UPLAND PEATS
Project Design for a North West Pilot Study

Project Design

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Prepared by:	Chris Howard-Davis	
Position:	Project Officer	
Date:	January 2003	
Checked by:	Jamie Quartermaine	Signed……
Position:	Senior Project Manager	
Date:	January 2003	
Approved by:	Rachel Newman	Signed……..
Position:	Director	
Date:	January 2003	
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Oxford Archaeology (North)
Storey Institute
Meeting House Lane
Lancaster
LA1 1TF
t: (0044) 01524 848666
f: (0044) 01524 848606

w: www.oxfordarch.co.uk
e: info@oxfordarch.co.uk

Janus House
Osney Mead
Oxford
OX2 0EA
t: (0044) 01865 263800
f: (0044) 01865 793496

THE UPLAND PEATS PILOT STUDY PROJECT DESIGN

SUMMARY

Following the submission of a proposal for a pilot study to investigate the archaeology of upland peatlands by Oxford Archaeology North, English Heritage commissioned the development of the following project design. It is recognised that the upland peats potentially incorporate an enormous archaeological resource and that this resource is susceptible to threats, particularly at the peat edges, from changes to the agricultural regime, mineral extraction, forestry, and the growing pressures of tourism; however, these impacts are set within the backdrop effects of climatic change and atmospheric pollution. The main aim of this pilot study is to investigate methodologies that can address the major issue of site visibility within peatland landscapes; this could potentially lead in the longer term to an extensive survey programme that would result in the creation of predictive modelling as a tool for the management of the upland archaeological resource on a national scale.

The pilot study will examine four areas of North West England (West Cumbria, Great Langdale, Central Cumbria, Forest of Bowland and the Anglezarke / Rivington Massif, both in Lancashire) which provide a diverse range of landscapes. These will act as a varied test bed for the proposed methodologies. The methodological study will use desk-based studies, remote sensing techniques, ground survey, infra-red aerial photography, testpitting / probing, and palaeoecological studies, the results all being integrated within a GIS system for cross-analysis, as a means of identifying and assessing the archaeological activity within and beneath the upland peats. The results of the project will be subject to a broader outreach in order to highlight to the general public the significance of the archaeological resource and the associated threats. The results of the programme will be presented as an assessment report with a revised project design, as defined by MAP 2.

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1. INTRODUCTION

1.1 INTRODUCTION

1.1.1 ***Peatland Resource:*** the peatland resource is one of the most valuable contexts for the recovery of archaeological and environmental data, and serves as a cultural resource for the enhanced preservation of organic structures and deposits within the peat. It is also an unparalleled resource for the study and dating of the development of the palaeoenvironmental record and man's effect thereon. Classic wetland sites, such as the bog-bodies of Cheshire (Turner and Scaife 1995), the wooden trackways of Somerset (Coles and Coles 1986) and the waterlogged Neolithic settlement of Ehenside Tarn in West Cumbria (Darbishire 1873), demonstrate the very considerable potential of peatlands for providing an important insight into the culture and character of prehistoric populations. These are all lowland sites, however, reflecting the fact that, until recently, emphasis has been placed on the recording and management of lowland peats, as these have been, and still are, under a well-publicised threat from a number of activities, principally the expansion of settlement, agricultural improvement/ drainage, landfill, and the continuing commercial harvesting of peat for horticultural use. In response to these threats a series of wide ranging surveys, particularly the Somerset Levels project, Fenland Survey, North West Wetlands Survey (NWWS), and Humber Wetlands Project, all funded by English Heritage, has highlighted the very considerable archaeological and environmental resource of the lowland wetlands throughout England.

1.1.2 ***Upland Peats:*** although the great emphasis on wetland studies to date has concentrated on the lowlands, the equivalent resource within the upland context is both sizeable and significant. For example Northern England contains 36,689 ha of lowland peat (Burton and Hodgson 1987, Appendix), but there are *c*216,000 ha of upland peats, at depths of greater than 0.5m (Valerie Hack, English Nature pers comm). It is clear that this represents an enormous resource in comparison with that in the lowlands (see Table 1 for data broken down by county). Not only are the upland peats extensive, but preserved within them are exceptionally rich archaeological landscapes, particularly prehistoric, which are unparalleled within the lowland context. However, past investigations of the uplands have concentrated on the abundant peat-free areas which offer extensive surface landscapes and exceptional site visibility. Consequently, despite their considerable archaeological potential, the adjacent peatlands have never been subject to any detailed investigation for archaeological remains.

County	**Area in hectares**

Cumbria	31,000
Cheshire	1,500 above 150m OD
Durham	22,000
Greater Manchester	*c*4900
Lancashire	22,600
Peak District National Park	28,800
South Yorkshire	34,600
North Yorkshire excluding National Parks	7,400
Yorkshire Dales National Park	35,000
North York Moors National Park	10,900
Northumberland	17,300
Total	**216,000**

Table 1: the area of upland peat in the northern counties of England (data supplied by the county Wildlife Trusts or county councils from data recorded during Phase 1 of the *Habitat Survey and Biodiversity Audits*)

1.1.3 ***Threat:*** the threats to these peatlands have not been as visible and as well-publicised as those jeopardising the lowland peatlands but nevertheless the uplands have come under pressure from a wide range of environmental impacts, which include afforestation, the intake of peripheral land at lower altitudes for agriculture, general land drainage and the pressures of increasing tourism. The succession of crises within the farming industry, exacerbated by the recent foot and mouth disease, is resulting in a change of use to both improved and unimproved land, and presents a significant threat to the archaeological landscapes. The pressures on upland farming has resulted in damaging changes to the wetland environment and the long term effect on the upland landscape has been highlighted by the *Monuments at Risk Survey* (MARS) (Darvill and Fulton 1998), where, in their upland study area (Cornwall), 16-20% of the upland

landscapes had been lost between 1949 and 1980. From examination of aerial photography it is evident that of the upland peatland of Britain *'c18% remains as natural landscapes, 16% is afforested, 16% is eroded'* (Phillips *et al* 1981). *'The remaining 50% is used for grazing and game hunting, and small-scale peat extraction, and can be described as degraded'* (Van de Noort *et al 2001).* This highlights the urgent need for a systematic survey of the archaeology in areas of upland peats before the degradation becomes so severe that considerable amounts of the peat resource are lost. The recent foot and mouth crisis has had a considerable impact upon the farming industry in the region; substantial numbers of farms have been sold off, and the buidings are in many instances being converted for purely residential use. The agricultural land is commonly being sold off to neighbouring, or sometimes more remote, farms, which are then becoming larger operations, with a more intensive apprach to upland farming. At this stage only a short time after the end of the foot and mouth episode, it is not clear yet to what extent this dramatic change in agricultural practice will have upon the upland peats (XXXX Confirm with Mervin Edwards 01768 865900 RDS (mobile 07774 136654)).

1.1.4 The visitor pressure in some instances also provides a significant impact to the survival of the peat, and is most notable on the line of the Pennine Way in the Peak District, where path erosion has cut major channels through the peat and resulted in substantial destructive drainage to the surrounding peatlands. While this is an extreme example, there is a risk to peatlands in all areas where intensive visitor pressure coincides with fragile peatland landscapes, and this is likely to be exacerbated by the increased access afforded by Countryside Rights of Way Act.

