aims of the project are as defined within the HLF Application and are as follows:
- To encourage local volunteers to gain an understanding of the history of catchment through surveying, excavation and researching their local history. The volunteers will learn techniques of surveying that they will be able to continue beyond the life of the project. To gain a set of meaningful and memorable learning experiences and offer a learning opportunity for visitors.
 - To facilitate access for project participants to professional training and supervision in a number of archaeological skills and techniques before and during the excavation.
 - To provide opportunities for informal learning and engagement for visitors to Sizergh Castle during the event. These opportunities will attempt to capture the interest of young people and families through active and stimulating games and activities, as well as more in-depth interpretation material and guided walks for the more mature and inquiring.
 - To introduce to visitors and participants, through a program of formal and informal learning, to subject topics including archaeology and archaeological resource management, historic and vernacular buildings, historic parks and gardens (including deer and veteran tree management) and the social and local history of the Sizergh Castle Estate.

3. METHODOLOGY

3.1 PROJECT PREPARATION

- 3.1.1 At the outset there will be a process of liaison between OA North, The National Trust and the Levens Local History Group. This will entail defining the output formats for incorporation into the HER, and having a field visit to examine the site and to refine the project methodology. OA North will liaise with the National Trust to enable a close co-operation on the estate and to ensure that the community project works in close accord with the other visitor activities and estate management.

3.2 ARCHAEOLOGICAL SKILLS WORKSHOP

- 3.2.1 The first stage of the project will be a skills workshop that will preferably be undertaken at Sizergh Castle and will entail a power point presentation as well as a practical demonstration of archaeological methods either in the venue or outside in the grounds (subject to the prevailing weather conditions). This would provide a general introduction, outlining the range of techniques available to the archaeologist, before addressing in detail the methods that will be undertaken by the participants. This would include an introduction to the theory and practices of archaeological excavation, palaeoenvironmental analysis, finds processing, and survey techniques. This would be followed up by demonstrations and instruction in geophysical survey, instrument survey and building survey techniques. The survey techniques would include theodolites, plane tables, a total station with pen computer (to display the results), and survey grade GPS. The aim would be to introduce the participants to the proposed programme but also to raise interest. Experience of previous launch events (eg at Holwick and Windermere Reflections) was that these attract lots of people, lots of interest and set the project off to a good start.
- 3.2.2 It is proposed that a series of workshops be delivered over one or two Saturdays and that there will be up to 50 attendees, and will require a number of OA North staff. The large numbers of attendees will demand that they are split into smaller groups and the activities will be staggered to allow full use of the day and provide for a more individual instruction by the professional archaeologists.

3.3 EXCAVATION OF THE DEER PARK BOUNDARY AND THE BURNT MOUND

- 3.3.1 The following section outlines a methodology for the undertaking of excavations of the Deer Park Boundary and the Burnt Mound. The excavations will run over a period of 14 consecutive days - 15th July to 28th July 2013 which includes two weekends. The emphasis for the excavation will be upon providing training, and providing a valuable experience for the participants, rather than undertaking extensive areas of excavations to tight timetables. The extent of the excavation areas will be defined on site and will be determined by the rate of observed progress of the participants. While it is important that all areas opened are fully excavated, the extent of the excavation areas will be defined so as to ensure that the participants can comfortably complete these areas within the time allowed. No more than half of the burnt mound will be excavated. At the end of the excavation the excavations areas will be backfilled and the turf will be relaid.
- 3.3.2 It is anticipated that there will be four members of professional archaeologists supervising the excavations and surveys, and that there will be a ratio of three participants for every professional. It is anticipated that there will be three supervisors working on the excavations and one supervisor undertaking the survey work (geophysics, buildings, topographic and palaeoenvironmental).
- 3.3.3 **Site Preparation and Preliminary Survey:** prior to the commencement of any work, a risk assessment will be compiled by the OA North Project Director. The initial element of the fieldwork will comprise the establishment of survey control, and an outline measured survey of both sites. The survey control will be established using survey grade GPS. The participants will be involved in the survey of the earthworks and will be undertaken using basic survey techniques, typically a theodolite and Disto, which will be plotted up on site (*Section 3.5.2*). This data will then be digitised and overlain onto historic mapping to allow the key areas of archaeological interest on the site to be identified.
- 3.3.4 **Turf Clearance and Excavation:** at the outset the turf will be carefully removed from the excavation areas by manual techniques and the turf will be stored separately from the spoil and adjacent to the excavation on tarpaulins / terram.
- 3.3.5 All excavation will be carried out using exclusively manual techniques. Spoil from the excavation will be stored at a location subject to discussions with the estate. Structural remains will be cleaned to define their extent, nature, form and, where possible, date. It should be noted that no archaeological deposits will be entirely removed from the site. It is not anticipated that excavation in any of the trenching will proceed below a depth of 1.2m, although should this be considered necessary, then the trench will be widened sufficiently to allow the sides to be stepped in or battered back to a safe angle of repose.
- 3.3.6 All information identified in the course of the site works will be recorded stratigraphically, using a system adapted from that used by the Centre for Archaeology Service of English Heritage. Results of the evaluation will be recorded on *pro-forma* context sheets, and will be accompanied with sufficient pictorial record (plans, sections and both black and white and colour photographs) to identify and illustrate individual features. Primary records will be available for inspection at all times.
- 3.3.7 A full and detailed photographic record of individual contexts will be maintained and similarly general views from standard view points of the overall site at all stages of the evaluation will be generated. Photography will be undertaken using 35mm cameras on archivable black and white print film, and all frames will include a visible, graduated metric scale. Extensive use of digital photography will also be undertaken throughout the course of the fieldwork. Photographs records will be maintained on special photographic *pro-forma* sheets.
- 3.3.8 **Planning:** the precise location of all archaeological structures encountered will be surveyed by a combination of manual techniques using a planning frame or using a theodolite / Disto. All survey drawings will be completed by manual draughting techniques on site. This process will ultimately generate scaled plans within an AutoCAD system, which will then be refined by manual draughting by local community volunteers. The drawings will be generated at an accuracy appropriate for 1:20 scale, but can be output at any scale required. Sections will be manually drafted as appropriate at a scale of 1:10. All information will be tied in to Ordnance Datum.
- 3.3.9 **Backfilling:** the excavation areas will be backfilled by OA North / NT staff using a backhoe mechanical excavator (to be provided by NT). The turfs will be relaid manually.

- 3.3.10 **Finds policy:** finds recovery and sampling programmes will be in accordance with best practice (following current Institute of Field Archaeologists guidelines) and subject to expert advice in order to minimise deterioration. OA has close contact with Ancient Monuments Laboratory staff at the University of Durham and, in addition, employs in-house artefact and palaeoecology specialists, with considerable expertise in the investigation, excavation, and finds management of sites of all periods and types, who are readily available for consultation.
- 3.3.11 Finds storage during fieldwork and any site archive preparation will follow professional guidelines (UKIC). Emergency access to conservation facilities is maintained by OA North with the Department of Archaeology, the University of Durham. Samples will also be collected for technological, pedological and chronological analysis as appropriate.
- 3.3.12 Human remains are not expected to be present, but if they are found they will, if possible, be left *in situ* covered and protected. If removal is necessary, then the relevant Home Office permission will be sought, and the removal of such remains will be carried out with due care and sensitivity as required by the *Burials Act 1857*.
- 3.3.13 Any gold and silver artefacts recovered during the course of the excavation will be removed to a safe place and reported to the local Coroner according to the procedures relating to the Treasure Act, 1996.

3.4 BUILDING SURVEY OF THE GREAT BARN

- 3.4.1 **Introduction:** the survey of the barn would be undertaken alongside the excavations, and would be undertaken to provide training for the participants in building recording. There is a need to produce a complete and accurate survey of the barn, so if at the end of the training project the barn has not been completed, then it will be taken to completion by OA North building surveyors, after the end of the main fieldwork, using the same techniques outlined below. A broad range of techniques will be undertaken in order to provide effective general training for the participants. This will include manual surveys using tapes, but also reflectorless total stations, and photogrammetry.
- 3.4.2 The measured survey will be carried out to English Heritage guidelines level 3 (English Heritage 2006). The detailed survey will provide for a full record of the ground plan, first floor plan, external elevations and cross sections through the structures. For the most part this will be undertaken by means of a Reflectorless EDM (REDM) totals station survey with respect to survey control established by GPS survey. This will be undertaken as a teaching opportunity and participants will be instructed in all aspects of building survey, from the principles of survey techniques, manual survey techniques, and methods of building analysis. It will take them through the whole process of building recording from initial examination through the mapping of plans and the creation of elevations, through to undertaking phasing of the structure and matching with historical plans.
- 3.4.3 The drawings will in part be undertaken using modern instruments, because of the need to capture 3D data, but it will take the participants through the whole process of instrument recording so that they have an effective grounding in building survey. The data will be captured and displayed on a pen computer, and this can serve as an effective presentational tool as the drawing can be displayed on a wall using a power point projector and visitors and participants can visualise the drawing being created.
- 3.4.4 It is understood that the ground floor is being used as storage, and the first floor is used as office space. The contents of the ground floor would need to be moved to enable the survey, and it is intended to minimise persons undertaking the survey on the first floor to limit any disruption to the users of the building.
- 3.4.5 **Control:** the survey control will be established by closed traverse using a Leica TC805 total station, and will be located using the Leica 1200 differential GPS, which maintains 0.015m accuracy. Height control will be established by the same process.
- 3.4.6 **Instrument Detail:** the detail survey will be established by REDM instrument (Leica 805), and the data will be superimposed onto the same grid within a CAD system. The instrument survey will be generated by EDM tacheometry using an REDM total station linked to a pen computer running TheoLT software. The digital data is transferred onto the pen computer for manipulation and transfer to other digital or hard mediums. The survey data will be accurate to $\pm 0.005\text{m}$. The survey will

result in the production of a ground plan and first floor plan. At least one cross section will be produced through the building, and will necessitate access / sight of the trusses and roof structure.

