ROAN EDGE QUARRY, NEW HUTTON, CUMBRIA

Palaeoenvironmental Assessment

Oxford Archaeology North

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CONTENTS

SUMMARY

Oxford Archaeology North (OA North) was commissioned by Cemex UK Operations Ltd to undertake a palaeoenvironmental assessment of land to the west and south-west of Roan Edge Quarry, Cumbria (area centred SD 5840 9250). Following on from a desk-based assessment and walkover survey, undertaken in April 2004 as part of the same planning application (5/05/9005), Cumbria County Council's Historic Environment Service (CCCHES) advised that a programme of predetermination archaeological work consisting of palaeoenvironmental sampling was required.

The archaeological work consisted of core sampling along two transects traversing the proposed quarry extension. In accordance with a verbal brief provided by CCCHES, this programme was intended to inform any further archaeological evaluation work by assessing the survival and extent of the peat deposits within the proposed development area and, consequently, the potential for archaeological remains.

The fieldwork was carried out in April 2006, and comprised an auger survey in order to record the sediment sequence in the area of development. In total, 21 cores were taken over two transects crossing the site. The on-site investigations showed that most of the site consisted of *c* 0.1m of topsoil overlying silt and solid geology. However, one small pocket of peat was situated at the southernmost corner of the site, but further investigations confirmed that it consisted only of up to 0.8m of modern *Sphagnum*.

A subsequent walkover of the site revealed a further small pocket of peat *c* 1.5m deep positioned approximately north of centre of the site, Sample Site 2, at NGR SD 5819 9260. This was sampled with a Russian-type auger and assessed for palaeoenvironmental indicators. The assessment showed it to contain a very well-preserved environmental record, which is likely to represent mid-late Holocene vegetation at the site.

Information provided from a previous assessment of the site (OA North 2004) showed that the site and its immediate area were subject to extensive peat-cutting and drying on moss allotments and spreading out areas. Therefore, the site is likely to have been denuded of its peat levels during this time, leaving the small pocket at Sample Site 2 within a small hollow or glacial feature.

Given the lack of both undated and dated pollen diagrams from this area of Cumbria, a programme of detailed palaeoenvironmental analyses is recommended. In addition, it is recommended that at least three samples are submitted for radiocarbon dating in order to provide a chronological framework with which to interpret the environmental data.

ACKNOWLEDGEMENTS

OA North would like to express its thanks to Jo Davies of Cemex UK Operations Ltd for commissioning the work. Thanks are due to Jeremy Parsons, Assistant Archaeologist, at the Cumbria County Council's Historic Environment Service for help and information. Thanks also to the Geography Department of Lancaster University for the use of their laboratory facilities.

The fieldwork was undertaken by Sandra Bonsall, Pete Schofield, and Denise Druce. The pollen samples were prepared by Sandra Bonsall, and Denise Druce carried out the palaeoenvironmental assessment and wrote the report. The report was edited by Elizabeth Huckerby and Emily Mercer, who also managed the project.

1. INTRODUCTION

1.1 CIRCUMSTANCES OF THE PROJECT

1.1.1 Oxford Archaeology North (OA North) was commissioned by Cemex UK Operation Ltd to undertake a programme of palaeoenvironmental assessment of land to the west and south-west of Roan Edge Quarry, Cumbria (area centred SD 5840 9250). A planning application has been submitted (reference 5/05/9005) to extend the present quarry westwards, equating to an area of approximately 20ha in extent. An initial desk-based assessment and walkover survey were undertaken by OA North in 2004 to assess the archaeological potential of the proposed extension area. Following these results, Cumbria County Council's Historic Environment Service (CCCHES) requested a programme of pre-determination archaeological work consisting of palaeoenvironmental sampling to assess the peat deposits. It is intended that this work will inform the requirement for any further archaeological evaluation work.

1.2 LOCATION, GEOLOGY, AND TOPOGRAPHY

1.2.1 The proposed development site lies on New Hutton Common, approximately 7km east of Kendal and 7km west of Sedbergh, to the south-west of junction 37 of the M6 motorway (Fig 1). The settlement of New Hutton, which gives its name to the parish, is located to the south-west, and the site itself lies close to former parkland and hilly, poorly drained areas of peat moss which, although enclosed, appear largely uncultivated. The land within the proposed development site is gently sloping, with heights of between 250m and 330m above mean sea level (Ordnance Survey 1993).

1.2.2 New Hutton lies within the South Cumbria Low Fells, where most of the area is underlain by relatively hard rocks: mudstones, siltstones, and sandstones (Countryside Commission 1998, 65-6). The rich geological resource is also reflected in the other quarries and gravel pits present in the area during the nineteenth century (CRO(K) WQR/I 63 1847).

1.3 HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

1.3.1 ***Introduction:*** the background overview is reproduced from the Archaeological Desk-Based Assessment and Walkover Survey (OA North 2004). This concluded that the proposed quarry extension was on land, which had been part of New Hutton Common, an area of unimproved moorland, until the early nineteenth century, after which time little activity was demonstrable.

1.3.2 ***Prehistoric Period:*** there is considerable evidence for prehistoric activity close to the site, but nothing is known from the study area itself. For example, there is a record from 1868, which states that workmen discovered a Neolithic cist burial in the township of Kendal (Bingham 1995, 30). Also from the same general area, finds include flints (HER 2468), two separate prehistoric axe

finds (HER 2481, 2486), a stone mace (HER 2485), and a barrow and cairnfield (HER 4160) (OA North 2001, 7).

1.3.3 Bronze Age activity is known within around 7km of New Hutton Common, where a burnt mound was excavated at Sparrowmire Farm on the northern edge of Kendal (Heawood and Huckerby 2002). The mound itself was composed of burnt stone, silt, and charcoal, with a wooden trough in the centre. The trough appeared to have been repaired at some stage, and the mound to have been in use for a considerable length of time (*op cit*, 45). No artefacts were found which were contemporary with the use of the burnt mound (*op cit*, 46). In the Iron Age, the area seems to have come under the control of the Brigantes tribe (Cunliffe 1991), and although there are no known remains of the Iron Age within the study area, Castlesteads hillfort lies close to the site, to the south-east of Kendal (Bingham 1995, 31).