1.1.5 The natural systems, particularly climatic change, that regulate the development or decline of both upland and lowland peat are indissolubly linked, and some of the threats that both face, such as agricultural improvement and changes in drainage patterns, are similar; as the archaeological value of many upland areas can be proved to be high, there is a clear need for specific wetland projects in the English uplands, complementing those undertaken in the adjacent lowlands (Van de Noort *et al* 2001, 3 (1.7)). As long ago as 1988, it was stated in the preliminary assessment of the NWWS that '*The lowland environmental database requires complementary evidence from the uplands to provide a more general understanding of man's role in the region's environmental history ... It is obvious that the recording, preservation and future management of one resource must of necessity be heavily unbalanced without consideration of the other*' (Howard Davis *et al* 1988, 35); that remains the case today. The upland peats of the region, although with a demonstrably richer archaeological record than those of the lowlands, remain without a systematic overview, an issue raised in the 1998 MARS report (Darvill and Fulton 1998). The need to address the upland peats is recognised in the English Heritage Strategy for Wetlands which defines as a research objective to impliment '*pilot surveys of the upland peatlands in England, linked to an assessment of the erosion of upland peat*' (English Heritage 2002).

1.1.6 The 1998 MARS report (Darvill and Fulton 1998) notes in its introduction that, of the significant difficulties faced by those managing the landscape, that of most significance to the MARS project was the '*Absence of baseline data for predictive studies on the likely fate of monuments in individual landscape types, and the resources needed for future conservation and management initiatives*' (*op cit*, 5).

The report places emphasis on the development of methodologies appropriate to the examination of 'hidden landscapes', such as those obscured by peat and alluvium, and highlights the value of the NWWS (funded by English Heritage) for the recovery of less tangible elements of the archaeological record from these landscapes (*op cit*, 241).

1.1.7 The scale of the peatlands, coupled with the general lack of visibility of the archaeological resource, means that there are considerable difficulties in the establishment of an effective management programme. It is therefore essential to use predictive modelling as a tool to enable the targeting of resources to areas with the greatest archaeological potential that are threatened. At present there is insufficient understanding of the peatland resource or the methodology necessary to identify the buried archaeological landscapes in order to establish such predictive modelling. A pilot project, established in areas of different types of peatland landscapes, is thus necessary to provide experimental methodological data which could lead to the establishment of parameters for such predictive modelling not only within the North West but in peatland areas throughout England.

1.1.8 In response to the changing fortunes of these important landscapes, a project proposal (LUAU 2001) for a programme of investigation was submitted to English Heritage by Oxford Archaeology North (OAN) (formerly Lancaster University Archaeological Unit (LUAU)) in February 2001. In response to this English Heritage invited OAN to submit a project design for a pilot project that would:

- assess the potential of the peatland resource in the North West;
- provide the experimental basis for the development of a methodology for a wider peatlands study;
- define the topographic and environmental contexts of the greatest archaeological potential.

1.1.9 The present project design puts forward aims and objectives for such a pilot project, then defines the methodology to be tested, coupled with the resource implications for the pilot project.

2. BACKGROUND

2.1 OVERALL STUDY AREA

2.1.1 The peatlands of England extend from Dartmoor in the Southwest through to the Cheviots on the Scottish border and make up over 3% of the country's landscape. However, the greatest extent of the upland peatlands are in Northern England within the Pennine chain, from the Peak District through to the Cheviots, and also within the outlying ranges of the North York Moors, the Lake District and the Forest of Bowland; there is in excess of 174,159ha of upland peat, in these outlying areas, comprising 82.2% of the total for England. Blanket peats are the most visible and, to the layman, most easily recognised and extensive element of these upland landscapes, but a range of other wetland types is also present at higher altitude, including valley and basin mires, often concealed by the subsequent development of blanket peats.

2.1.2 For the purposes of this project, and in order to compile data complementary to that of the English Heritage-funded NWWS (which dealt exclusively with lowland wetlands), upland is defined as above 100m OD. Prehistoric activity is not specifically limited by altitude, as has been demonstrated by the presence of Neolithic axe factories around the summit of the highest mountain in England (Scafell Pike), and that of hillforts on many of the upland summits. Recent surveys in the Lake District (Quartermaine and Leech forthcoming) have shown that the extent of prehistoric settlement is restricted by local constraints, such as steep slopes, rather than by altitude and, where the local topography allows, settlements can extend up to 480m OD (Simmons 1996, 141).

2.1.3 ***Period and type of site:*** the anthropogenic evidence derived from wetlands of all kinds falls neatly into three elements:

1) archaeological monuments and deposits pre-dating the development of peat which have been protected and preserved by it; these can represent extensive elements of (usually) prehistoric landscapes;

2) archaeological monuments and deposits lying within or on top of the peat (often with a well-preserved organic element having potential for radiocarbon dating);

3) evidence for human activity and its context extrapolated from palaeoenvironmental evidence preserved within the peat, which also bears excellent potential for radiocarbon dating.

Where evidence has been forthcoming from upland peats in the North West, often as a result of palaeoenvironmental work, the sites have spanned a wide chronological range, from the early Mesolithic period (Simmons and Innes 1987) to at least the medieval period (many peat sequences have been truncated by medieval and later turf cutting (Hodgkinson *et al* 2000, Appendix 5). The inception date for peat growth varies greatly through the region and with altitude. Whilst some localised areas have been subject to intensive palynological study, for example the extensive work by Pennington (1975) in the Lake District, many

of these studies have not been subject to radiocarbon dating, and the inception dates for peat formation is generally poorly known.

2.1.4 Survey, especially of the Lakeland Fells, has suggested that some prehistoric elements of the palimpsest upland landscape are very well preserved. In the central Pennine area the Mesolithic is perhaps the best represented, with known monuments ranging from small hunting camps to the huge and long-lived multiple re-use gathering places of the type characterised by Warcock Hill South in West Yorkshire (Radley and Mellars 1964), all exposed by eroding peat. Extensive Neolithic activity is represented around the central fells of the Lake District where axe manufacture was undertaken over an extended period. The extent and range of the workings is not known definitively because much of the resource can be presumed to have been preserved beneath peat, but animal and tourist erosion is having an adverse effect on the peat cover, exposing and thereby eroding an increasing number of sites (Quartermaine 1994).

2.1.5 On the western slopes of the Lake District extensive prehistoric stone-built settlements and field systems are often partially covered by blanket peats. These are traditionally dated to the Bronze Age, but little absolute dating is available for them and they could potentially extend into the Iron Age. Settlements of a type typically ascribed to the Romano-British period are also represented in the Lake District, and sometimes within similar topographic zones to their prehistoric forebears; in some cases (eg Barnscar (Quartermaine and Leech forthcoming)) they are superimposed. Even such monuments as the Roman fort at Hardknott and the Roman road at High Street are partially covered by peat, which has preserved them; however, the growth of tourism has placed some of these monuments under threat as the pressure of visitors had caused the erosion of these peats.

2.1.6 Growing, if rather less physically substantial, evidence has emerged in recent years for post-Roman/early medieval exploitation of an already peat-covered landscape, for instance at Shoulthwaite, where palaeoenvironmental investigation of peats within a hillfort ditch revealed that it was cut (or possibly recut) in the late sixth / early seventh century AD (LUAU 1999). Also, palaeoenvironmental analysis at Littlewater basin mire, near Haweswater, has revealed considerable agricultural activity through the second half of the first millennium AD (LUAU 2000). Recently, a fence or hedgeline at Seathwaite (Cumbria) has been dated to the medieval period, cal AD 1301-1442 (535+/-45 BP, OxA-7751 (Wild *et al* 2001, 55).

2.2 PARTNERS IN THE PROJECT

2.2.1 The achievement of NWWS, alongside a considerable expertise in both extensive and intensive landscape survey, especially in the uplands of Cumbria and Lancashire, has made it abundantly clear that a project of the scope envisaged needs to be undertaken in partnership with local and regional bodies. It is certain that these will add to the available range of expertise, supplement resources by contribution, particularly in kind, and even bring additional finance to the project. Such collaboration has the enthusiastic support of local curators (Philip Holdsworth (Cumbria County Council), John Hodgson (Lake District National Park Authority), Robert Maxwell (National Trust), and John Darlington (Lancashire County Council) and has received encouragement from Sue

Stallibrass and Jacqui Huntley, English Heritage Regional Scientific Advisors, for the North West and North East respectively.