- 3.4.7 **Manual Survey Detail:** in addition it is proposed to undertake sections of the survey, particularly the ground floor plan by manual survey techniques and will entail the use of low cost survey equipment, such as tapes. In this instance the external outline of the plan will be undertaken by instrument survey in order to minimise errors that can be derived from purely distance based survey methods, but the internal plan would be by manual techniques based upon the instrument outline. It is intended to record floor surfaces by manual survey, using a planning frame and will provide participants experience in such techniques.
- 3.4.8 **Elevation Production:** a range of techniques will be implemented in order to implement the drawing of the external elevations. The most efficient survey technique is to record the elevations by photogrammetry, using ground based photographs, but this has the disadvantage that much of the processing of the drawings is undertaken in the office, and makes it difficult for the participants to understand the process. The alternative is to use the reflectorless total station and the drawing can then be seen being created on the pen computer screen. It is proposed to undertake some elevations using both techniques so that participants will have familiarity with both techniques.
- 3.4.9 **Photogrammetry:** a series of ground oblique photographs of each elevation will be undertaken using a 10 megapixel digital SLR from many different camera positions, which will include some taken from a telescopic mast. Survey control will be established on each elevation by means of a reflectorless total station. Models of each elevation will be created by photogrammetry using the photogrammetric Agisoft package and this will provide accurate elevations surfaces draped with corrected photographic images. These will then be digitised in outline to create the final elevation drawings. The drawings will depict key features, such as quoins, and ashlar, but not all stones.
- 3.4.10 **Reflectorless Survey:** select elevations will be undertaken by reflectorless total station and by training the laser dot around the architectural detail. The digital data will be output straight into a pen computer which will allow the user to visualise and check the output.
- 3.4.11 **Drawing Up:** the raw data from the total station and the GPS will be combined within a CAD system, and then plots will be generated to enable the drawing up of the sites within the field. The archaeological detail is drawn up in the field as a dimensioned drawing on the plots with respect to survey markers. On completion of the field survey the drawings will be enhanced within the CAD environment to produce the final drawings.
- 3.4.12 The survey will record all pertinent archaeological detail. The survey will be combined with general topographic mapping of the locale and any other mapping identified during the DBA.
- 3.4.13 **Annotation of drawings:** irrespective of the means used to generate drawings, they will be annotated with salient information, including wear marks associated with machinery, wear patterns on floors, masons or carpenter's marks, graffiti and daub marks relating to historic and contemporary use, and the location of re-used structural timbers.
- 3.4.14 **Photography:** in conjunction with the archaeological survey a photographic archive will be generated, which will record significant features as well as general views. This photographic archive will be maintained using high-quality digital cameras with 10 mega pixel resolution. The use of a digital camera provides very effective manipulation of photographic images, and these will be used in the report. The use of photography in this way considerably enhances the usability of a database and greatly assists the analysis of the monument. The photography will provide general views, and wider context. It will record then internal and external character and will provide for internal and external detail, including opening, timber framing, assembly marks and other significant features. A metric scale will be used for all photographs.
- 3.4.15 **Description:** a detailed description of the complex will be carried out to English Heritage Level 3 guidelines as appropriate, utilising *pro-forma* sheets. This provides for a comprehensive analytical account for buildings of special importance and the following methodology will be followed.
- 3.4.16 The written account will provide the understanding required in order to place the building in its historical, architectural and cultural context. The descriptive record will include the following accounts:

- A general description of the buildings, which will include details of the plan, form and function. Allied to this, a detailed description of the materials used and development sequence and phasing, including any alterations, repair and rebuilding, will be provided;
 - An account of the wider context within which the buildings are situated. For example, its relationship to places and buildings within the local area, as well as its historical relationship to the area;
 - An appropriate description of each individual room/discrete space and component.
- 3.4.17 **Lighting:** the building has lighting in most areas but it may be necessary to bring in additional temporary lighting to assist with the fabric recording.

3.5 ENVIRONMENTAL PROBING / CORING SURVEY

- 3.5.1 A process of environmental coring will be undertaken by experienced palynologists to examine the palaeoecological potential of the area around the burnt mound. This will reconstruct the extent of former tarns / standing water and show the relationship between the burnt mound and the local hydrology. This will be undertaken by two methods: probing and transect coring. The former technique will record the shape of the underlying basin and the second technique will examine the stratigraphic development of the infilling of the tarn.
- 3.5.2 **Probing:** probing will be used to trace the former buried topography and any buried landscape features such as field boundaries. Specially designed probes will be used which will have a survey prism mounted on top. Probing will be undertaken on an approximate 2-3m grid across the sites. When the probe has been achieved a solid base then the depth and position of the probe will be recorded using a total station. This will result in a series of survey points recording the depth of the mire and will be used to generate a contour model of the bottom of the former basin. In addition survey points will be created for the upper surface of the mire to generate a contoured DTM; this will provide a comparison between the upper and lower extents of the mire deposits. This work will be undertaken by the participants under the guidance of a surveyor.
- 3.5.3 **Transect Coring:** a lightweight gouge auger will be used to obtain variably-spaced peat borings along transect lines through the area of the mire. The depth, type, and preservation of the waterlogged stratigraphy will be recorded on *pro-forma* record sheets, and the survey will seek to record the character of the basin mires. The spacing between the cores will be variable and will be dependent on the depth of deposits, the topography, and the archaeological context. The sediment stratigraphy will be recorded using the terminology and procedures outlined by Troels-Smith (1955). The cores will be located, both spatially and in altitude, by means of total station. Sampling intervals will be dependent on the nature of the deposits, but as far as possible will attempt to achieve approximately regular spacing. This data will be utilised to produce stratigraphic diagrams, using symbols based on Troels-Smith (1955), which will illustrate the extent and depth of the deposits. Samples will be taken at the top and bottom of the cores to facilitate radiocarbon assay. This work will be undertaken by the participants under the guidance of a palaeoenvironmentalist.
- 3.5.4 **Analysis of Stratigraphic Data:** in addition to the recording of the deposits in the field, small samples of peat will be taken from significant levels. These will be examined microscopically in the laboratory for plant macrofossils to confirm the field identification and some will be assessed for pollen sampling. Larger samples from basal deposits will be assessed for radiocarbon dating to provide inception dates for the waterlogged deposits. By means of the dating of selected cores, the palaeoenvironmental methods will be used to help establish the chronology of the mire and provide a chronological context for the burnt mound.

3.6 TOPOGRAPHIC SURVEY OF DEER PARK BOUNDARY AND ENVIRONS

- 3.6.1 Alongside the excavation works it is proposed to undertake a detailed survey of the Deer Park Boundary and all earthwork features in the environs of the castle. This is essential to provide an appropriate context for the excavation and would also be intended to record the wider topography in the environs of the Deer Park Boundary. The same will be happening for the burnt mound, but this will be undertaken as part of the palaeoenvironmental survey. The detailed topographic survey of the environs of the Deer Park Boundary will be undertaken to English Heritage Level 3 (Ainsworth *et al* 2007).