1.3.4 ***Roman Period:*** the Roman road between Ribchester and Tebay runs 5km to the east of New Hutton Common (Margary 1973, 377-82; Ordnance Survey 1984), and there is a fort at Low Borrowbridge, approximately 9km to the north of New Hutton Common. Roman military presence in the vicinity is further attested by the 3.27 acre fort at Watercrook, south of Kendal,and excavations have revealed evidence for an associated extramural settlement to the south and east (Potter 1977). More specifically, Roman activity is known within the study area, due to the discovery of a fourth century gold coin on Broadhead farm sometime before 1926 (Shotter 1996, 113).

1.3.5 A possible Romano-British settlement has been identified at Birks Farm (HER 2088), approximately 1.5km north-west of the proposed development area. To date, work on the site appears to have comprised survey only, but parallels have been drawn between the Birks Farm settlement and a settlement at Stone Walls in Urswick. Excavations at Stone Walls led to the attribution of a first or second century BC date for the site (Dobson 1907, 93), although this is far from certain.

1.3.6 ***Medieval Period:*** evidence for medieval activity can be drawn from documentary sources. The distinction between New Hutton and Old Hutton seems to have occurred towards the end of the thirteenth century, before which the settlement, possibly Old Hutton, was known simply as Hutton (Nicolson and Burn 1777, 106). By the early fourteenth century New Hutton is documented; in 1337 *Noua-Hoton* appears in the Lay Subsidy Rolls (Smith 1967, 131). The study area is likely to have been used for no more than peat extraction and quarrying during this period, as it was until the early twentieth century.

1.3.7 ***Post-medieval Period:*** New Hutton Common was enclosed in 1847 (CRO(K) WQR/I 63 1847). It is unclear from the award what was already in place at the time and what was newly created as part of the enclosure, but the people of the township were provided with a recreation ground, conveniently situated on the side of the Sedbergh to Kendal turnpike road. Again, it is not clear if the road was turnpiked as part of the enclosure, or if it had been turnpiked previously. Another notable feature, apparently unusual for enclosure systems, was the setting out of moss allotments. These included spreading grounds on which to

lay the cut peat to dry, and private carriage roads to allow the dry peat to be taken away. It is possible that the public watering place for cattle/sheep wash, was already in existence, and that it was simply documented as an element that continued from the period of enclosure. Another notable feature in the landscape, although unassociated with the enclosure, was the Killington Reservoir to the south-east, which was used for storing water for the Lancaster-Kendal canal (Northern Archaeological Associates 2000).

1.3.8 During the walkover survey for the initial archaeological assessment of the site two features were noted (Sites 29 and 30, OA North 2004). Their origin and function were believed to possibly relate to earlier quarrying or peat cutting, presumably from the post-medieval period.

1.4 PALAEOENVIRONMENTAL BACKGROUND

1.4.1 Investigations at Sparrowmire Farm, Kendal (SD 5130 9415), in advance of housing development, revealed a burnt mound and an area of peat (Heawood and Huckerby 2002). Palynological analysis was carried out on a 2.06 m deep deposit *c* 30m from the burnt mound, and on a 0.3m band of peat, which ran directly under the burnt mound itself.

1.4.2 The deeper deposit consisted of a basal layer of *c* 0.7m of clay and shell marl, sealed by 1.35m of herbaceous and wood peat, which is likely to have developed in a small lake/kettlehole. The base of the peat was dated to 10,933-9979 Cal BC (10,440 ± 90 BP; GU-8435), during which time the environment was made up of open grassland and associated herbaceous taxa. Following on from this, scrub woodland of birch, juniper and willow became established on drier ground following the amelioration in climate during the early Holocene. A rapid increase in alder and oak pollen at 0.395-0.405m depth, dated to 5526-5361 Cal BC (6465 ± 60 BP; GU-8446), suggests that alder carr developed at the site during the Mesolithic period. A temporary clearance episode, indicated by a slight increase in herbaceous pollen alongside the presence of cereal-type pollen, is also recorded at 0.32m depth. Dated to 4667-4350 Cal BC (5645 ± 60 BP; GU-8434), this clearance episode may indicate very early cereal cultivation in the area. This early date from near the surface of the peat at Sparrowmire Farm suggests that the deposits are severely truncated (Heawood and Huckerby 2002).

1.4.3 Palynological work carried out at Archer Moss, a blanket peat bog situated on a watershed at Carlinghill, Howgill Fells, recorded vegetation changes at the site since 2050-1500 cal BC (3480 ± 100 BP; GAK-4533) (Cundill 1976 cited in Harvey and Chiverrell 2004). The pollen record at this site recorded several clearance episodes, which were not dated, however, but were interpreted as becoming most marked during the Bronze Age period. Through cross-correlation with a nearby pollen site, Cundill (*op cit*) suggested that an episode of large-scale clearance took place in the area during the late Iron Age/Romano British period. This episode in the pollen record was represented by a marked reduction in tree and shrub pollen, accompanied by an increase in heather, grasses, sedges and bracken, plus an expansion in the pastoral indicator ribwort plantain (*op cit*).

1.4.4 A subsequent major clearance episode took place towards the top of the Archer Moss diagram, which Cundill (*op cit*) attributed to Norse colonisation in the tenth and eleventh centuries and the introduction of large scale sheep farming in the uplands (*op cit*). Subsequent work by Harvey and Chiverrell (2004) on the same deposits at Archer Moss has highlighted the importance of these clearance signals in relation to changes in surface wetness and slope instability.

1.4.5 A more complete pollen record was identified from a peat bog at Wet Sleddale, eastern Cumbria (NY 558 130), which showed clearance activity and cereal cultivation to be taking place in the area during the Bronze Age, at c 1856-1520 cal BC (3350 ± 55 BP; AA-28375 (Wells pers comm; Chinn and Innes 1995). In addition, a very marked clearance episode took place during the Romano British period, at cal AD 110-380 (1785 ± 50 BP; AA 28374) (*op cit*) and, like the pollen record from Archers Moss, this episode at Wet Sleddale was represented by an increase in heather and bracken alongside evidence for pastoralism and cultivation.

1.4.6 Heawood and Huckerby (2002) highlighted that in contrast to many other parts of the Lake District, there are few published pollen diagrams for the Late-Devensian and Holocene from the eastern edge of Cumbria. In addition, studies that have been published, such as Skelsmergh Tarn and Kentmere (Walker 1955), lack adequate absolute dating (Heawood and Huckerby 2002). Given that the peat deposits at Sparrowmire were missing a palaeoenvironmental record of up to the last 6670 years, and that the pollen record at Archer Moss lacks sufficient radiocarbon dating, any subsequent Holocene sites are of considerable regional importance.