2.2.2 The Lake District National Park Authority has confirmed that it wishes to be a partner in the project. It will contribute considerably in kind, providing digital SMR data, digital mapping of earlier surveys, and the loan of digital mapping data. Where appropriate, the National Trust will also contribute resources in kind, for example in logistics. Resource in kind is also promised by Cumbria County Council, including the loan of digital mapping data in order to facilitate work outside the confines of the National Park.

2.2.3 In north Lancashire, the project will be carried out within the context of the Bowland Initiative, a project which is intended to address the problems and revitalisation of a rural area in economic decline. In the course of this, Lancashire County Council will make available considerable resources in kind, including the loan of digital mapping data, and access to contour data, digitised OS first edition and other historical maps, Phase 1 habitat information, geology, soil, hydrology and key habitat data. The Bowland Initiative includes an application for Heritage Lottery Funding and is supported by Lancashire County Council, English Heritage, DEFRA, and a number of other environmentally significant organisations, such as the RSPB. Monies within that application have been earmarked for archaeological research on the Bowland uplands.

2.2.4 ***National Agencies:*** in addition to the direct partners identified above, the project will seek to forge links with national agencies that are involved in the management of the environment. These include DEFRA (including the Rural Development Service (RDS)), English Nature, The Countryside Agency, other National Park Authorities, The Archaic Peat Deposits Project (funded by English Nature and English Heritage), and the National Rivers Authority. The establishment of links with these organisations will enable the cross-feeding of research data and is intended to enable the facilitation of management proscriptions at a national level for the preservation of the peatland resource. Contacts will initially be made through their regional offices, but will ultimately be extended to a national level. Expressions of cooperation have already been expressed from Bob Middleton (DEFRA), Dr RP Money (Archaic Peat Deposits Project) and Valerie Hack (English Nature, Kendal Office).

2.3 CIRCUMSTANCES OF THE PROJECT

2.3.1 ***Threats to the Resource:*** it has been recognised for some years that changes in the patterns of farming and an expanding range of leisure activities are placing a severe and increasing strain on the survival of typical upland landscapes of all types, not least that of the wide expanses of upland blanket peats well known in the central and northern Pennines and within the Lakeland Massif and its outliers. The *Monuments at Risk Survey* (MARS) (Darvill and Fulton 1998), has highlighted numerous threats to these upland landscapes, and it has been shown that in England between 1949 and 1980 their upland grass terrain category has diminished from 10% of the land surface of the country, to 7.4%, with the presumption that, between 1980 and today, it has been further reduced. It has also become clear that the threats deriving from farming and leisure activities, and the accelerating need for a reconsideration of strategies for the preservation and

management of upland peatlands at a national level, have been thrown into stark relief by the recent succession of crises in hill farming, culminating with the foot and mouth crisis of 2001.

2.3.2 ***Forestry:*** a significant factor in the survival of upland peats has been the impact of new forestry, both from the direct impact of deep ploughing, and the more widespread impact of drainage for forestry plantations, which causes the drying out of peats. While modern day forestry plantations typically attempt to preserve the visible archaeology within 'islands' in the forest or within rides, this does not consider invisible buried remains, which tend to be severely degraded or destroyed as a result. While the number of new forestry schemes within the National Parks is now declining, significant numbers of schemes are still being introduced within the peripheral unprotected areas of upland.

2.3.3 ***Tourism:*** one of the more significant factors affecting the peatlands is the widespread encouragement of use of upland areas as a leisure facility by increasing numbers of walkers, runners, and cyclists, and the increase of off-road leisure use of bridle paths, old coach and drove roads, and other green roads by 4x4 vehicles. In the Lake District National Park, for example, the distribution of visitors throughout its area of influence is not homogeneous, with the result that some areas are more seriously affected than others. Similarly, land management for other purposes, such as water catchment or, in the case of the National Trust, to attempt to preserve traditional aspects of the landscape and rural economy, has had an appreciable effect on public accessibility. The new Countryside and Rights of Way Bill through Parliament will have a significant impact on the breadth of public access, and debates surrounding the potential impact on the landscape are current. One already identified impact is a dramatic increase in path maintenance work over the uplands, which, dependng on the technique employed, is having a significant localised impact upon the underlying peats and any archaeology contained within.

2.3.4 ***Farming:*** the succession of crises within the farming industry has resulted in a gathering public and political impetus towards a general reconsideration of farming methods, and there will be changes to agricultural practice as a result of changes within the Common Agricultural Policy Third Programme. Proposals for changes in herd management and land use will undoubtedly come out of such a review and are likely to have a fundamental impact on upland farming. With the evident economic difficulties experienced by upland farmers, changes of agricultural practice are increasingly being examined and farmers are increasingly looking to diversify out of farming, often into tourism. Considerable numbers of farms are being sold as residential properties and the land either reverting to scrub or being taken over by a smaller number of much larger farms. All this results in change of use to the land, with corresponding localised and sometimes more general damage. The changes of use are varied but include the intake of peripheral land at lower altitudes, the alteration of drainage patterns, land improvement for pasture often entailing drainage, the establishment of small forest plantations and a general intensification of exploitation; with all of this comes a threat to the underlying peatlands. Alongside this there are reductions in the number of grazing sheep as a result of the significant reduction of upland flocks by culling in the course of the 2001 outbreak of foot and mouth disease (substantial numbers of upland sheep were culled while on winter lowland pasture). This results in a

reduction in animal erosion and could result (in the short-term at least) in the unrestricted regrowth of normally grazed vegetation, ultimately leading to the development of scrub woodland. This will significantly reduce site visibility and accessibility. Although not growing on peat itself, bracken will colonise exposed soils at its periphery. The thick rhizome mat formed by bracken is regarded as potentially damaging to the preservation of stratified archaeological deposits, with recent research on Dartmoor suggesting that, within a period of 20 years, uncontrolled bracken growth at a given monument would displace some 20% of archaeological deposits extending to *c*0.26m below the surface (Dartmoor Archaeology and Bracken Project 2001, 9). As a result of increased bracken growth, site visibility will be reduced and the possibility of damage to newly exposed monuments, and importantly the stratigraphic sequence, increased.

2.3.5 Collectively the effect of the present crisis is resulting in a dramatic change to the upland farming landscape; however, it is too soon after the epidemic to establish the extent to which there will be a damaging and long-lasting impact upon the peatland landscape.

2.3.6 The impact of the changing agricultural practice is similarly having a direct impact upon the farms and farm buildings and these are being severely adversely affected as a result. This has prompted the submission by OAN of a project proposal for a pilot study, at the request of English Heritage, which would examine the threats, the impact of foot and mouth disease, establish a methodology, and assess the condition of the resource of traditional farm buildings in the North West. This farmsteads project, when considered with the proposed upland peat project, would together provide an holistic approach to the issue of the impact of agricultural change upon the rural landscape and enable a more effective assessment of the problems and the potential solutions.

2.3.7 In addition there is the long term residual effects of land improvements undertaken within the last thirty years; these have entailed the deliberate and widespread drainage of upland peatlands. While some drains have become blocked and no longer effect the drainage of the peatands, many have been expanded by subsequent water erosion, often creating substantial gullies, which then substantially increase the drainage of the adjacent peatlands (Quartermaine 1994).