- 3.6.2 **Survey Methods:** it is intended that this primarily serve as a training exercise for the volunteers, so the survey techniques will be devised to be easy to understand, and will allow for plotting in the field, and using equipment that is easily affordable by volunteers. This will inevitably mean the use of more outdated technologies, and this will have a significant impact on productivity. There is a broad range of survey options that can be achieved by volunteers with access to non-expensive equipment, and it is proposed to introduce the volunteers to a range of techniques and then concentrate the survey using a theodolite and disto. A disto mounted on top of a theodolite telescope will be used to provide the base data for on site plotting. The disto is self reducing and has a range of c120m. The data would be drawn up in the field using an accurate film based protractor and ruler. A gazetteer and photographic record will also be compiled.
- 3.6.3 In addition it is proposed to purchase a tile of Ascii LiDAR which will provide the height information that will be used to create a detailed contour map of the area and will enhance the final product.
- 3.6.4 **Survey Control:** it is proposed that survey control be introduced to the sites by means of a high accuracy survey type differential GPS where possible. This can achieve accuracies of +- 20mm, and will ensure that the survey is accurately located onto the Ordnance Survey National Grid. If at any of the sites there is no mobile reception (necessary to provide corrections for the GPS) then the control will be established by means of a total station.
- 3.6.5 **Detail Survey Overview:** the detail survey by theodolite / disto will record all structural and earthwork components, which will be drawn by hachure survey. Survey points will be marked on the ground using spray paint and the survey drawing will be manually drawn up with respect to them. On completion of the survey the field drawings will be digitised into a CAD system. The survey will record all archaeological features, earthworks and elements. The survey will aim to identify, locate and record all built elements of the landscape.
- 3.6.6 **Aerial Photography:** it is also proposed to record the excavation sites and immediate environs by means of high altitude photography, which, using specialist photogrammetric software, can be used to create accurate three dimensional models of the site and topographic surfaces. There are two means of achieving this by means of an extendable mast or using a UAV. The mast has a maximum height of 8m, and for small sites it is very effective in that it can provide high resolution surface images for the modelling process. However, for more extensive sites it generates more photographs than the software can handle. The alternative is the use of the UAV, which provides photography from any altitude up to approximately 80m height. Survey control is introduced to the photographs by the placement of survey control targets across the site which are located by means of survey grade GPS.
- 3.6.7 The photogrammetric processing is undertaken using Agisoft software which provides detailed modelling using the overlap of up to 50 photographs, and creates a very detailed DTM (Digital Terrain Model) across the site. The photographs are then digitally draped over the model to create an accurate three dimensional model of the ground surface. The primary output, however, is an accurate two dimensional image which can be used to generate accurate plans or profiles although 3D models can be provided for the participants in PDF form.
- 3.6.8 **Gazetteer:** a descriptive record of all features will be compiled using a standard proforma, which will incorporate a provisional interpretation of the function of the site / feature, where possible, and similarly will provide a provisional interpretation of the site's chronology where possible. Once the digital gazetteer has been collated and edited, it will be output as an Access Report and input directly into a Microsoft Word format. The gazetteer output will be compatible with the NT SMR and the LDNPA HER. This data will be formatted and topped and tailed within word to produce the gazetteer volume for the survey project. The description will include the following fields:
- NTSMR Number
 - LDNP HER number
 - Site Number
 - Form
 - Site Name
 - NGR
 - Site Description
 - Monument Type
 - Period
 - Interpretation

- Dimensions
- Threats
- Management
- Photo reference
- Condition
- Surveyor
- Date of survey

3.6.9 **Photographic Record:** a photographic archive will be generated in the course of the field project, comprising landscape and detailed photography. Detailed photographs will be taken of the archaeological features using a scale bar. All photography will be recorded on photographic pro-forma sheets which will show the subject, orientation and date. The photography will be undertaken using a digital SLR camera with 10 megapixel resolution.

3.7 GEOPHYSICAL SURVEY

- 3.7.1 A detailed magnetic and resistance survey will be carried out using a Bartington Grad601-2 gradiometer and/or a Geoscan RM15 resistance meter. Both of these instruments have internal data loggers. Data will be collected in zig-zag mode over the same 30m by 30m grids, the magnetic data being collected at 0.25m intervals on profiles 1m apart (3600 readings per grid) whilst the resistance survey data will be collected at 1m intervals on profiles 1m apart (900 readings per grid). These instruments are easy to use and handle and the basics of survey operation and technique can be easily explained.
- 3.7.2 The survey grid will be staked out and surveyed using either an RTK GPS system or total station to Ordnance Survey co-ordinates to at least 0.05m accuracy. Bamboo canes will be placed at grid node points and survey ropes and canes will be used to mark out the survey traverses.
- 3.7.3 All data will be downloaded immediately following collection using specialist survey software (Archaeosurveyor) and will be minimally processed where applicable. Raster images will be exported, usually in .png or .jpeg format for presentation and dissemination. These images will be imported into CAD software and overlain on a geo-referenced base plan. An interpretation of the anomalies will be presented in CAD and a non-technical summary and discussion of the results will be included in a report which will accompany the interpretation.
- 3.7.4 It is proposed that much of the survey area will be surveyed by an experienced geophysicist prior to project participants and casual visitors' involvement in order to allow for some final example data to be available for viewing at the commencement of the project. This has worked well at similar events undertaken in the past. The survey will be carried out in accordance with English Heritage guidelines (2008) and IFA standards (2010).

3.8 INTERPRETATION BANNERS

- 3.8.1 It is proposed to produce a series of six interpretation banners / panels, which will be produced at the outset and in the course of the project. These panels would be printed onto a very durable PVC banner fabric which can be suspended from its corners by eyelets or mounted onto a solid wooden base, and would be A0 sized. They would have limited amounts of text and a small number of large photographs, and would be similar to those used at Dunham Massey and would be intended to steer people into the area of the excavation. There would, however, be one panel that would have more information and would be intended to provide appropriate background information and would be set up at the finds processing gazebo.
- 3.8.2 These banners are cheap to produce, typically £ 15.00 for an A1 sized banner, and can be printed for next day delivery. A banner of this form was used at the recent Stocks in Bowland excavations (See below); the design work took 0.7 man days and the printing and delivery took a day, so it was possible to create an interpretation banner from inception in two days. The implication is that at least some of the banners / panels can be produced with a very short lead in during the course of the project, and can be used to present initial results of the excavations. After the completion of the Stocks excavation the panel was left on display at the site and has now been exposed for six months, which includes last winter, and has shown no deterioration or fading over that period.

- 3.8.3 It is suggested that the panels would have the themes, but these can be varied to fit in with specific needs.
- Aims of the project, and credits to organisations involved.
 - Prehistoric Activity in the Sizergh area (including examples of BA vessels)
 - Layout of the Sizergh park boundaries (including examples of park pales and medieval artefacts)
 - Survey techniques that will be employed in the project
 - 2 x initial results of the excavations including Agisoft aerial photographs

3.9 FINDS PROCESSING AND OUTREACH

- 3.9.1 Finds processing for the excavations will be undertaken on site, and will entail washing, bagging, marking and indexing. The two sites that will be excavated typically will produce very little in the way of any finds; however, in this instance finds processing will provide a means of outreach interaction with the visitors who will be interested in the excavation but will not have a direct involvement with the excavation. The intention is to undertake the limited finds processing that will be undertaken alongside a presentation of finds (ex-situ) from other sites that will allow the visitors to visualise and handle finds from the Bronze Age and medieval periods. OA North has a teaching collection of material from these periods, which for the Bronze Age is entirely lithics. However, on select occasions during the excavation it would be possible to bring to site special artefacts, including intact BA funerary urns, as long as there is sufficient supervision to ensure the security of these valuable artefacts. In this instance these artefacts would be accompanied by Chris Howard Davis, who is OA North's most senior finds specialist, and will provide considerable insight to all aspects of finds for the participants and visitors.
- 3.9.2 A gazebo will be erected adjacent to the excavations and will have all the materials necessary for the storage and processing of finds including tables and chairs. A poster / interpretation panel will be erected in the gazebo (*Section 3.8*) and will provide information for the visitors about the sites, the excavation process, and artefacts from these periods.
- 3.9.3 ***Demonstration of Pottery Making:*** OA North has in the past had considerable success with the making of hand made Bronze Age vessels as this provides a fantastic opportunity to engage the involvement of children. The vessels would be made by the visitors under OA North guidance using Air Dried Clay which hardens without the need for firing in a kiln. The vessels are made in the traditional way using coils of narrow tubes of clay to build up the vessel walls, and the pot would then be decorated using stamps. OA North has examples of vessels produced by this method (see left) and photographs of actual vessels which would serve as a template for the visitors to create their pots. On completion the visitors would take their vessel away as a lasting memento.
- 3.9.4 The production of pottery vessels would be undertaken as part of the Schools / KYA events (*Section 3.10*) and would require a dedicated person to enhance the outreach; an additional person would be provided for these days. The proposed member of staff has considerable experience of historic reenactments and would be dressed in prehistoric period clothing, with appropriate tools, such as a replica Bronze Age axe, and this would add to the period atmosphere.