2. METHODOLOGY

2.1 PROJECT DESIGN

2.1.1 A project design (*Appendix 1*) was submitted by OA North for a palaeoenvironmental assessment and was tailored to satisfy a verbal brief provided by CCCHES. The project design was adhered to where applicable; in the light of the site work showing there to be very little peat coverage across the study area, no geographical mapping could be undertaken and only one sampling location was assessed for palaeoenvironmental indicators. The work was consistent with the relevant standards and procedures of the Institute of Field Archaeologists, and generally accepted best practice.

2.2 PALAEOENVIRONMENTAL ASSESSMENT

2.2.1 ***Introduction:*** the site of the quarry extension had not been subject to any previous intrusive archaeological investigation, and therefore knowledge of any unidentified archaeological sites was limited. Assessment of the survival of palaeoenvironmental deposits to examine the survival and extent of the peat can inform the likely age of any archaeological finds or monuments preserved beneath or within it. Peat can preserve both prehistoric archaeological remains and environmental indicators, such as pollen, waterlogged plant remains and other biological indicators, due to the unique combination of anaerobic and waterlogged conditions. The study of such biological indicators allows us to reconstruct past changes in the climate and vegetation, which can also be indicative of human factors in prehistory and more recent periods.

2.2.2 An open chambered Eijkelkamp gauge auger was used to record the peat/sediment depth down to underlying mineral deposits at 21 core locations. These were positioned at a sampling interval of 50m over two transects crossing the proposed quarry extension, which was agreed with CCCHES prior to commencement of the fieldwork. However, obstructions on site, namely a large earthwork mound, required some modification of the core positions in order to obtain a representative sample strategy (Fig 2). The geographical position of each core and its height aOD was recorded by GPS and input into a GIS database.

2.2.3 Following the programme of coring, which produced little evidence of peat, a walkover assessment of the site located a single area of peat to the west of Core 5 (Fig 2). This was sampled with a Russian-type peat corer that would enable an assessment of the biological indicators as appropriate. This included charred and waterlogged plant macrofossils, pollen, insect remains, and the potential for radiometric dating of the peat deposits was also assessed;

- Stratigraphy: the stratigraphy of the core sample was recorded by stratigraphic unit, and written descriptions placed within the archive. Samples were selected for the assessment of pollen, waterlogged and charred plant remains, insect, and other environmental indicators.

- Palynology: the samples were prepared for pollen using standard procedures (Faegri and Iverson 1989) and mounted in silicone oil. Two exotic (*Lycopodium*) spore tablets were added to each sample to provide a standard counting reference and to determine pollen concentrations. The pollen slides were examined with an Olympus BH-2 microscope using x400 magnification routinely and x1000 for critical identifications. Counting continued, where possible, until a sum of between 100 and 150 pollen grains from land pollen types was reached on two or more complete slides, to reduce the possible effects of differential dispersal under the coverslip (Brooks and Thomas 1967). Easily identifiable pollen grains were recorded, those from broad groups, e.g. grasses, and the dandelion family (*Asteracea*e), were also recorded and grains not identified quickly were recorded. Pollen identification was carried out using the standard keys of Faegri and Iversen (1989) and Moore *et al* (1991) and a small reference collection held at OA North. Cereal-type grains were not differentiated into types at this stage. Microscopic charcoal fragments were quantified where present, and the presence of any fungal spores was also noted. Plant nomenclature follows Stace (1991).

- The state of preservation of the pollen was also noted and the indeterminate grains were recorded using groups based on those of Birks (1973). Charcoal particles greater than 5µm were also recorded following the procedures of Peglar (1993).

  Pollen data was recorded on standard *proforma* sheets, which were integrated into the site archive. This data was calculated as a percentage of the pollen sum of all land pollen and is presented in tabular form.

- Waterlogged and charred plant remains: the potential for waterlogged and charred plant remains was assessed. These were wet-sieved through a series of standard meshes and the residues examined with a binocular microscope. All types of plant material were noted and identified if possible, as were their relative quantities, in a simple scale of abundant–rare.

2.3 ARCHIVE

2.3.1 A full archive has been produced to a professional standard in accordance with current United Kingdom Institute for Conservation (UKIC 1990) and English Heritage guidelines (English Heritage 1991). The paper and digital archive will be deposited with the Cumbria County Record Office (Kendal) on completion of the project. Copies of the report will be deposited with the Cumbria HER in Kendal.

3. PALAEOENVIRONMENTAL ASSESSMENT RESULTS

3.1 CORING SURVEY

3.1.1 In total, 21 cores were taken initially across the site (Fig 2). However, the investigation revealed that most of the site consists of up to *c* 0.15m of topsoil overlying silt and solid geology (*Appendix 2*). Core 4 also contained *c* 0.15m of clay overlying 0.27m of silty-stony-clay, and Core 14 contained just 0.25m of reed peat. This same area of peat deepened slightly towards the south (marked as area of marsh on Fig 2), but further investigations confirmed that it only consisted of up to 0.8m of modern *Sphagnum* peat and, representing relatively recent growth, would therefore provide very little palaeoenvironmental information.

3.1.2 A walkover of the site, undertaken to investigate the potential for further areas of peat, revealed a further small pocket *c* 1.50m deep (NGR SD 5819 9260, Sample Site 2; Fig 2). This was sampled with a Russian-type auger and assessed for palaeoenvironmental indicators, the results of which are given below. The small pocket is likely to represent a small hollow or glacial feature in which the peat has developed. The stratigraphy of the peat from this hollow is as per Table 1:

Depth	**Peat Description**
0-0.16m	Not sampled
0.16-0.27m	Loose fibrous peat
0.27-0.38m	Humified peat
0.38-0.82m	Slightly humified peat
0.82-1.21m	Humified peat
1.21-1.54m	Humified wood-peat

Table 1: Stratigraphy of the peat encountered at Sample Site 2

3.2 POLLEN AND MACROFOSSIL ASSESSMENT

3.2.1 The results of the pollen assessment and associated macrofossil remains from Sample Site 2 are shown in *Appendix 3*. The macrofossil remains and microfossil charcoal fragments are shown as a scale of abundance where + is rare, ++ is occasional, +++ is frequent, and ++++ is abundant. The pollen data are given as actual counts and as percentage of total land pollen (TLP), which includes the total sum for trees/shrubs/climbers, dwarf shrubs, crop plants, and herbaceous pollen. The fungal/algae spores are assigned to groups defined by Van Geel (1978).