2.3.8 Similarly, there is growing evidence for an acceleration of climatic change, which has the potential to have a significant and increasing impact on the upland landscape of the North West. In the short term, increased rainfall has already contributed to the accelerating erosion of upland peatlands by increasing run-off in areas of already unstable peat where vegetation cover has been damaged or removed. In the past, for example on Anglezarke in the 1970s and 1980s, extensive uncontrolled burning as a result of drought had much the same effect (Howard Davis 1996, 135). This resulted in the substantial deepening and widening of natural drainage channels, the redeposition of peat in erosion fans, landslip, and the widespread loss of peat cover over large areas of the moor, exposing the underlying mineral soils. In the longer term, climatic change has the potential to alter substantially the environmental regime of English uplands.

2.3.9 ***Quantification of Threats:*** although it is apparent that there are a wide ranging threats to the upland peats, throughout the country, it is, at present, not evident as to

which are will have the greatest impact and as to how damaging this will be to the peatland resource. There is a clear need to quantify the impact of the individual threats upon the resource, to examine how they impact the peatlands and to establish which topographic contexts are under the greatest threat.

2.3.10 ***Legal Status:*** the uplands of North West England vary in legal status and ownership. Much of the central Cumbrian uplands lie within the Lake District National Park and a substantial proportion of this is owned by the National Trust; the uplands of Yorkshire are in part within the Yorkshire Dales National Park and the North York Moors National Park. The North Pennines of Cumbria, the Forest of Bowland of North Lancashire, and Nidderdale in North Yorkshire, are designated Areas of Outstanding Natural Beauty. Some of the better known ritual, funerary and settlement and field system complexes are protected as Scheduled Monuments, although the Neolithic axe factories in the central Lake District are not. It should be noted that a submission for World Heritage Status for the Lake District is being put forward which, if successful, would have a hopefully beneficial impact upon the management of the archaeological resource.

2.3.11 ***Access:*** OAN's extant and continuing good working relationships with many of the public and private bodies concerned will facilitate consent to work on their land and, apart from any restrictions remaining in place as a result of the 2001 outbreak of foot and mouth disease, access is not regarded as a general problem. Access to one or two of the larger privately-owned estates has in the past been restricted but it is important to note that if, as intended, elements of the project are carried out under the aegis of wider-based rural initiatives, such as that currently proposed for the Forest of Bowland (*Section 2.3.4*), this impediment will be removed and the County Councils of Lancashire and Cumbria have a well-established track-record of close negotiations with the large estates in both regions.

2.3.12 ***Archive and Deposition:*** the archive to be created by the programme will incorporate data initially from two counties, and this will comprise conventional paper material, alongside digital GIS data, which will need an appropriate computer system to be used, and palaeoenvironmental cores, which will need to be stored in cool (refrigerated) conditions. It would be detrimental to the development of management strategies if the archive were to be split up into county-sized components, as this would significantly undermine its usefulness. The palaeoenvironmental cores could also not be stored by Record Offices and museums rarely have facilities for refrigerated storage. In addition, the primary data are held within a single GIS system in order that they be used effectively. At the request of the curators it is, however, proposed that the digital archive be transferred in appropriate formats back to the respective SMRs, where the data will be curated and maintained, and where the data will be used to develop management strategies for sites and areas. However, a digital copy of the complete data set will be retained along with the palaeoenvironmental cores at the Lancaster offices of OAN to enable further analysis on a regional or national basis. This data set will exclude map data which will be returned to the County Council and National Park SMRs from where they originated. The archaeological data, which will include data under copyright from the SMRs, will be retained solely for the use of the Upland Peat Project.

2.4 PILOT STUDY AREAS

2.4.1 The project is seeking to explore a methodology and a management policy that will enable the preservation of the upland peats. The targetting of management proscriptions needs to be on those upland peats that are under greatest threat and those preserving a significant archaeological resourve. The examining of specially selected areas will serve to establish a methodology that can be applied to the whole issue of site visibility in the upland peatlands, and will also serve to explore and quantify the character and scale of the threats that are impacting the resource. This project will concentrate on four areas of peatland in the North West: the south-west fells of the Lake District, the western slopes of the Forest of Bowland, and the western outlying uplands of south Lancashire. These areas have been chosen, in consultation with those partners mentioned in *Section 2.2* above, so as to maximise and expand on the results of earlier surveys, which include NWWS (Hodgkinson *et al* 2000), the Lake District National Park Survey (LDNPS, Quartermaine and Leech forthcoming), the United Utilities Plc estate survey of the Forest of Bowland (LUAU 1997b), and the Anglezarke Survey (Howard Davis 1996). Three of the areas (South-West Fell, Langdale and Anglezarke) have been subject to detailed survey, and have involved the mapping of the eroding peat scars in the vicinity of the archaeological sites, and as such can provide comparative data for assessing the changing condition of the peatlands. The intention of selecting the four areas is to provide disparate peatland landscapes, each affected by a differing range of threats, and each with differing site visibility. The examination of such areas will enable a detailed investigation of the various threats to the peatland resource and will explore methods to identify the archaeological resource.

2.4.2 ***West Cumbria*** (Area 1, Fig 1): the proposed study area forms a transect across the south-west fells in West Cumbria in the Lake District. It has been selected as it is an area of proven archaeological resource (Quartermaine 1989; Leech 1983), but where peat cover is generally thin and patchy. The absence of peat allows for exceptional site visibility and, allowing for differences of topography, it will provide a control to assess the archaeological potential of other upland areas where site visibility is restricted by peat cover. By virtue of the limited peat deposition, it is more vulnerable to external disturbance or environmental change.

2.4.3 The western part of the proposed study area has been surveyed as part of the English Heritage-funded Lake District National Park Survey, which revealed there an extremely rich archaeological resource, and recorded this in some detail, which will not need to be repeated within this project. In the main the archaeological resource comprises multi-period (though principally Bronze Age) settlement and agricultural landscapes extending over as much as 40km^2, and a staggered transect is proposed across these, between SD 116 962 and SD 200 936, which will take in significant variations in terrain and altitude. The LDNPS survey areas were selected on the basis of the assumption that site locations favoured particular types of topography and range of altitude; the proposed survey will extend considerably beyond the earlier study areas in order to test these assumptions.

2.4.4 Although blanket peat coverage is generally thin, the presence of a large number of small basin mires gives the opportunity for detailed examination and comparison between local environmental conditions through time. It is anticipated that returning to an area where high-quality survey was carried out approximately

17 years ago will enable a clear picture of peat loss and/or erosion to be gained and quantified by re-survey, as closely comparable to the original as possible (now achieved at considerably greater speed using GPS technology). It will allow an assessment of how the loss of overlying peat has changed the appearance and potential interpretation of particular monument groups by exposing more elements, or more clearly defining boundaries. It will also assess how peat loss can have affected preservation, by laying monuments open to other forms of damage. The manner in which the changing modern vegetation patterns associated with peat loss have affected site visibility will also be examined.

2.4.5 ***Forest of Bowland, north Lancashire*** (Area 2, Fig 2): the Forest of Bowland is designated as an AONB and has been selected for this project since it has extensive tracts of largely undisturbed peat, and substantial peatlands are already actively managed for the preservation of vegetation cover in pursuance of the needs of other industries, such as water catchment, moorland management, and game shooting. The west-facing scarp of this upland block is an exception to this, and numerous erosion patches there have exposed substantial areas of mineral soil in recent years. To the immediate west, the Over Wyre mosses were extensively surveyed by the NWWS (Middleton *et al* 1995) and the west-facing periphery of the Bowland upland bloc provides a well-defined interface between the two projects where NWWS data and that derived from this study would run contiguously. An archaeological survey has already been undertaken of the United Utilities Plc holdings in Bowland; these extend across the southern and eastern parts of the Forest of Bowland, and form approximately one third of the designated AONB. This project used standard extensive survey techniques, but identified only a restricted archaeological resource (LUAU 1997b), as a result of poor site visibility, directly related to the considerable surviving depth of peat. A recent palaeoecological study at Fairsnape Fell, however, on the western slopes of the Forest of Bowland, has demonstrated vegetation change in later prehistory and also in the historical period (Mackay and Tallis 1994). The proposed transect will extend from the eastern edge of the NWWS study area, at the Lancaster Canal near Cabus (SD 485 485), via Nickey Nook to White Moss (Grizedale Fell) (SD 575 505) at the western edge of the survey area for the United Utilities Plc survey; as such this provides a genuine point of comparison between results of the present project and those of the NWWS survey and the United Utilities Plc surveys.