3.10 SCHOOLS AND GENERAL OUTREACH

- 3.10.1 ***Dallam, Lewis Schools and Kendal Young Archaeologists Club:*** there will be a process of interaction with the Dallam and Levens schools, and the Kendal Young Archaeologists Club (KYAC) as part of the projects outreach. The first stage will be a presentation to the schools (and KYAC at Kendal Museum) at the outset of the project, then a site visit from both schools in the course of the project and for KYAS on one of their monthly Saturday meetings in the period leading up to the event. This will be followed by a recap presentation at the end of the project to demonstrate the interim results. This outreach phase would be undertaken by a member of staff who is a former headmaster and has considerable experience of teaching. On the day of the site visit, there will be a range of child friendly activities such as finds handling, geophysical survey, pot making, topographic survey and excavation, and additional members of supervisor staff will be brought in for specific events.

- 3.10.2 On completion of the project a final presentation will be established for all the participants and dissemination to the local community through an evening talk. This will be at a local venue and will present the final results of the programme.

3.11 REPORT PRODUCTION

- 3.11.1 **Archive:** the results of the management programme will form the basis of a full archive to professional standards, in accordance with current English Heritage MoRPHE guidelines (The Management of Research Projects in the Historic Environment, 2006). The project archive represents the collation and indexing of all the data and material gathered during the course of the project. It will include summary processing of any features, finds or other data recovered. This archive will be provided in the English Heritage Central Archaeological Services format. A synopsis (normally the index to the archive and the report) should be placed in the Cumbria Historic Environment Record. The artefacts will be deposited with Kendal Museum. The archive will include the raw survey digital data in AutoCAD format.
- 3.11.2 **Analysis and Report:** OA North accords with best practice for the analysis of the excavation results in accordance with the guidelines of MoRPHE. This would involve a brief assessment of the data-set generated by the excavation, followed by a review of the excavation archive; this process will be undertaken in close consultation with the client. The report format will be agreed at this stage. The Harris Matrix, largely produced during the excavation programme will be completed and checked as part of this assessment phase. The proposed programme anticipates assessment of the artefactual evidence and of the site stratigraphy leading to the production of a final report.
- 3.11.3 **Palaeoenvironmental Assessment:** subject to the results of the evaluation an assessment of any environmental samples will be undertaken by the in-house palaeoecological specialist, who will examine the potential for further analysis. The assessment would examine the potential for macrofossil, arthropod, palynological and general biological analysis. A programme of detailed analysis may be recommended subject to the results of the assessment, but the extent and requirements of such work can not be determined at this early stage of the project.
- 3.11.4 **Absolute Dating:** subject to the availability of material from secure contexts, it may be appropriate to undertake radiocarbon dating of sampled organic material if the possibility can be demonstrated that this technique will aid the establishment of a tight chronology. Absolute dating will be particularly useful for the interpretation of archaeological remains from which no other dating material is available, and for palaeoecological material. Sufficient dates will be required to improve the reliability and accuracy of dating. The actual number required will be subject to the results of the trenching. The dates will be taken by the OA North palaeobotanist (Elizabeth Huckerby), who will undertake the initial processing of the dates and submit them to the radiocarbon laboratory.
- 3.11.5 **Final Report:** the final report will present, summarise, and interpret the results of the programme and will incorporate specialist reports on artefact assemblages and environmental reports. It will include an index of archaeological features identified in the course of the project, with an assessment of the site's development. It will incorporate appropriate illustrations, including copies of the site plans and section drawings all reduced to an appropriate scale. The report will consist of a statement of acknowledgements, lists of contents, executive summary, introduction summarising the brief and project design and any agreed departures from them, methodology, interpretative account of the site and associated structures, gazetteer of features, a complete bibliography of sources from which data has been derived, and a list of further sources identified during the programme of work.
- 3.11.6 The report will incorporate appropriate illustrations, including copies of the site plans, detailed survey plans of each excavation area, maps of the wider landscape, all reduced to an appropriate scale. The site mapping will be based upon the CAD base. The report will be accompanied by photographs and historic illustrations illustrating the principal elements of the landscape.
- 3.11.7 **Survey Reporting:** the report will also incorporate the results from the topographic survey, the building survey, and the geophysical survey, which will be accompanied by appropriate illustrations. The results of all the techniques will be assessed alongside the results of the earlier Sizergh Estate report (OA North 2011), and an assessment of the development of the landscape will be made in the light of this work.
- 3.11.8 **Short Report:** a reduced version of the final report will be compiled, which will be heavy on illustrations and photographs and will be 24-30 pages in length and in A4 format. Although based on

the final report, it will be subject to desk-top publishing design, and will include a well designed cover to improve the visual appearance. It will be commercially printed and it is anticipated that there would be an output of 50 copies.

- 3.11.9 **Editing and submission:** the report will be subject to the OA North's stringent editing procedure; then a draft will be submitted to the National Trust for consultation. Following acceptance of the report, ten bound copies and CD copies of the report (and digital copy in PDF and Word formats) will be submitted to the National Trust. A summary of the work will be provided for OASIS.

3.12 OTHER MATTERS

- 3.12.1 **Access:** the sites are within the Sizergh Estate and in the ownership of the National Trust; parking will be at the Sizergh Castle car park and it is assumed full pedestrian access will be available to the sites. The survey will entail recording of the seventeenth century barn, which has a ground floor that is occupied for storage; the contents would need to be reduced or removed to enable the survey. The first floor is occupied and it is assumed that there would be limited access to this floor.
- 3.12.2 **Fencing:** a barrier needs to be provided between the excavation and the general public to prevent injury to the public, but also must not restrict visibility of the excavations. It is suggested that movable crowd control style barriers are used which can be erected quickly and are stock proof.
- 3.12.3 **Health and Safety:** full regard will be given to all constraints during the survey, as well as to all Health and Safety considerations. The OA North Health and Safety Statement conforms to all the provisions of the SCAUM (Standing Conference of Unit Managers) Health and Safety manual. Risk assessments are undertaken as a matter of course for all projects, and will anticipate the potential hazards arising from the project. A specific risk assessment is provided to address the specific issues relating to children under the age of 16.
- 3.12.4 **Insurance:** insurance in respect of claims for personal injury to or the death of any members of the public in the course of the project will be covered by OA North, who has insurance cover which complies with the employers' liability (Compulsory Insurance) Act 1969 and any statutory orders made there under. For all other claims to cover the liability of OA North in respect of personal injury or damage to property by negligence of OA North. The insurance cover is as follows:
- £10 million public liability
 - £10 million employers liability
 - £5 million professional indemnity
- 3.12.5 OA North regularly undertakes community projects that include children under the age of 16 and is incorporated within the insurance cover. These children should be under the supervision of a parent or guardian, or a responsible CRB checked adult who has agreed to take on the responsibility of the child.

4. WORK TIMETABLE

- 4.1 OA North will be able to deliver the services according to the agreed project timetable as specified in the project brief.

5. RESOURCES

5.1 OA NORTH PROJECT TEAM

- 5.1.1 The excavation will be directed by Andy bates (Project Officer) and the survey will be undertaken by Peter Schofield (Project Officer) and Alastair Vannan, under the guidance of the project manager, Jamie Quartermaine. The reports will in part be written by members of the society, and part by staff of OA North. The OA North element of report production will be split between Peter and Alastair.
- 5.1.2 **Project Management:** the project will be under the project management of **Jamie Quartermaine, BA Surv Dip MIFA** (OA North Project Manager) to whom all correspondence should be addressed. Jamie is a very experienced landscape surveyor, who has undertaken or managed literally hundreds of surveys throughout Northern England since 1984, and has considerable experience of working on

similar projects to that proposed. He has managed a major recording programme of Lyme Park, Cheshire, and very detailed surveys of the South West Fells including areas such as Barnscar and Burnmoor. He has also undertaken surveys of Lowther Park, Cumbria, Rufford Park, Lancashire and has also managed the recording programme of Lathom Hall and Park, Lancashire and the survey of the Forest of Bowland for United Utilities. He has been a project manager since 1995 and has managed over 250 very diverse projects since then, which are predominantly survey orientated, but of all periods from the Palaeolithic to the twentieth century.

- 5.1.3 Jamie is a qualified land surveyor (Topographic Sciences Diploma Glasgow University) and has an exhaustive knowledge and understanding of surveying techniques. He regularly runs training courses in survey techniques and has the expertise to devise a variety of low tech survey techniques for training volunteers.
- 5.1.4 **Excavation Director:** the excavations will be directed by **Andy Bates** BSc Msc (OA North Project Officer) who has considerable experience of archaeological excavation, having undertaken complex urban excavations in Gateshead and has undertaken a number of high profile community excavations, such as the medieval Castle at Lathom House. He specialises in studies of animal bone has published extensively on the subject.
- 5.1.5 **Project Surveyors:** the survey will be undertaken by **Peter Schofield** and **Alastair Vannan**. **Peter Schofield** (OA North Project Officers). Peter works full time on landscape surveys across the north-west. He has undertaken surveys at Hardknott Forest, Cumbria, Hartley Fold Estate, Cumbria, Ennerdale Valley, West Cumbria, a major programme of landscape survey across nine upland areas in North Wales, Little Asby Common for the Friends of the Lake District, and the Holwick and Force Garth surveys, Teesdale. With the exception of Jamie Quartermaine, he is our most experienced landscape archaeologist.
- 5.1.6 **Alastair Vannan:** Alastair Vannan has considerable experience in the survey of upland landscapes. Fore example he undertook with Peter the surveys of Buttermere and Nether Wasdale on behalf of the National Trust. He also has considerable experience of documentary work and undertook both the documentary study for the recent Holwick community survey, but also supervised the field teams. Alastair would undertake the documentary study for the proposed fulling mill survey. Alastair has been leading a number of community excavations, which included the major excavation of Lathom House (nr Ormskirk), and also the excavations of Stocks Church, Forest of Bowland.
- 5.1.7 **Karl Taylor:** the geophysical survey would be undertaken by Karl Taylor who has considerable experience of geophysical surveys having worked as a project manager for Stratascan and now works for Phase Surveys.