3.2.2 Twelve samples were processed from Sample Site 2 for pollen and plant macrofossil analysis. Pollen preservation was generally good. However, no pollen was present in the sample taken at 0.4m depth, the reason for which

cannot be ascertained at this stage, and levels of pollen in the two uppermost samples were low, perhaps reflecting very rapid accumulation rate.

3.2.3 Most of the samples contained abundant monocotyledon and *Sphagnum* remains, and the samples at and below 0.66m also contained wood fragments. Other plant remains included seeds of *Carex* sp. (sedge), *Potamogeton* (pondweed), and *Juncus* (rush), which are likely to have come from plants growing directly on the bog surface. Similarly, the leaves of *Erica* (heaths) at 0.66m depth, and *Vaccinium oxycoccus* (bilberry) are likely to have came from the surface vegetation. The presence of *Plantago lanceolata* (ribwort plantain) suggests that the vegetation surrounding the site had undergone some disturbance.

3.2.4 The lowermost sample, at 1.52m, was dominated by arboreal pollen, and the abundant wood fragments at this level suggest that woodland was growing very nearby, or indeed directly on the site. The tree pollen was dominated by *Corylus avellana/Myrica gale* (hazel/bog myrtle) with limited *Betula* (birch), *Alnus* (alder), and *Quercus* (oak). The high number of *Pteropsida* (fern) spores suggests that the woodland was fairly open, and much of the herbaceous pollen, such as *Filipendula* (meadowsweet) and *Potentilla* (cinquefoils) possibly represent vegetation growing on, or on the margins of, the bog.

3.2.5 At 1.42m depth, values of arboreal pollen drop to just over 50% TLP, and is still dominated by hazel, with a slight increase in oak and *Salix* (willow). *Calluna vulgaris* (heather) pollen also increases slightly, and *Rumex* sp. (docks) and *Poaceae* (grass) pollen dominate the herbaceous assemblage.

3.2.6 A slight regeneration in the woodland occurs at 1.25m depth, but above this arboreal pollen continues to decline. A marked change in the pollen record occurs at 0.9m depth, which is represented by an increase in heather, sedge and ribwort plantain, plus the first indications of cereal cultivation. Levels of *Sphagnum* spores and *Potamogeton* pollen also increase at this level, which suggests that conditions may also have become wetter at this time also.

3.2.7 The general decline in woodland continues, and at 0.36m arboreal pollen only makes up 3.61% TLP. The landscape by then was more or less totally open and dominated by a mosaic of heather and grassland.

4. CONCLUSION

4.1 DISCUSSION

4.1.1 It is likely that the peat has been truncated across the site, given the information provided during the previous desk-based assessment (OA North 2004). During the post-medieval period, moss allotments and spreading grounds were created for the cutting and drying out of peat, together with private carriage roads in order to carry the peat away (see *1.3.7*). This suggests substantial peat cutting activity, which probably denuded the site of its peat levels, leaving all that remained found at Sample Site 2 in a small hollow. Nevertheless, it is difficult to definitively ascertain without further analysis of the pollen and plant macrofossil record. Similarly, it is difficult from present evidence to place the deposits within a chronological framework, but comparable levels of pollen types at Archer Moss suggest that the lowermost deposits at Roan Edge Quarry could be Iron Age/Romano-British in date. This is based on the percentages of the arboreal pollen, and the relative abundance of heather, grass, sedge, and ribwort plantain pollen. Indeed, it is possible that the increase in disturbance levels and accompanying evidence for cereal cultivation could equate with the increased human activity recorded during the Romano-British period at both Archers Moss and Wet Sleddale, or with the tenth/eleventh Cumbrian upland settlement suggested by Cundill (1976; cited in Harvey and Chiverrell 2004).

4.2 IMPACT

4.2.1 The assessment has shown that the small peat deposit in the proposed development site at Roan Edge Quarry contains a well preserved record of vegetation change, perhaps dating to the Iron Age/Romano British period or earlier. Changes in the pollen record are likely to represent shifts in vegetation, primarily, equated with human disturbance and changes in climate. In addition, the palaeoenvironmental record at Roan Edge Quarry will potentially enhance current research underway nearby at Archer Moss (Harvey and Chiverrell 2004), which plans to highlight the importance of clearance episodes in relation to changes in surface wetness and slope instability.

4.3 RECOMMENDATIONS

4.3.1 Given the regional importance of the site, plus the lack of undated and dated pollen diagrams from this area of Cumbria, it is recommended that a detailed programme of palaeoenvironmental analyses be carried out on the peat deposits at Roan Edge Quarry.

4.3.2 In addition, it is recommended that at least three samples be submitted for radiocarbon dating in order to provide a chronological framework with which to interpret the pollen data, and to date key events in the pollen diagram.

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6. ILLUSTRATIONS

Figure 1: Site Location Map

Figure 2: Location plan of proposed quarry extension showing sampling and coring locations

APPENDIX 1: PROJECT DESIGN

1. INTRODUCTION

1.1 BACKGROUND

1.1.1 Cemex UK Operations Ltd (hereafter the 'client') has requested that Oxford Archaeology North (OA North) submit proposals to undertake a palaeoenvironmental assessment of land to the west and south-west of Roan Edge Quarry, Cumbria. A planning application has been submitted to extend the present quarry westwards. A desk-based assessment and walkover survey were undertaken by OA North in 2003 on the site to assess the archaeological potential. Following these results, Cumbria County Council's Historic Environment Service (CCCHES) have requested a programme of pre-determination archaeological work consisting of palaeoenvironmental sampling to assess the peat deposits. This work will inform any further archaeological evaluation work. The following proposals have been prepared in accordance with a verbal brief provided by CCCHES.

1.1.2 The site is located to the south-west of J37 of the M6 motorway, approximately 7km east of Kendal and 7km west of Sedbergh. The area of the proposed quarry extension to be investigated is 20ha in extent.

1.2 ARCHAEOLOGICAL BACKGROUND

1.2.1 The desk-based assessment (OA North 2003) demonstrated that the land of the proposed quarry extension had been part of New Hutton Common. This had remained unimproved moorland until the early nineteenth century, and even then no substantial improvements took place. A quarry and gravel pit (HER 17509) within the current working area of Roan Edge Quarry appears on the enclosure map, but it is not clear if they were in existence before the enclosure took place.