2.4.6 This and the other proposed study areas will enable the project to address the need for responsive survey and analytical methodologies capable of optimising data-gathering in differing peat conditions. It will thus enable in the future tailored local or individual responses to the problems of the management of the resource, in areas of deep peat possibly relying much more heavily on the predictive modelling of zones of high potential, rather than on a database of extant monuments. This is likely to necessitate a differing approach to interaction with local land holders, relying more on a range of less overtly archaeological observations to predict and locate potential sites of interest. More use will be made of targeted opportunities to raise local awareness, not only with regard to the nature of the archaeological resource, but also to the desirability of reporting it. Such an approach will fit well within the Lancashire Farm Facilitation Service and a proposed HLF submission for an environmental and archaeological study of

the Forest of Bowland, which will provide baseline data for the Lancashire Farm Facilitation Service.

2.4.7 ***Anglezarke and Rivington Moors, south Lancashire and Greater Manchester*** (Area 3, Fig 3): this extensive upland has been chosen to encompass both an area of actively eroding peat with a moderately to relatively well-known archaeological resource (Anglezarke), and some relatively recent (1980s) targeted palaeoecological research on modern vegetational cover, with another (Rivington) that has thick uneroded peat and little archaeological evidence (Howard Davis 1996). Anglezarke Moor is a relatively low-lying and gently-sloping moorland (maximum altitude 390m OD), which contrasts with the adjacent, elevated, steep-sided but flat-topped moorland of Rivington (maximum altitude 450m OD). In the past, extensive survey on Anglezarke in the 1980s (*ibid*) has established the potential for discovery of significant archaeological monuments preserved beneath the peat, as well as demonstrating a significant amount of activity post-dating peat onset, in the form of stone structures within and upon the peat. The area has suffered from a number of natural and man-made episodes of erosion in the last quarter-century, including widespread peat fires, the likelihood of arrested peat development as a result of atmospheric pollution, and heavy recreational use as a direct result of its proximity to the major urban conurbation of Bolton / Manchester.

2.4.8 The survey established a rich archaeological record from as far back as the early Mesolithic period, with evidence for Neolithic ritual monuments, Bronze Age landscapes, and a considerable amount of built evidence for post-medieval farming practice and the nature of its mixed economy, depending on seasonal activities such as quarrying to supplement income. The palaeoenvironmental record implies that Prehistoric upland exploitation had continued throughout the Iron Age and Roman periods at least.

2.4.9 The principle reason for selecting this area is to provide a direct comparator between two very comparable moorlands, but with differing site visibility as a result of recent erosion. As an area of severe peat erosion, and one that has been subject to detailed survey in the 1980s, it will be possible to assess the impact of peat erosion upon the resource by comparing the present day condition with the records of the earlier survey. At the same time, palaeoecological investigation will examine the extent to which the ecological resource has been affected, and the degree of truncation, by comparing cores from both moors. By virtue of the earlier detailed survys of the landscape it will be possible to provide reliable quantitive data for the threats and the changing condition of the peatlands.

2.4.10 ***Great Landgale, Cumbria (Area 4, Fig 4):*** the Great Langdale pilot study area is selected specifically to enable the opportunity to review the impact of visitor pressure upon the peatland resource. The area is subject to considerable visitor pressure, being in the centre of the Lake District and being one of the easily accessible mountainous areas. The plateau behind the summits of Harrison Stickle and Pike of Stickle, has a sunstantial peatland resource which overlies extensive Neolithic axe factory workings (Bradley and Edmonds 1993). The area is important for the present study because earlier surveys, dating back to 1984 (Claris and Quartermaine 1989), have involved detailed recording of the axe factory workings and the associated peat desposits, including precise mapping and

fixed point photographs for all axe factory working sites. Investigation of the area as part of the present study will enable a direct comparison between the condition of the peatlands now and those from 1984. It will provide the potential to quantify the impact of visitor pressure, and grazing pressure (Quartermaine 1994), upon such peatlands and will serve as a comparator for other areas of peatland which have high levels of visitor pressure.

2.5 PREVIOUS WORK

2.5.1 Numerous survey projects have been undertaken within the North West uplands within the last 25 years, many concentrating on areas where peatlands have not developed. The most significant and relevant of these has been a series of landscape surveys undertaken by Oxford Archaeology North (OAN) (in its former guise of Lancaster University Archaeological Unit) at the behest of a number of public and private organisations. In Cumbria, the Lake District National Park Survey (Quartermaine and Leech forthcoming) has made a significant contribution to the understanding of the development of human activity and settlement in the National Park. Surveys at Haweswater and Thirlmere, prompted by the management requirements of United Utilities Plc (formerly North West Water Plc), one of the largest private land-owners in the region's uplands, have expanded the record of known sites of all ages considerably (eg LUAU 1997a). Elsewhere, in Lancashire, a survey of the United Utilities Plc holdings in the Forest of Bowland (LUAU 1997b) has made a first contribution to understanding infra-regional differences in the levels of preservation and visibility of archaeological sites in the upland context and, if considered with the extensive survey undertaken at Anglezarke and Rivington Moors in the mid-1980s (Howard Davis 1996), bears the potential to explore perceived differences in the level of upland settlement or other land use over an extended period.

2.5.2 As part of the original Anglezarke Moor survey, the opportunity was taken to undertake palaeoenvironmental research in relation to a burial cairn excavated as part of the project (Howard-Davis 1996; Barnes and Bain 1985) and which was linked in to palynological work undertaken from the Rivington-Anglezake uplands (Bain nd). Elsewhere, however, palaeoenvironmental research has not played a large part in the investigation of upland archaeology within the region, because of a lack of integration between this and archaeological research. A considerable amount of palaeoecological research (undertaken with other priorities than archaeology) exists, however, for the central uplands of the Lake District, much of which provides evidence for the anthropogenic modification of the surrounding vegetation from as early as the Early Mesolithic period (Pennington 1973, 96) and on, throughout the Prehistoric period (Pearsall and Pennington 1973; Pennington 1975; Bradley and Edmonds 1993). Between 1987 and 1997 English Heritage funded an extensive archaeological and palaeoenvironmental survey of the lowland peats of North West England (NWWS) which has been published on their behalf as a series of nationally well-received county-based monograph reports (Cowell and Innes 1994, Middleton *et al* 1995, Hall *et al* 1995, Leah *et al* 1997, Leah *et al* 1998, Hodgkinson *et al*; Middleton *et al* forthcoming), and information was further disseminated by a series of annual conferences, as well as the participation of individuals in numerous other public events.

2.5.3 ***NWWS Archive:*** the NWWS archive is maintained and curated by OAN at their Lancaster office, and is accessible to local curators and other researchers. As a direct result of NWWS, OAN continues to maintain academically respected palaeoenvironmental expertise in-house, and in addition has maintained access to appropriate laboratory facilities via agreement with Lancaster University.