APPENDIX 3: SIZERGH PALAEOENVIRONMENTAL ASSESSMENT RECOMMENDATIONS

A3.1 CHARRED PLANT REMAINS/CHARCOAL

- A3.1.1 **Burnt Mound:** the burnt mound deposits and associated features, such as the trough and area of burning, should be checked for any palaeoenvironmental and dating material. The assessment will include checking the deposits for any charred plant remains (CPR), such as cereals and other edible remains. The preservation and potential for species identification of any charcoal will also be assessed in order to determine the type of wood used for the activity in the burnt mound.
- A3.1.2 Eight bulk samples taken from the burnt mound should be assessed, and should include two/three from the trough, one from the burnt stone and charcoal area, and four/five (series samples) from the burnt mound itself.
- A3.1.3 **Sizergh Ditch:** four bulk samples were taken from the two ditch sections. The ditch fills should also be assessed for any palaeoenvironmental remains. Given that the age of the ditch is unknown, the fills should be assessed for the recovery of any CPR and charcoal suitable for radiocarbon dating.

A3.2 WATERLOGGED PLANT REMAINS (WPR) /WOOD

- A3.2.1 **Burnt Mound Peat:** small sub-samples will be taken from the monolith underlying the peat in order to determine the type of vegetation growing at the site and how this changed over time. This information can be correlated with the pollen data as an aid to a reconstruction of both the local and regional environment. Bulk samples of the wood remains underlying the burnt mound and trough should also be assessed.
- A3.2.2 **Off-site sequence (the possible kettle hole):** the depth of the deposits in the boggy area near to the burnt mound reached over 3.5m in places. This consisted of roughly 2m of peat, overlying a succession of clay and marl deposits, a typical sequence found in kettle holes in Cumbria (eg Sparrowmire, which also had a burnt mound; Heawood and Huckerby 2002). Dates from similar features indicate initial infilling occurred during the late glacial period into the early Holocene.
- A3.2.3 The clay, marl, and peat deposits from such features contain abundant well-preserved pollen, and each of these stratigraphic units show marked vegetation types, associated with the late glacial temporary warm period, subsequent cooling, and amelioration in climate at the start of the Holocene. In order to determine whether the feature at Sizergh is a kettle hole, it would be extremely useful to assess the nature of the pollen against existing data. There are six stratigraphic units within the off-site sequence, and therefore it would be extremely useful to assess the pollen in each (six samples, assessment to be undertaken separately).
- A3.2.4 **On-site sequence (beneath and immediately adjacent to the burnt mound):** three samples should be assessed from the peat underlying the burnt mound in order to correlate this deposit with the main off-site sequence. The burnt mound appears to be situated on the periphery of the boggy area, and therefore the pollen there may be from a more local source and complement the data from the off-site sequence.
- A3.2.5 Several monoliths were taken from the clay-filled ?cut feature immediately adjoining the burnt mound, which appeared to contain lenses of small stones, possibly originating from the burnt mound itself. If this is the case, then the feature may be contemporary with the burnt mound, and provide a pollen record directly associated with the activity. Several depositional layers were apparent in this feature, and, ideally, five samples should be assessed for pollen.
- A3.2.6 **Sizergh ditch:** samples were taken through the ditch for microfossil analysis. It is recommended that at least four samples should be assessed for pollen. If pollen is preserved, it may provide an indication of the age of the ditch, which is likely to be important should no datable material be recovered by other means.

A3.3 SUGGESTED DATES FROM THE BURNT MOUND

- A3.3.1 It is suggested that two CPR/short-lived charcoal fragments from the burnt mound (upper and lower mound deposits) should be dated. Additionally, two dates should be obtained from the top of the peat underlying the burnt mound (two separate macrofossils or one humin and one humic date, per English Heritage recommendations; P Marshall *pers comm*). Finally, one CPR/short-lived charcoal fragment from other burnt mound features (trough/hearth) should be dated.
- A3.3.2 **Off-site sequence:** four dates from the peat (two separate macrofossils or one humin and one humic date from both the top and bottom of the peat, to be undertaken separately, should be obtained.
- A3.3.3 **Sizergh Ditch:** a single date from the base of the ditch should be obtained, if there is any datable material.
- A3.3.4 **Dendrochronology Date:** if the oak wood from the trough proves to be suitable, a date can be obtained for this feature.

A4.1 STRATIGRAPHIC SURVEY

The data from the stratigraphic survey across the Sizergh kettle hole need to be analysed to define the stratigraphic sequences, and drawings need to be compiled (to be undertaken separately).

APPENDIX 4: RADIOCARBON ASSAY CALIBRATION PLOTS

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RADIOCARBON DATING CERTIFICATE

17 July 2014

Laboratory Code SUERC-53872 (GU34300)**Submitter** Denise Druce
Oxford Archaeology North
Mill 3, Moor Lane Mills
Moor Lane
Lancaster LA1 1GF**Site Reference** Sizergh Kettle Hole**Sample Reference** Core (A) 8-10 cm (humin)**Material** Peat : Humin fraction **$\delta^{13}\text{C}$ relative to VPDB** -29.2 ‰**Radiocarbon Age BP** 1625 \pm 35

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or telephone 01355 270136 direct line.

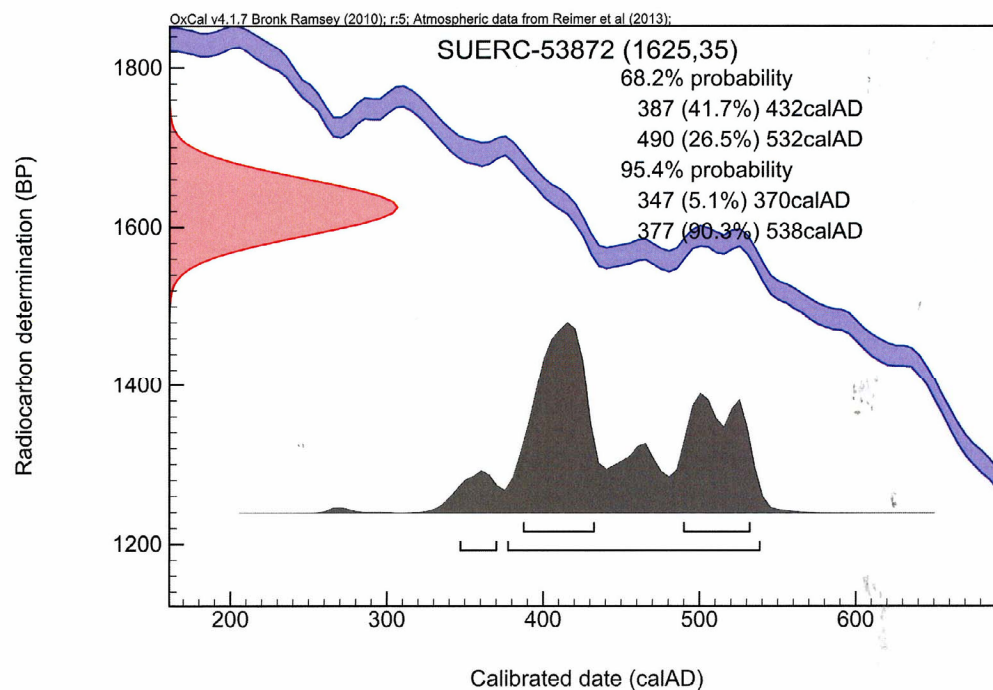
Conventional age and calibration age ranges calculated by :-

Date :- 17/07/2014

Checked and signed off by :-

Date :- 17/07/2014

**University
of Glasgow**The University of Glasgow, charity number SC004401The University of Edinburgh is a charitable body,
registered in Scotland, with registration number SC005336

Calibration Plot

Calibration Plot for SUERC-53872 - Humin Sample at core depth 0.8-0.1m

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RADIOCARBON DATING CERTIFICATE