1.2.2 The potential for earlier remains within the site is indicated by a possible Romano-British settlement recorded 1.5 km to the north-west of the quarry at Birks Farm. There is evidence of Roman activity even closer to the quarry, with the discovery in the early twentieth century of a Roman gold coin (HER 4926) within the study area. In addition, the Roman cemetery at Low Borrowbridge lies within 10km of New Hutton Common. Medieval records indicate the presence of a park (HER 6813) to the north-west of the site, and a medieval drove road (HER 4738) has been identified on the eastern edge of the study area. The potential for the preservation of Roman and medieval remains is substantial since, unlike many of the surrounding areas, including much of the study area, the proposed development site does not seem to have been subject to peat extraction at the time of enclosure during the early nineteenth century.

1.3 OXFORD ARCHAEOLOGY NORTH

1.3.1 OA North has considerable experience of the assessment of sites of all periods, having undertaken a great number of small and large-scale projects during the past 25 years. Such desk-based assessments have taken place within the planning process, to fulfil the requirements of clients and planning authorities, to very rigorous timetables. OA North also has extensive experience of such archaeological work required for an Environmental Impact Assessments, including bypass schemes, road improvement schemes, quarry extensions, and motorway link roads.

1.3.2 OA North has considerable experience of work in the immediate area, particularly in and around Kendal. OA North having recently undertaken investigations at the Westmorland Gazette and Booths Supermarket redevelopment site in Kendal town centre, and along Highgate and Strickland Gate, in particular at Elephant Yard. OA North is also involved in the archaeological investigations at Kendal Castle. OA North has also carried out numerous investigations at Milnthorpe and close to the site during the programme of work along the

North West Ethylene Pipeline. To the south-west of the site excavations have been undertaken at Levens and an extensive project was based on the AONB at Arnside and Silverdale. These investigations have been varied from desk-based studies and landscape surveys to excavations.

1.3.3 OA North also has extensive experience of peat surveys and analysis having undertaken work on the North West Wetlands Survey for English Heritage, which assessed the palaeoenvironmental potential of several sites in the area around Kendal and Sedbergh, together with work at Sparrowmire in Kendal and Demmings Moss, to the south of Kendal. OA North are also undertaking a pilot study to investigate the archaeology of the upland peats of the north. Consequently, OA North's palaeoenvironmentalists have experience of detailed pollen analysis from mires, palynological evaluation of potential palaeoecological sites, estimation of the mineral content of peat samples to ascertain the presence or absence of inwash and quantitative evaluation of microscopic charcoal.

1.3.4 OA North has the professional expertise and resources to undertake the project detailed below to a high level of quality and efficiency. OA North is **an Institute of Field Archaeologists (IFA) registered organisation, registration number 17**, and all its members of staff operate subject to the IFA Code of Conduct.

2 OBJECTIVES

2.1 The objectives of the project are:

- to provide information on the origin of the peat
- to then assess the likely age of any archaeological remains surviving within and below the peat deposits.

2.2 The required stages to achieve these ends are as follows:

2.3 ***Palaeoenvironmental Assessment:*** to take samples of the peat across the site and assess the nature and potential of the peat. The work will be undertaken according to English Heritage guidelines on Environmental Archaeology (2002) and Oxford Archaeology guidelines and instructions (2000).

2.5 ***Report and Archive:*** a written report will assess the significance of the data generated by this programme within a local and regional context. It will present the assessment results and describe the depositional sequence. Recommendations for mitigating measures and/or further investigation will also be presented.

3 METHOD STATEMENT

3.1 PALAEOENVIRONMENTAL ASSESSMENT

3.1.1 ***Introduction:*** the area has not been subject to any previous intrusive archaeological investigation, and therefore knowledge of any unidentified archaeological sites is limited. An assessment of the survival of palaeoenvironmental deposits to examine the survival and extent of the peat will inform the likely age of any archaeological finds or monuments preserved beneath or within it. Peat can preserve both prehistoric archaeological remains and environmental indicators, such as pollen, waterlogged plant remains and other biological indicators, due to the unique combination of anaerobic and waterlogged conditions. The study of such biological indicators allows us to reconstruct past changes in the climate and vegetation, which can also be indicative of human factors in prehistory and more recent periods.

3.1.2 ***Extraction of peat depth information:*** the peat will be cored on two perpendicular transects crossing the site. The cores will be at a sampling interval of 50m over the proposed quarry extension, unless the samples show the site to be stratigraphically uniform and the interval will be widened to 100m. An open chambered Eijkelkamp gauge auger will be used to record

the peat depth down to underlying mineral deposits. This will provide information on the depositional sequence.

3.1.3 The number of cores will be dependent on the peat depth and the terrain but it is envisaged that a maximum of 24 cores will betaken over four days.

3.1.4 ***Mapping of peat depth information:*** the geographical position of each core and its height aOD will be recorded and inputted into GIS. This information, combined with the depths of the peat encountered, will be compiled into a database and would be used to provide a 3D model allowing the surviving peat to be mapped and the underlying mineral topography to be produced. A written report will be produced to identify areas of possible archaeological potential.

3.1.5 ***Environmental Sampling:*** two cores, to be selected on site by the palaeoenvironmentalist, will each be sampled for detailed palaeoenvironmental assessment of biological and environmental indicators as appropriate, such as charred and waterlogged plant macro fossils, pollen, insect remains and the potential for radiometric dating of the peat deposits will be assessed.

- Stratigraphy: the stratigraphy of the core samples will recorded by stratigraphic unit, and written descriptions placed within the archive. Samples will be selected for palynological, waterlogged and charred plant remains, insect, and other environmental indicator assessment and analysis.

- Palynology: palynological assessment of samples will involve an examination for critical grains. Counting will continue, if possible, until a sum of between 100 and 150 pollen grains from land pollen types has been reached on two or more complete slides, to reduce the possible effects of differential dispersal under the coverslip (Brooks and Thomas 1967). Easily identifiable pollen grains will be recorded, those from broad groups, *eg* grasses, and the dandelion family (Asteraceae), will also be recorded and grains not identified quickly will be counted. Pollen identification will be carried out using the standard keys of Faegri and Iversen (1989) and Moore *et al* (1991) and a small reference collection held at OA North. Cereal-type grains will be defined using the criteria of Andersen (1979). Plant nomenclature will follow Stace (1991).