2.5.4 OAN is widely acknowledged as a leader in extensive field survey and has undertaken numerous field projects in the uplands of Northern England; the results of these will be heavily drawn upon during the proposed project, lessening the need for new survey work and improving the cost-effectiveness of the programme. Archives generated by all upland-related work by OAN are deposited in the appropriate County Record Office and/or with the commissioning client. Duplicate archives of all such relevant projects are retained at the OAN Lancaster office and are thus freely available for consultation. Access to the appropriate county SMRs and to the database maintained by the Lake District National Park Authority has been negotiated with the curators of the region.

3. AIMS AND OBJECTIVES

3.1 INTRODUCTION

3.1.1 The proposed project is a pilot study initially examining the upland peats of NorthWest England, but which is aiming to develop a methodology and management strategy for the archaeologicall significant upland peats across the rest of the country. The development of such a strategy needs to establish the nature, and severity of the threats that impact the upland peats, and also to establish under which peatlands are preserved the greatest, and most significant archaeological resource. To establish the latter there is a need for an experimental programme to investigate techniques that will cost-effectively identify the underlying archaeological monuments. Developing from this investigative and experimental programme will be the establishment of a predictive model for the identification of the significant archaeological resources and those areas, and types of peatland, which are under greatest threat. This will enable the targeting of resources to facilitate the efficient, effective, and proactive management of the surviving peatlands in a changing physical and politico/economic environment. The aims and objectives are in accord with the English Heritage Strategy for Wetlands (2002), which lay considerable emphasis on the management of the wetlands, in conjunction with the wetland management agencies (English Nature and the Environment Agency). This also highlights the need for outreach to raise the awareness of the threats and value of the welands to a wider institutional and public audience. The strategy recognises the need for further research to quantify the archaeological resource, and identify the '*range of direct and indirect threats*'. It defines as a priority the need for research into the upland peatlands.

3.2 AIMS

3.2.1 It is recognised that the enormous extent of the English uplands means that an entirely survey-orientated approach is not economically feasible, and that therefore a need exists to investigate a cost-effective approach that will provide data to enable the management of the resource. It is thus proposed that a pilot study be undertaken in four contrasting parts of North West England, enabling refinements of recording and interpretative methodology to be tailored to varying physical circumstances, thereby providing scope for comparison between the four areas to begin to indicate genuine variations in distribution, preservation and so on and, most importantly, to assess the validity of further work.

3.2.2 The aims expressed below are applicable not only to the proposed pilot study, but also to any subsequent work that should be deemed appropriate. The primary aims are to develop a methodology to quantify in a cost-effective manner the resource, and the threats to it, and to produce a suite of data and interpretative comment which will facilitate economic, efficient, flexible and proactive management, preservation, and presentation of the anthropogenic element of the surviving upland peat resource throughout England, within a changing physical and politico/economic environment.

3.2.3 To this end separate but integrated aims can be defined:

i) Development of Appropriate Methodologies:

a) to develop a suite of field and analytical methodologies by means of a series of studies centred on four areas of upland peatlands, selected to provide a range of contrasting physical, archaeological, and palaeoecological landscapes on which to develop and test methodologies;

b) to establish the possibility of creating a predictive model that can be used as a management tool for the nationwide resource.

ii) Peat Monitoring:

a) to determine the physical extent and survival of upland peats in the selected pilot study areas;

b) to establish the extent and likely causes of erosion in these areas;

c) to assess the rate of loss and decline of the peatlands in these areas;

d) to extend the assessment of peat loss and erosion, by means of a broader desk-based study, to the wider area of the North West.

e) to identify and quantify the threats impacting on the peatlands within the study areas, and to establish a model, pertaining to the rest of the country, that identifies the conditions governing peat loss and decline.

iii) Evaluation of the Archaeological and Palynological Resource:

a) to determine the nature, extent, quality, survival and date-range of associated archaeological and palaeoenvironmental evidence within four pilot study areas;

b) to determine the impact of peat-loss on the resource in these areas;

c) to gain an understanding of the archaeological process and any human activity in the peat-covered pilot study areas, with a view to ultimately gaining a broader understanding of human interaction with the physical landscape at all periods in the uplands of England.

iv) Management:

a) to develop an academically sustainable suite of predictive models which will facilitate the development of a schedule of economic, efficient, flexible and proactive management;

b) to enable the preservation, and presentation of the anthropogenic element of the surviving upland peat resource within a changing physical and politico/economic environment;

c) to review the information base derived from ***ii*** and ***iii*** (above), and assess its validity in targeting further areas for fieldwork and developing a national strategy for the management of upland peatlands.

d) to quantify and assess the threats to the upland peats, and to establish which type of peatland landscape is most vulnerable.

v) Dissemination:

a) to publish a review of the project, to inform and enable discussion within both the archaeological profession and the wider context of other landscape and environmental management professionals.

b) to extend the outreach of the project and disseminate its aims and results to a wider audience.

3.3 OBJECTIVES OF THE PROJECT

3.3.1 ***Development of Methodologies:*** the principal management aim of the pilot study is to develop a baseline survey and management tool that will be applicable for all upland peat regions in England; the objectives towards this aim are as follows:

i) to implement a programme of experimentation in identification and recording techniques of the archaeological resource and a corresponding experimental approach to palaeoecological field methodologies;

ii) to assess the potential of a range of palaeoenvironmental strategies to optimise data recovery in disparate and varying terrain and, where desirable, the refinement of old and the development of new approaches to the closer integration of palaeoenvironmental and archaeological data;

iii) to develop an effective, well-designed, and flexible GIS which will provide an easily accessible presentation of a range of datasets;

iv) to effect the economic and efficient collection and utilisation of extant written and photographic records to provide an appropriate, reliable, and swiftly assimilated information base for a GIS intended to provide the potential for predictive modelling;

v) to attempt to provide systematic absolute dating of significant peat horizons and peat inception in close association with selected monuments, transects, and/or other significant palaeoenvironmental deposits;

vi) to achieve the integration of the project, where possible and appropriate, with other regional environmental and economic initiatives;

vii) to ensure, wherever realistically achievable, easy compatibility between the proposed GIS and the datasets of agreed curatorial bodies within the region.

3.3.2 Management Objectives: the project would assess the threat to the resource, and the need for the implementation of a proactive management regime. Where possible the impact of the threats to the upland landcape would be quantified so enabling the development of a management programme that is targeted at peatland terrains that are most vulnerable, and would enable the monitoring and preservation of the threatened upland blanket peats. If the survival and curation of these deposits is to be affected by such a regime, it will necessitate a rapid and informed archaeological approach that takes into consideration all facets of the preservation of a significant and increasingly vulnerable prehistoric and historic landscape. It is difficult to see how such a response could be effected without reliable baseline data, well-structured and responsive recording methodologies, and the facility for predictive modelling. To this end the primary management objectives are to provide a baseline survey that will enable the establishment of predictive modelling, which will serve as a management tool to target resources to

areas of greatest archaeological potential and threat, and can inform the management decision making. The detailed objectives to achieve this are as follows:

i) to develop an effective, well-designed, and flexible GIS which will provide an easily accessible presentation of a range of datasets. This will facilitate the development of predictive models, intended to inform management decision-making;

ii) to achieve the integration of the project where possible and appropriate, with other regional environmental and economic initiatives, in order to maximise the added value of the project as a proactive tool in the management and preservation of upland peat;

iii) to inform the formulation of countryside stewardship schemes within upland contexts, and thereby allow the management of the resource;

iv) to ensure, wherever realistically achievable, easy compatibility between the proposed GIS and the datasets of agreed curatorial bodies within the region;

v) to enable the transfer of data into the Historic Landscape Characterisation programmes within the Northern Counties.