17 July 2014

Laboratory Code SUERC-53873 (GU34301)**Submitter** Denise Druce
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Mill 3, Moor Lane Mills
Moor Lane
Lancaster LA1 1GF**Site Reference** Sizergh Kettle Hole**Sample Reference** Core (A) 8-10 cm (humic)**Material** Peat : Humic Acid **$\delta^{13}\text{C}$ relative to VPDB** -29.5 ‰**Radiocarbon Age BP** 1396 \pm 35

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :-

Date :- 17/07/2014

Checked and signed off by :-

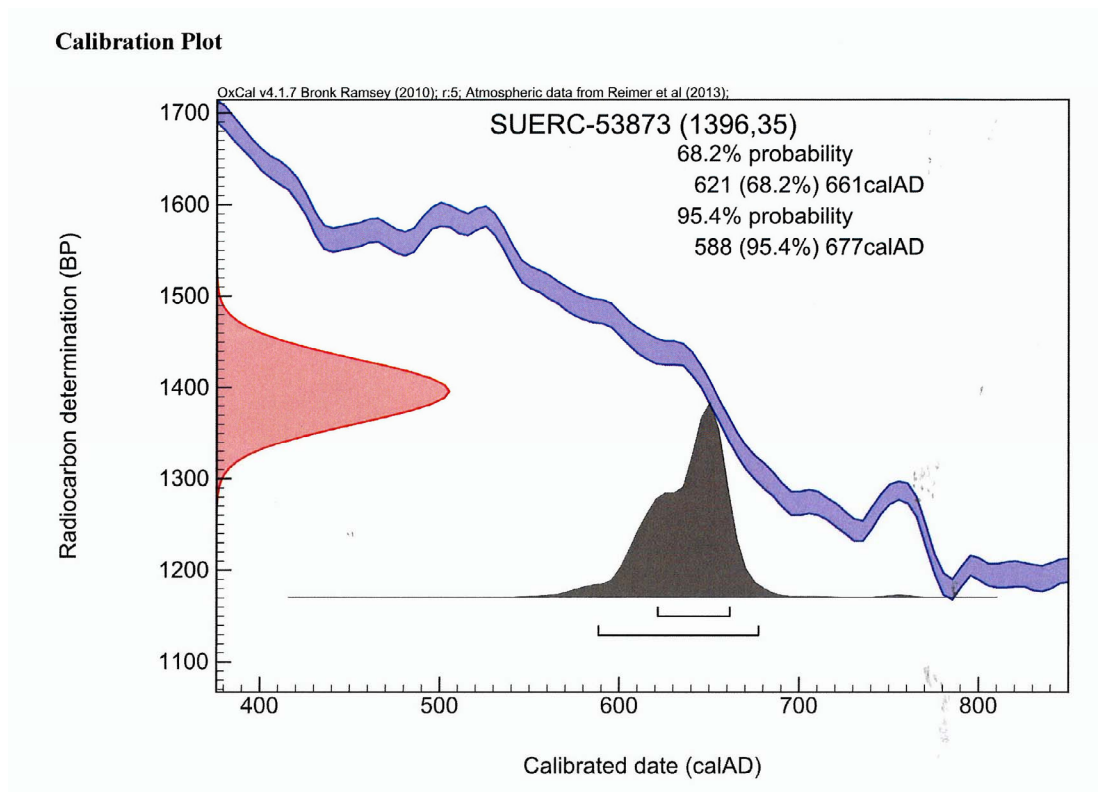
Date :- 17/07/2014



The University of Glasgow, charity number SC054401



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Calibration Plot for SUERC-53873- Humic Sample at core depth 0.8-0.1m

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RADIOCARBON DATING CERTIFICATE

18 August 2014

Laboratory Code	SUERC-54703 (GU34700)
Submitter	Denise Druce Oxford Archaeology North Mill 3, Moor Lane Mills Moor Lane Lancaster LA1 1GF
Site Reference	Sizergh Kettle Hole
Context Reference	n/a
Sample Reference	Core (A) 148-150 cm (humic)
Material	Peat : Humic Acid Dated
$\delta^{13}\text{C}$ relative to VPDB	-30.2 ‰
Radiocarbon Age BP	9026 \pm 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- *E. Dunbar*

Date :- 18/08/2014

Checked and signed off by :- *P. Naysmith*

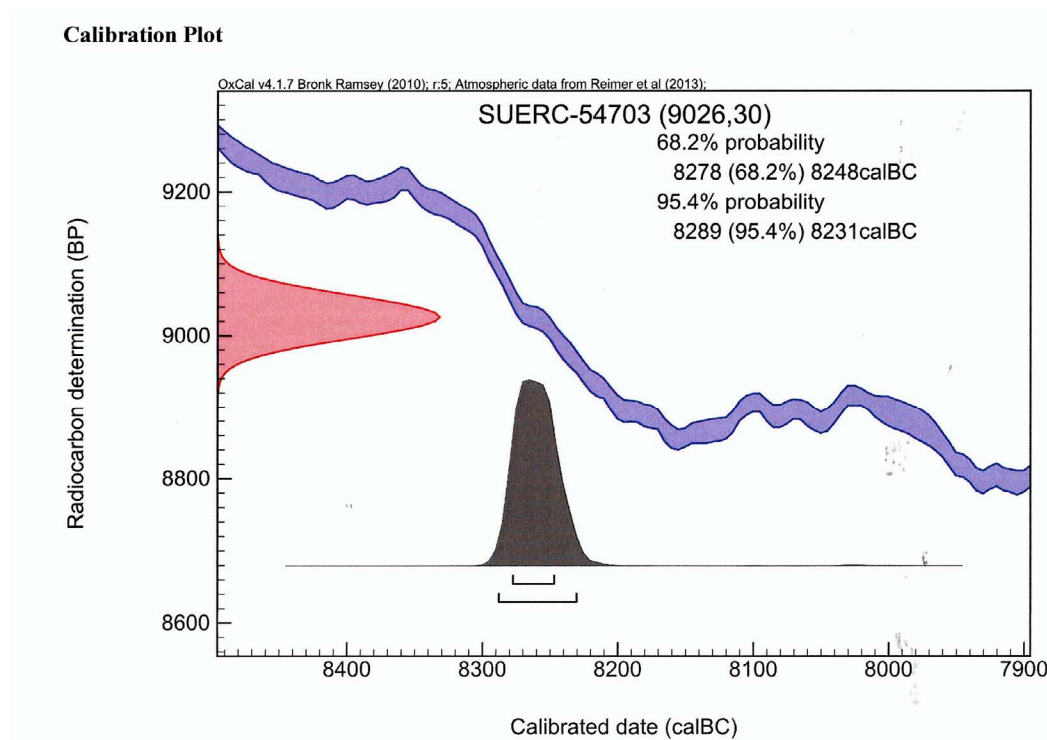
Date :- 18/08/2014



The University of Glasgow, charity number SC054401



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Calibration Plot for SUERC-54703 - Humin Sample at core depth 1.48-1.5m

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RADIOCARBON DATING CERTIFICATE

18 August 2014

Laboratory Code SUERC-54704 (GU34701)

Submitter Denise Druce
Oxford Archaeology North
Mill 3, Moor Lane Mills
Moor Lane
Lancaster LA1 1GF

Site Reference Sizergh Kettle Hole
Context Reference n/a
Sample Reference Core (A) 148-150 cm (humins)

Material Peat : Humins Dated

$\delta^{13}\text{C}$ relative to VPDB -31.1 ‰

Radiocarbon Age BP 9156 \pm 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- E. Dunbar