  The state of preservation of the pollen will also be noted and the indeterminate grains will be recorded using groups based on those of Birks (1973). Charcoal particles greater than 5µm will also be recorded following the procedures of Peglar (1993).

  Pollen data will be recorded on standard *proforma* sheets, which will be integrated into the site archive. This data will be calculated as a percentage of the pollen sum of all land pollen and will be presented in tabular form.

- Waterlogged and charred plant remains: the potential for waterlogged and charred plant remains will be assessed. These will be wet sieved through a series of standard meshes and the residues examined with a binocular microscope. All types of plant material will be noted and identified if possible, as will their relative quantities, in a simple scale of abundant–rare.

3.2 REPORT

3.2.1 One bound and one unbound copy of a written synthetic report will be submitted to the client, and a further copies submitted to the Cumbria HER within eight weeks of completion. The report will include;

- a site location plan related to the national grid

- a front cover to include the planning application number and the NGR

- the dates on which the fieldwork was undertaken
- a concise, non-technical summary of the results
- the background to the project and methodology;
- a description of the methodology employed and work undertaken
- the results of the assessment
- measures to mitigate the impacts of the proposed site will be included in the discussion as will the perceived need for any further investigation
- a copy of this project design, and indications of any agreed departure from that design
- the report will also include a complete bibliography of sources from which data has been derived
- suitable illustrations, bibliography.

3.2.2 This report will be in the same basic format as this project design; a copy of the report can be provided on CD, if required.

3.2.3 ***Confidentiality:*** all internal reports to the client are designed as documents for the specific use of the Client, for the particular purpose as defined in the project brief and project design, and should be treated as such. They are not suitable for publication as academic documents or otherwise without amendment or revision.

3.3 ARCHIVE

3.3.1 The results of all archaeological work carried out will form the basis for a full archive to professional standards, in accordance with current English Heritage guidelines (*Management of Archaeological Projects*, 2nd edition, 1991). The project archive represents the collation and indexing of all the data and material gathered during the course of the project. OA North conforms to best practice in the preparation of project archives for long-term storage.

3.3.2 This archive will be provided in the English Heritage Centre for Archaeology format and a synthesis will be submitted to the Cumbria HER (the index to the archive and a copy of the report). OA North practice is to deposit the original record archive of projects with the appropriate County Record Office, in this case Kendal.

3.3.3 The Arts and Humanities Data Service (AHDS) online database project *Online Access to index of Archaeological Investigations* (OASIS) will be completed as part of the archiving phase of the project.

4 OTHER MATTERS

4.1 HEALTH AND SAFETY

4.1.1 OA North provides a Health and Safety Statement for all projects and maintains a Unit Safety policy. All site procedures are in accordance with the guidance set out in the Health and Safety Manual compiled by the Standing Conference of Archaeological Unit Managers (1997). A risk assessment will be completed in advance of any on-site works and copies will be made available on request to all interested parties.

4.2 ACCESS

4.2.1 OA North will consult with the client regarding access to the site.

4.3 PROJECT MONITORING

4.3.1 Whilst the work is undertaken for the client, the Assistant County Archaeologist will be kept fully informed of the work and its results, and will be notified a week in advance of the commencement of the fieldwork. Any proposed changes to the project design will be agreed with CCCHES in consultation with the client.

5 WORK TIMETABLE

5.1 ***Peat Extraction and mapping:*** approximately four days will be required to complete the fieldwork and three days for the mapping.

5.2 ***Assessment of cores:*** this element will be dependant on the depth of the monolith, for example;

- 1m core will be 4 days
- 3m core will be 10 days
- 5m core will be 16 days

5.4 ***Archive/Report:*** the report and archive will be produced following the completion of all the fieldwork. The final report will be submitted within eight weeks of completion of the fieldwork, unless an deadline has been agreed with the client on commission, and the archive deposited within six months.

6 STAFFING

6.1 The project will be under the direct management of **Emily Mercer BA (Hons) MSc AIFA** (OA North senior project manager) to whom all correspondence should be addressed.

6.2 Assessment of any palaeoenvironmental samples which may be taken will be undertaken under the supervision of **Elizabeth Huckerby MSc MIFA** (OA North project officer) and **Denise Druce PhD** (OA North project officer). Elizabeth has extensive knowledge of the palaeoecology of the North West through her work on the English Heritage-funded North West Wetlands Survey, and has acted as palaeoenvironmental consultant to all OA North projects over the last 10 years. Denise is an experienced environmental archaeologist who has extensive knowledge in palynology. Denise also has much experience with the analysis of upland peats having undertaken research for CADW and is currently involved in the OA North Upland Peats project funded by English Heritage. Elizabeth and Denise will be assisted by **Sandra Bonsall** (OA North environmental assistant).

7 INSURANCE

7.1 OA North has a professional indemnity cover to a value of £2,000,000; proof of which can be supplied as required.

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APPENDIX 2: THE CORING SURVEY RESULTS

CORE No.	DEPTH 1 (cm)	DEPTH 2 (cm)	DESCRIPTION
1	0	15	Topsoil on grey silt /stony
2	0	15	Topsoil on grey silt/stony
3	0	20	Topsoil
3	20	35	Grey silt/stony
4	0	20	Topsoil on fine grey silt
4	20	35	Fine brown silt
4	35	50	Grey/blue silty-clay
4	50	77	Grey/blue silty-clay, very stony
5	0	5	Topsoil on fine grey silt
5	5	12	Pale orange clay, very stony
6	0	15	Topsoil directly on to bedrock
7	0	15	Topsoil directly on to bedrock
8	0	10	Topsoil
8	10	15	Grey stony clay layer on to bedrock
9	0	10	Topsoil directly on to bedrock
10	0	10	Silty topsoil directly on to bedrock
11	0	15	Topsoil
11	15	20	Light brown stony silty layer
12	0	10	Topsoil directly on to stone
13	0	10	Topsoil
13	10	14	Light brown very stony silt

14	0	10	Topsoil
14	10	35	Reed peat on to stony silty layer
15	0	10	Topsoil directly on to stone
16	0	20	Topsoil
16	20	30	Very stony grey silt
17	0	15	Topsoil directly on to bedrock
18	0	5	Topsoil directly on to bedrock
19	0	5	Topsoil directly on to bedrock
20	0	8	Topsoil directly on to bedrock
21	0	8	Topsoil directly on to bedrock