3.3.3 ***Academic Objectives:*** the academic objectives provide the underlying premise behind the proposed pilot project. It is intended that the study should make a valuable contribution to local and regional archaeological knowledge, since the development of the upland palimpsest landscape is not well understood in the region, or beyond. The selection of four separate and contrasting areas will provide a consistent dataset and will thus allow valid comparisons to be drawn, indicating differences and similarities within the region. In general, the project will complement the research already undertaken on the lowland wetlands of the region, and thereby add significantly to an understanding and potential management of the national wetland resource. The detailed objectives within this overarching objective are as follows:

i) to contribute towards an increased understanding of the upland element of the Mesolithic territorial ranges within the four study areas;

ii) to contribute towards an increased understanding of the inception and development of the Neolithic period in the region;

iii) to contribute to an increased understanding and more reliable dating of the inception and development of Bronze Age settlements and field systems in the Cumbrian uplands and to contrast this with the apparent lack of such well-preserved Bronze Age agricultural landscapes elsewhere in the region;

iv) to attempt to link the development or otherwise of these complexes with changes or regional differences in the agricultural strategies of contemporary groups implied within the palaeoenvironmental record;

v) to contribute to an increased understanding of the Iron Age, which remains enigmatic within the region as a whole;

vi) to contribute to an understanding of upland settlement and exploitation during the later Iron Age and the extent of change that can be attributed to the arrival of Rome within the region;

vii) to contribute to an understanding of the post-Roman and pre-Conquest exploitation of the uplands of northern England;

viii) to contribute to an understanding of the medieval exploitation of the uplands of the region;

ix) to contribute to an understanding of the constraints on human activity throughout prehistory and history in an attempt to determine whether the perceived limitations of altitude, aspect, and slope have more than an incidental bearing on the distribution of sites;

x) to contribute to a wider knowledge and refined dating of peat onset in the North West.

3.3.4 ***Prehistoric:*** whilst palaeoenvironmental evidence for clearance and farming activity is widespread throughout the palaeoenvironmental record of the region, extant Neolithic monuments are less well known, and Neolithic settlement not at all. Reliable dating is needed to establish the extent to which Bronze Age landscapes have their origin in the Neolithic. At the opposite end of the Bronze Age there is a need to gain an insight into the apparent absence, or indications of a withdrawal from, the uplands subsequent to the recorded climatic changes of the later Bronze Age. Such a study would contribute significantly to regional and national knowledge of these periods sometimes represented in the North West as an atrophy of Bronze Age development rather than the developmental progression towards urbanism seen in the southern part of England.

3.3.5 ***Iron Age / Early Medieval Transition:*** current evidence implies that, apart from the imposition of the Roman civil and military infrastructures, the native population remained unchanged to such an extent that in most of North West England the period should be more correctly regarded as a Roman and, indeed, post-Roman Iron Age. A relatively large distribution of Romano-British settlement has been identified within areas of high site visibility in the uplands which contrasts both with the adjacent lowlands and also the peat-covered uplands; there is a need to redress the bias and examine the extent to which such settlement extended over the extensive peat-covered uplands. Recent palynological studies have identified substantial clearance episodes within the Lake District, which, coupled with place-name evidence, suggests a marked occupation of the uplands during the early medieval period, but there is a marked dearth of settlement evidence. There is a need to redress the imbalance in the peatland regions by field survey, coupled with palynological sampling to identify the evidence for the early medieval occupation.

3.3.6 ***Publication and Presentation Objectives:*** the objectives of dissemination are fundamental to the project, and develop out from the immediate needs of the pilot project to a broader dissemination as part of subsequent stages of the project.

i) ***Academic Publication:*** at present the full extent of publication can not be fully assessed. However, it is likley that at last one monograph within the *Lancaster Imprints* series will be produced; it should be noted that six NWWS volumes have been published within this series, with a seventh

nearing completion. It is also proposed to explore the use of a series of *Occasional Papers* that have been published by Oxford Archaeology, which in the past has been used with some success for the publication of small excavations.

ii) ***Specialist Publication:*** elements of the project significant to the understanding of particular periods will, of course, be disseminated, where possible, via an appropriate national journal. Likewise, significant contributions to the understanding and interpretation of the palaeoenvironmental record will be disseminated, where possible, through the appropriate national journal.

iii) ***Conferences:*** if the project produces the results predicted of it, it is proposed that a conference be organised, to present the results of the project and to invite input from specialists working in similar fields. This would be operated on a similar basis to those established for the NWWS.

iv) ***Outreach:*** as a management tool, it is anticipated that data and information accrued during the project would be available for more targeted public presentation. This could take the form, for example, of information boards, encouraging a better and more widespread understanding of the upland landscape by those who use it for work and leisure. Work elsewhere has ably demonstrated that raising the level of public knowledge of end-users of all kinds engenders increased respect for the preservation of natural and man-made features within the landscape. At this stage it is proposed that leaflets be produced introducing the aims and scope of the project, and these would be targeted on landowners, museums, and libraries.

v) It is proposed that a series of lectures be made to local groups and societies, particularly within the area of each study area to broaden the outreach of the project. It is also proposed to produce a schools pack to provide information that would be pertinent to the relevanmt key stages of the schools curriculum.

vi) ***Digital Outreach:*** Some public (possibly restricted) internet dissemination of the GIS or its datasets via the Archaeological Data Service is being explored. This would have, presumably, to rely on the consent of individual landowners and statutory bodies.

4. PILOT STUDY METHODOLOGY

4.1 INTRODUCTION

4.1.1 Within such a large area as the North West, there is inevitably substantial variation in the state, preservation, and extent of present peat cover. In some areas, for instance the west-facing scarp slopes of the Pennines, it can be shown to be eroding rapidly, whilst in others, for instance parts of the Forest of Bowland, it remains in a good state of preservation with several metres depth of peat surviving over considerable areas. Similarly the known archaeological and palaeoenvironmental resource associated with the peatlands is highly variable, and on occasion extremely localised. It is thus proposed that a phased approach for the pilot study would provide best value in establishing the scope and size of the resource. At a macro-level, a desk-based study will capture the extent of peat from soil survey maps and infra-red satellite imagery, and will also capture upland SMR data for the North West region. At a micro-level, the study will look in detail at four specifically chosen areas which it is thought reflect the considerable range of conditions of peat survival, threat, and archaeological potential within the north-west of England. It is intended that this will act as an assessment of potential for, and facilitate informed decision on, the nature and extent of any subsequent wider-ranging project.

4.1.2 The detailed field survey and palaeoecological analysis in the four areas will establish the surviving extent of, and perceptible threats to, their upland peats and associated archaeological and palaeoenvironmental resource. Appropriate desk-based and fieldwork techniques will be used to determine the rate of erosion and loss, the nature and extent of association with archaeological remains below, within, or above the peat, and the palaeoenvironmental and dating potential of the peat.

4.2 PREPARATION

4.2.1 ***Tasks 1 - 6*** **(Aims i a/b; iv a ; v b)**

4.2.2 The project infrastructure will be set up. In addition initial liaison with spcialists and curators will be undertaken, an the data base and GIS will be established. GIS training will be provided for team members.

4.2.3 ***GIS Structure (Task 4):*** at the outset, a GIS system will be established and a database designed to facilitate input and analysis of the data. It will be tailored to allow interaction between datasets from the individual study areas and also comparison with extant projects, such as the NWWS, enabling a region-wide analysis, of the wetland archaeological and palaeoenvironmental resource. The GIS will be designed by appropriate specialists in this field (*Section 5*). The potential for the use of GIS systems has been clearly demonstrated by the NWWS project, as a means of integrating a map-based interpretation system with the detailed database; it is proposed that an effective system should be developed using the experience gained from that project and from the establishment of the GIS for the Lancaster and Oxford Urban Archaeological Databases.