Date :- 18/08/2014

Checked and signed off by :- P. Maynard

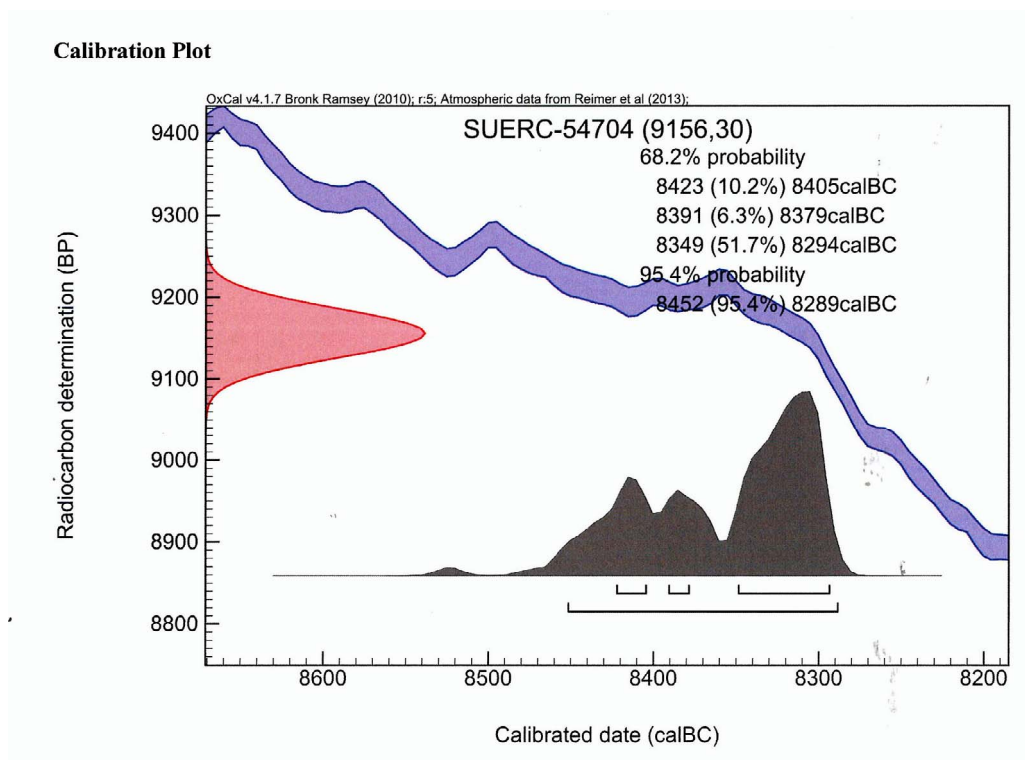
Date :- 18/08/2014



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Calibration Plot for SUERC-54704 - Humic Sample at core depth 1.48-1.5m

ILLUSTRATIONS

FIGURES

Figure 1: Site Location

Figure 2: Selected monuments within the Sizergh Estate

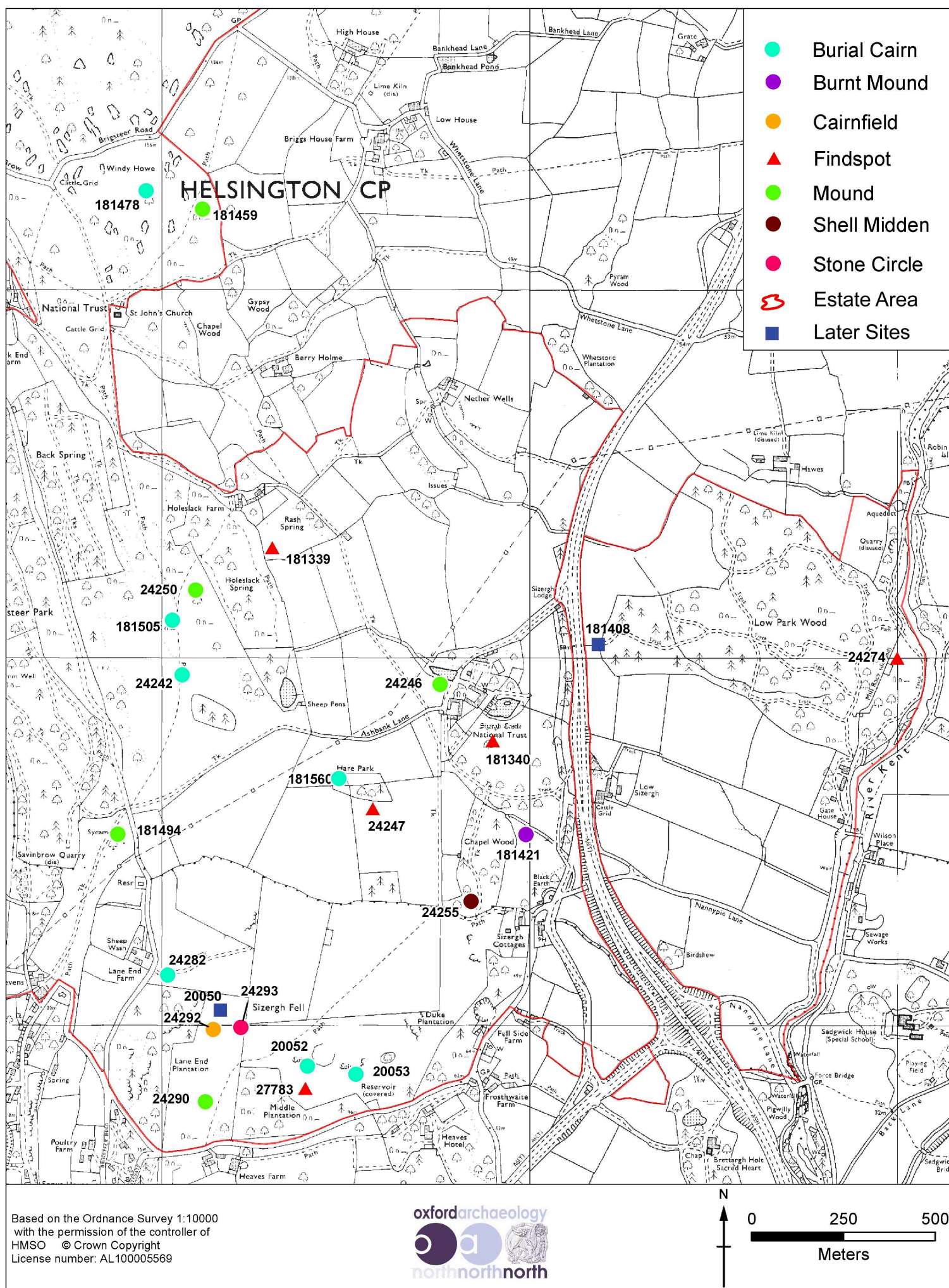
Figure 3: Topographical features on the Sizergh Estate, overlain on Lidar mapping

Figure 4: Contour mapping of the kettle hole and burnt mound from the photogrammetric survey showing the location of the transects

Figure 5 Borehole transect points overlain on the Lidar mapping, and the stratigraphic results of the transects



Figure 1: Site location



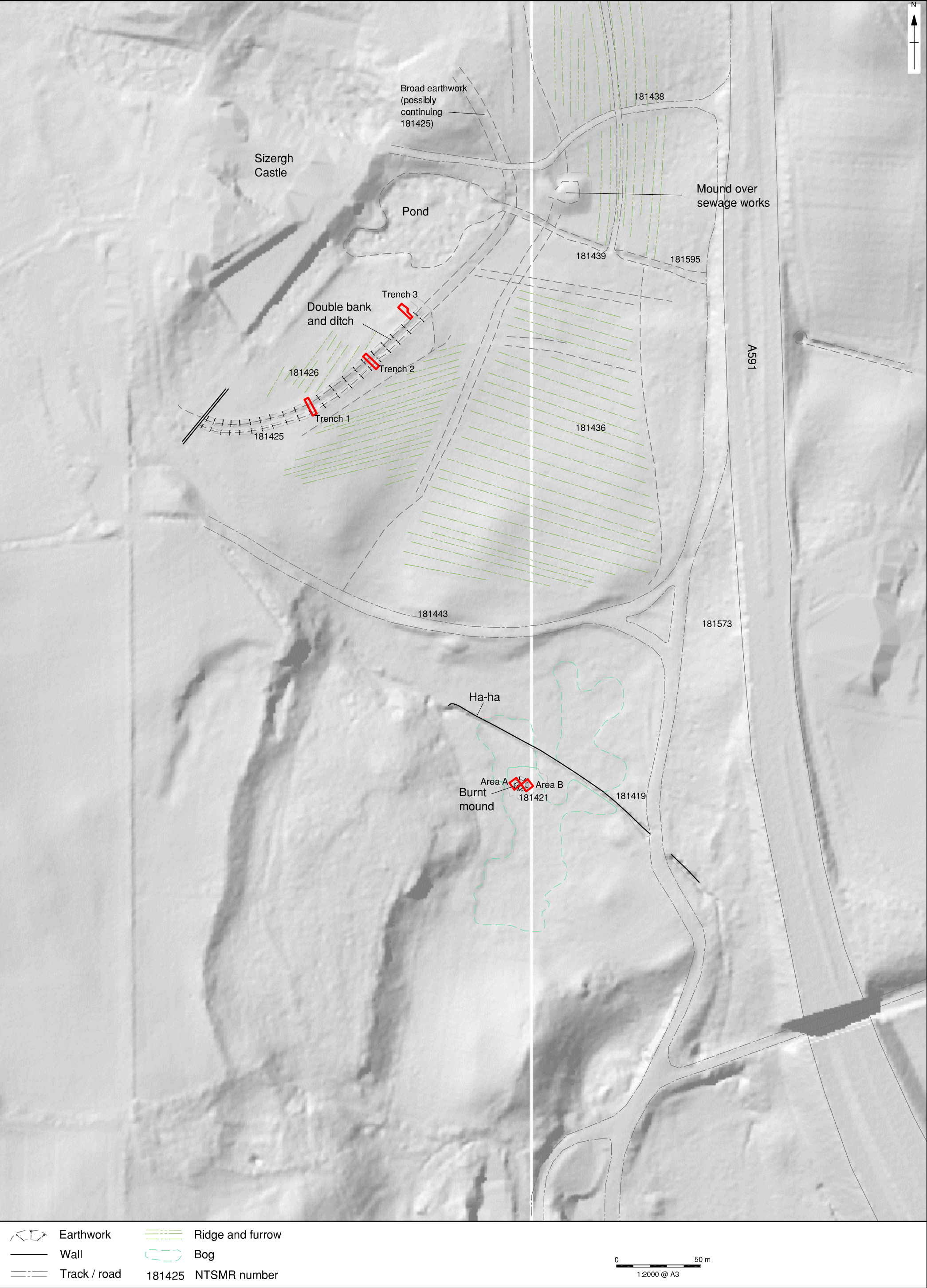


Figure 3: Topographical features on the Sizergh Estate, overlain on LiDAR mapping