APPENDIX 3: POLLEN AND PLANT MACROFOSSIL ASSESSMENT RESULTS: SAMPLE SITE 2

Depth (m)	**0.19**	**0.26**	**0.29**	**0.36**	**0.40**	**0.66**	**0.82**	**0.90**	**1.12**	**1.25**	**1.42**	**1.52**
Pollen preservation	Poor	Fair	Mixed	Good	No pollen	Good	Good	Good	Good	Good	Mixed	Mixed
Microscopic charcoal fragments	+	++	+++	+++		+	+		+	+	+	++
PLANT MACROFOSSILS												
Indeterminate plant remains			++++					+++		++	++++	++++
Monocotyledon remains	++++	++++	++++	++++			++++		++++	+++	+++	
Sphagnum leaves	++++	++++		++++	++++	++++	+++	+			+++	+
Moss indet.		++						+				
Wood fragments						++	++	++++	+++	++++	++	+++
cf. *Vaccinium oxycoccus* leaves	+											
Erica sp. leaves						+						
Carex sp. seeds	+	+				+	++	+			+	+
Poaceae seeds			+									
Potamogeton sp. seeds						+						
Juncus seeds								+			+	+
Ranunculus sp. seeds							+					
Fungal sclerotia												+++
Silt			++									+++
Fungal/algae remains												
Spores indet		1	10	7		6	4	12	1	2	3	4
Type 18/19 ascospores						5	76					
POLLEN												
Trees/Shrubs/ Climbers %												
Alnus							1.72	2.65	2.97	9.02	7.81	5.04
Betula		25.00	s			1.39	6.90	5.96	11.88	15.04	7.03	15.13
Corylus avellana-type	25.00					11.11	6.90	10.60	12.87	21.05	22.66	45.38
Carpinus								s				
Fraxinus			2.74									
Pinus						1.39		0.66		1.50		0.84
cf. Picea				1.20								
Quercus			2.74	2.41		1.39	1.72	2.65	1.98	9.02	12.50	7.56
Tilia									0.99			1.68
Salix						2.78		1.32	1.98	7.52	4.69	1.68
Ulmus			s								0.78	1.68
Total Trees/shrubs/ climbers %	**25.00**	**25.00**	**5.48**	**3.61**		**18.06**	**17.24**	**23.84**	**32.67**	**63.16**	**55.47**	**78.99**
Dwarf Shrub %												
Calluna		12.50	8.22	22.89		25.00	22.41	18.54	0.99		4.69	0.84
Crop Plants %												
Cerealia								1.32				
Herbs %												
Apiaceae						1.39	1.72		0.99		0.78	0.84
Vicia-type								1.32				
Aster-type	25.00											
Cirsium sp												

Centauria nigra								1.32				
Chenopodiaceae												
Cyperaceae						25.00	13.79	18.54			3.91	
Filipendula sp				1.20				1.32	4.95	6.77		10.08
Rubiaceae												1.68
Plantago lanceolata			8.22	7.23		4.17	10.34	6.62		0.75	1.56	1.68
Poaceae	50.00	50.00	68.49	63.86		19.44	34.48	18.54	11.88	7.52	22.66	
Potentilla sp						4.17		1.32		1.50	2.34	3.36
Artemisia sp.									0.99			
Ranunculus sp		12.50	4.11			1.39		3.97	43.56	15.79	2.34	1.68
Rumex sp			2.74	1.20		1.39		1.32		1.50	11.90	
Rosaceae								1.32	1.98	1.50		
Scrophulariaceae											0.78	
cf. Onagraceae											0.78	
cf. Saxifragaceae											0.78	
Brassicaceae												
Succisa pratensis								0.66	1.98	1.50		0.84
Taraxacum-type			2.74									
Total Herbs %	**75.00**	**62.50**	**86.30**	**73.49**		**56.94**	**60.34**	**56.29**	**66.34**	**36.84**	**39.84**	**20.17**
Total Land Pollen Sum	**8**	**16**	**73**	**83**		**144**	**116**	**151**	**101**	**133**	**128**	**119**
Unknown/indet. pollen												
Broken grain						6		4		2		3
Concealed grains	2		6	5		6	12	6	2	8	42	22
Crumpled grains						10	6	6	1	18	10	16
Degraded	2	2		2				2	3	4	50	27
Unknown herbs			2	1				2	1	3	3	
Ferns												
Polypodium								s	2	22	3	16
Pteropsida (monolete)			2			4		16	10	102	102	76
Pteropsida (trilete)						4		2			1	
Pteridium			2							4	3	2
Mosses												
Sphagnum						16	10	30	1		5	1
Lycopodium												4
Aquatics												
Myriophyllum alterniflorum												
Potamogeton				1		16		12	2			

The macrofossil data and and microscopic charcoal is shown as a scale of abundance where + = rare, ++ = occasional, +++ = frequent, and ++++ = abundant, s = observed during quick scanning. Pollen % are calculated as percentage of Total Pollen Sum (TLP), which includes trees/shrubs/climbers, dwarf shrub, crop plants, and herbaceous pollen. The Pollen Sum, unknown/indet pollen, ferns, mosses and aquatics are given as actual counts.