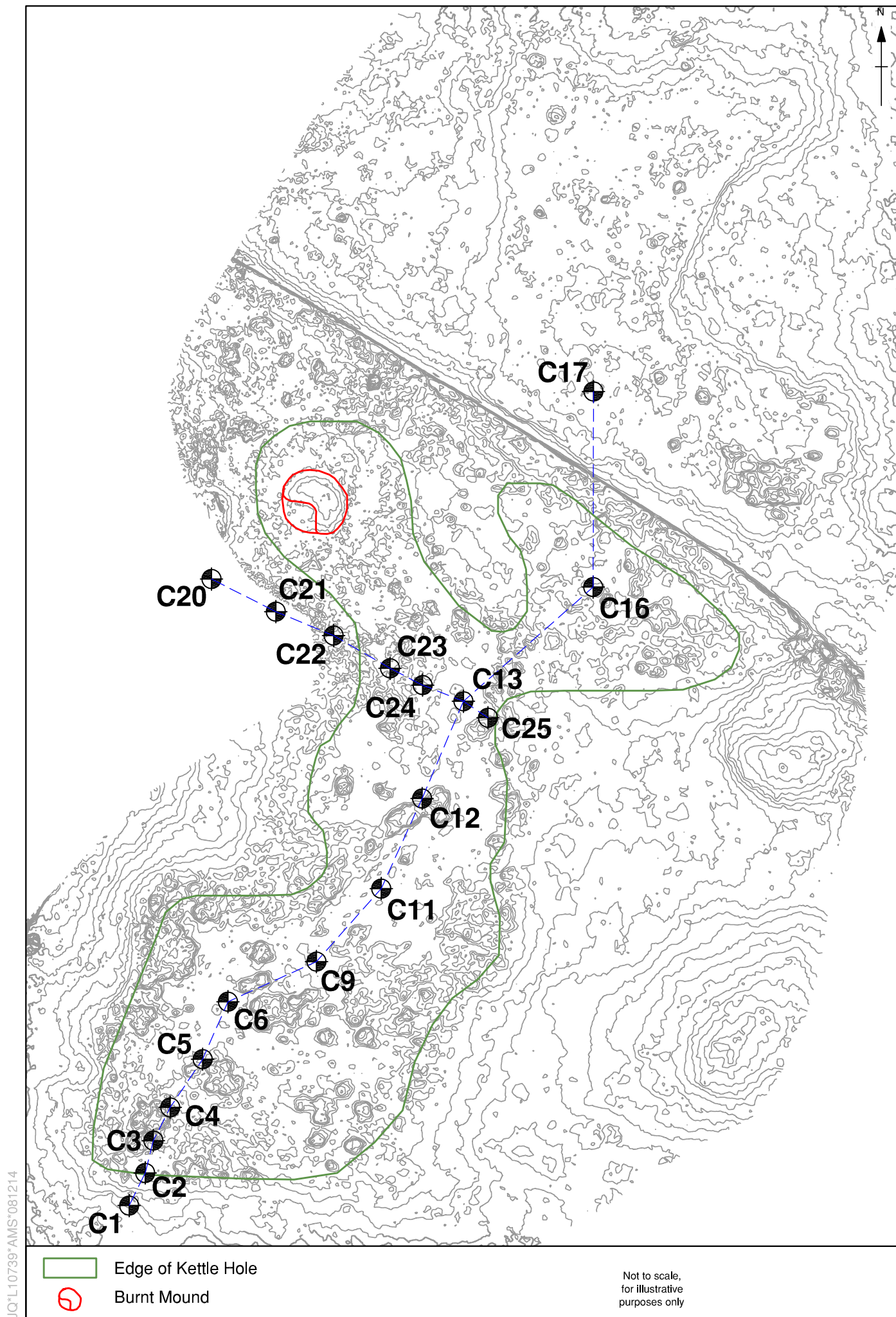


Figure 4: Contour mapping of the kettle hole and burnt mound from the photogrammetric survey showing the location of the transects

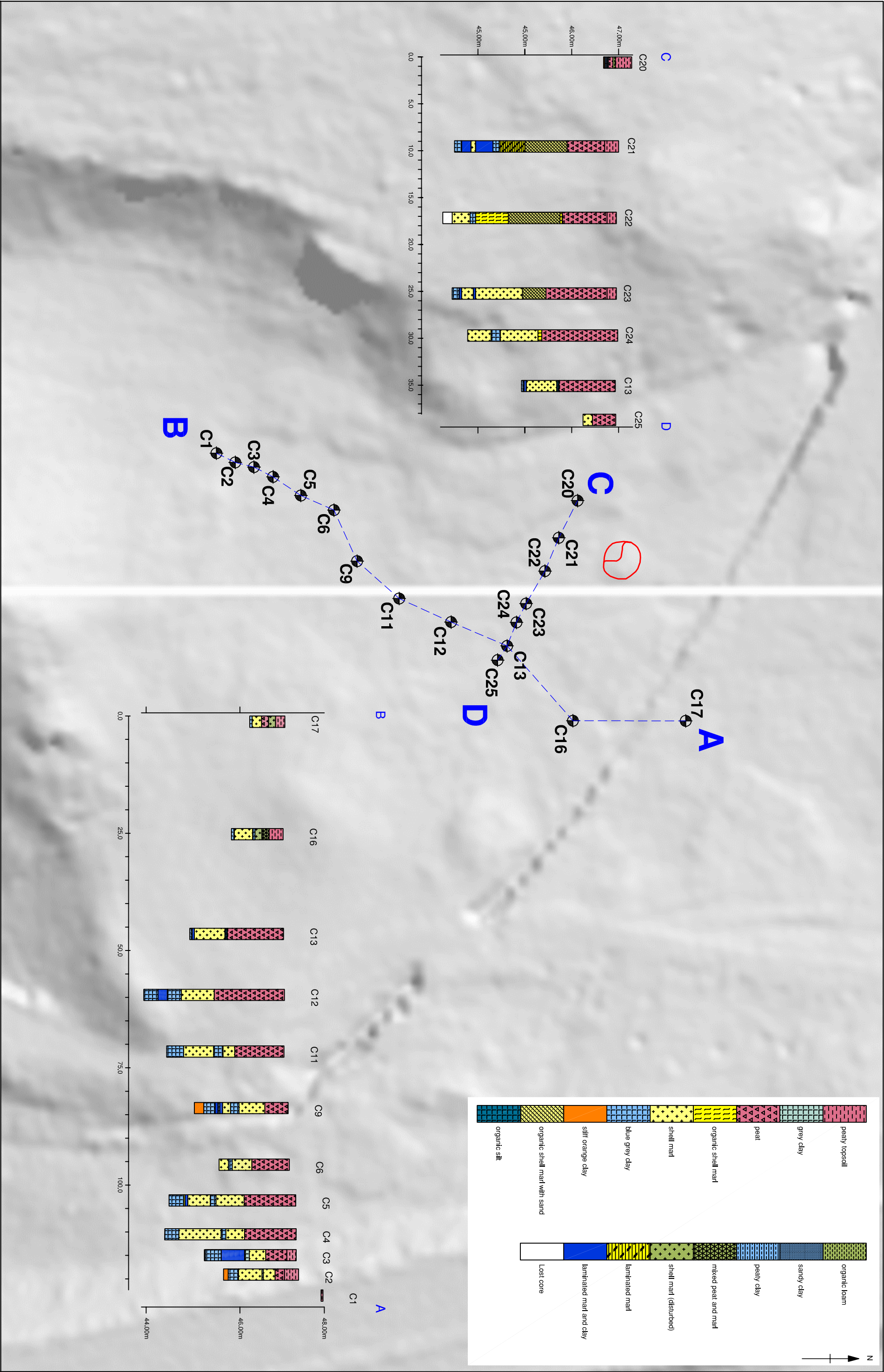


Figure 5: Borehole transect positions overlain on the LiDAR mapping and the stratigraphic results of the transects

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