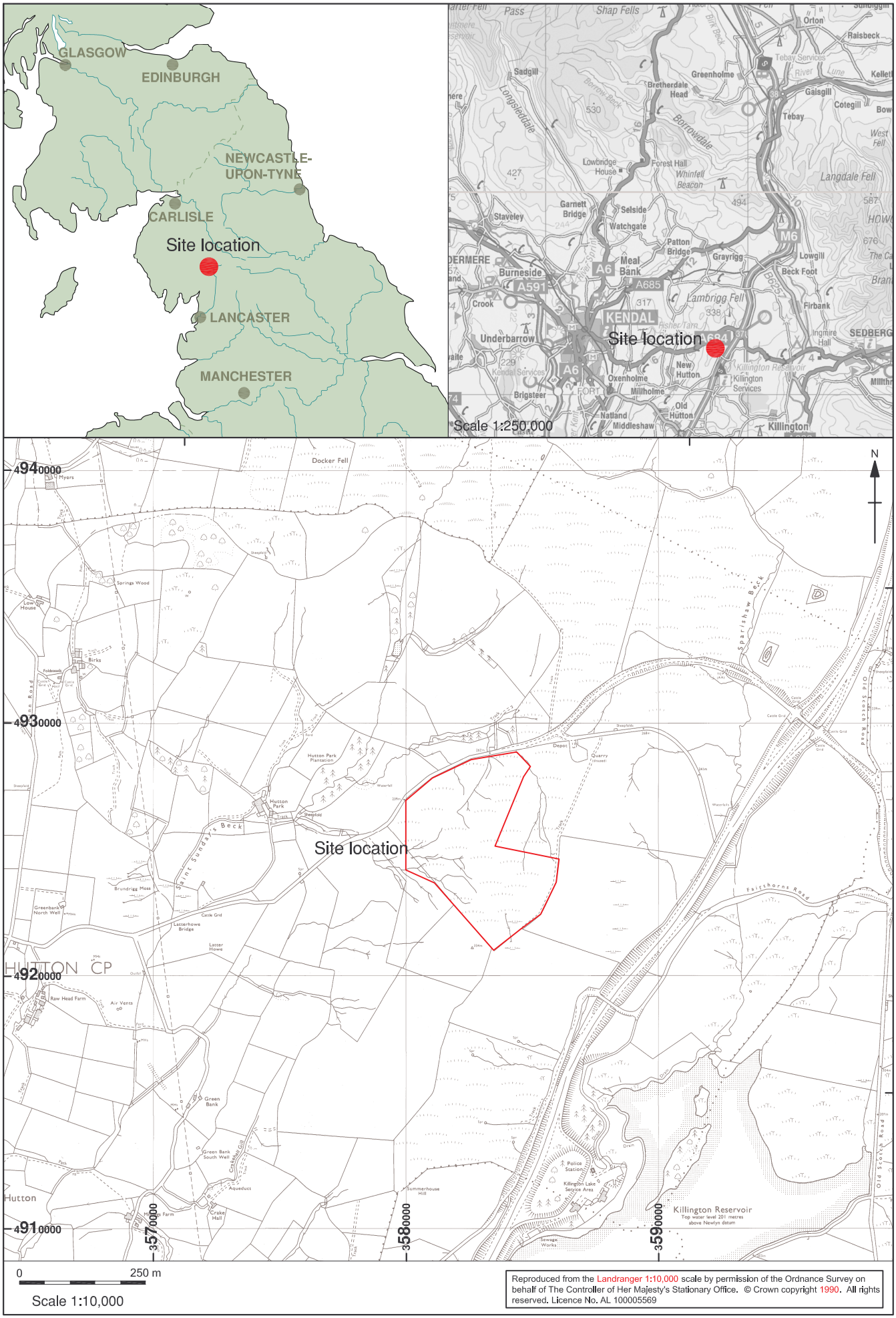

Figure 1: Site Location Map

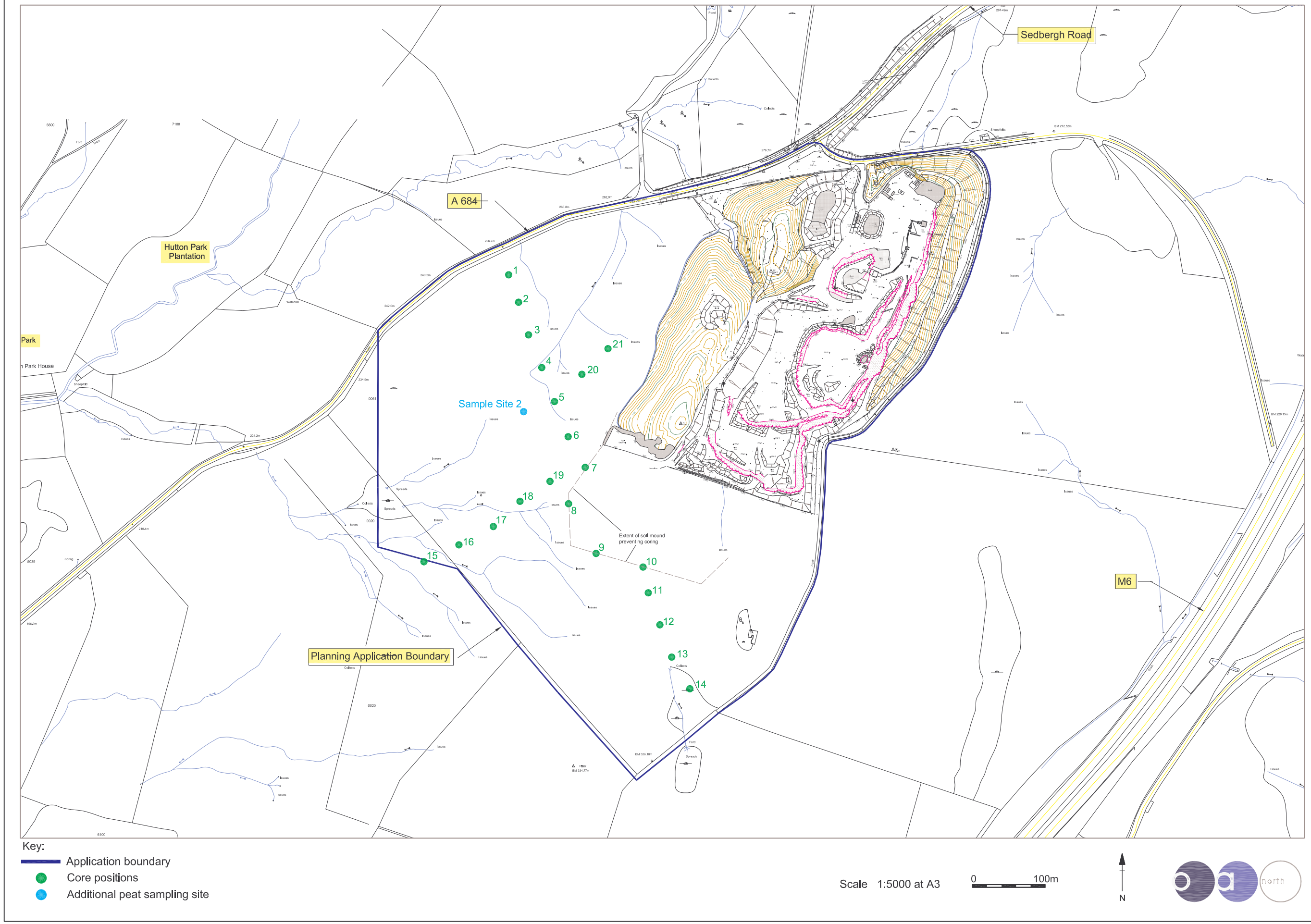

Figure 2: Plan showing location of cores