4.2.4 Whilst the project will 'stand alone', it is important that it also integrates data from the region's Sites and Monuments Records (SMRs) and provides data to feed into these systems. However, The North West SMRs use a variety of GIS packages; for instance, the Lake District National Park Authority uses Mapinfo 5, Cumbria County Council uses GGP, and Lancashire County Council is currently using ArcView 3.2a. This is not necessarily a problem as all of these packages have exchange formats which can be easily read by other packages. The choice of system for this project is limited by the tools available, the need to provide exchange formats, and the need to operate on a desk-top PC. It has been decided, following consultation, to use ArcView with Spatial Analyst and 3D-Analyst extensions, as this satisfies the conditions defined above, is compatible with the SMR GIS systems, and will maximise our experience of using both ArcInfo (with NWWS) and ArcView (Oxford and Lancaster UADs). The structure of the GIS would be based on the Lancashire GIS in order to enhance compatibility for transfer of datasets to that SMR. The most recent version of the software, V8.1, allows for an active link with Access 2000, which is an essential pre-requisite of the proposed GIS, and has the advantage that a mouse-click on a point or area on the ArcView map can result in the relevant Access database record being displayed in an Access form. Conversely, the click of a button on an Access form can result in the relevant point or region being highlighted on the ArcView map. This form of dynamic linkage provides a powerful tool for database query and spatial visualisation.

4.2.5 Access 2000 incorporates extremely powerful tools for the creation of customised forms, and functionality can be improved through the use of macros and Visual Basic Scripts linked to buttons and events. ArcView allows the display of data in different layers; this overlaying technique, along with buffering and the advanced capabilities of the two Analyst extensions, will allow the presentation, modelling, and interpretation of layers of information ranging from early maps, documentary evidence, and palaeoenvironmental data, to topographic surfaces, peat coverage, SMR data, and archaeological survey data. Such techniques are fundamental in the analysis of geographic datasets, and will allow the derivation of a much broader range of information layers. The clear graphic representation of information will allow rapid comparisons of a disparate range of data, which would, for example, allow for spatial analysis between site data and altitude or peat cover as a means of predicting buried site distribution, and will facilitate the effective and responsible management of the archaeological resource.

4.2.6 ***Database Structure (Task 5):*** the database used will conform to standards defined by English Heritage and the former Royal Commission on Historical Monuments (England) (RCHM(E) 1998), including the use of the various thesaurus created by the Royal Commission. It will be compatible with existing national and international archaeological record formats, including the MIDAS standard (RCHM(E) 1998). As a starting point, the project will utilise a similar data structure to that established within the Exegesis software, which is utilised by Lancashire SMR. It will, however, also incorporate additional tables and fields to allow the incorporation of palaeoecological data. This database structure incorporates the generally agreed division between Events, Monuments and Findspots.

4.2.7 ***GIS Training (Task 6):*** following the design of the GIS and database system, selective members of the project team will be trained in the input and manipulation of the combined database and GIS system.

4.3 DESK-BASED ASSESSMENT

4.3.1 ***Tasks 7-21*** **(Aims i a; ii a/b/c; iii a/c)**

4.3.2 ***Graphical Data Sets (Task 7):*** the primary stage of the desk-based assessment is to capture datasets from the Lake District National Park Authority and Lancashire County Coucil, which will include historic and current mapping. Agreements have been made with Lancashire County Council and the Lake District National Park Authority for the use of pertinent digital datasets. The base mapping for the GIS will be the Ordnance Survey (OS) Landline coverage, which was surveyed at accuracies appropriate for 1:2500, or 1:1250 publication; and 1:10,000 and larger scale raster mapping will be used for location mapping purposes. The datasets will be provided under licence by Lancashire County Council and the Lake District National Park Authority; it is a requirement of the OS licence that this data is deleted or returned at the completion of the project and that it is not used on any other project.

4.3.3 Other digital datasets supplied will include raster scanned OS 1st edition maps at 1:10,560 scale (published 1844-1852). Statutory information, such as boundaries of the National Park, AONBs, SSSIs, Scheduled Monuments, Registered Parks and Gardens, and Parishes, District and County Boundaries, is available for the project areas. Historic land characterisation mapping has been undertaken for Lancashire and is presently being produced for Cumbria (the west Cumbria area has yet to be mapped); this digital data, where available, will also be incorporated into the project. This work has defined broad character types describing the historic dimension of today's landscapes, but does not attempt to map for any earlier historical period. However, an enhanced landscape characterisation is presently being undertaken by Lancashire County Council for the Forest of Bowland and this dataset will potentially be available for the proposed project. Digital terrain data are available for Lancashire and will enable the definition of modelled surfaces for the analysis of the palaeoecological and archaeological data.

4.3.4 ***Soil Map Data (Task 8):*** it is also intended that a layer be established showing the extent of peat from soil maps for the whole of the documentary study area (Cumbria and Lancashire), but, this is only available in paper format at 1:250,000 scale and thus is of insufficient accuracy for detailed survey work. It is therefore proposed that the use of infra-red satellite imagery be investigated as a means of identifying the extent of peat in the pilot study areas (*Section 4.2.9*).

4.3.5 ***Palaeoenvironmental Desk-Based Study (Tasks 9-12, 15 and 16):*** a preliminary desk-based data-gathering exercise will establish the extent, nature, and known archaeological and palaeoenvironmental status of the four areas proposed. It will also inform the detailed selection of much more limited field study areas (transects (*Section 4.5.4*)) for intensive archaeological and palaeoenvironmental investigation.

4.3.6 It will derive baseline data about the present extent and survival of peat, and significant areas of erosion, from the Phase 1 Habitat Survey for counties and districts, extant Soil Survey data, soil maps, and through the use of infra-red satellite imagery. The value of these documentary techniques will be tested by ground truthing, in the course of the field surveys (*Section 4.4*), and an assessment will be made of the value of this technique for their use in the future.

4.3.7 ***Satellite Imaging (Tasks 9-11):*** the use of infra-red satellite images can provide an indication of the vegetation cover over the ground and, as there are notable differences in the dominant vegetation on unimproved peatland by comparison with better drained land, this can be used as an indicator of peatland. It is proposed that Landsat 7 infra-red images be used which provide a pixel resolution of 30m. The material will be provided as raster images or will be scanned into the GIS system. The images can be examined by an automated system which provides comparison between the vegetation of peat-covered areas used as a control and the rest of the image. In the present instance it is proposed that only a small area be examined to enable the system to be tested and for this it will be possible to use manual comparison techniques to provide an assessment of peatlands. The results of the desk-based exercise will be subject to ground truthing to test the reliability and accuracy of the system.

4.3.8 ***Air Photography (Tasks 19-21):*** contemporary and past air-photographic coverage will be examined and plotted for the broad extent of the pilot study areas; this will serve to determine and chart the progress of peat erosion over the last 50 years (since RAF vertical air photography was taken soon after World War II), ideally as a series of time-slice maps. As air coverage within the region varies considerably in scale and frequency, the project will start with the most recent available coverage and work back, to establish as complete a coverage as possible. The changing extent of the peat cover will be incorporated as separate layers into the GIS, which will then be used to analyse the areas with the greatest degradation. The most recent photography will be used to identify areas of exposed, and therefore eroding, peat, to serve as a guide for the field survey which will then target these areas.

4.3.9 ***Palaeoenvironmental Documentary Study (Tasks 17-18):*** the desk-based study will derive baseline palaeoenvironmental data from a search of the relevant journals, a selected range of unpublished work, and from contact with leading workers in the region. It will seek to determine the accurate (six or eight-figure NGR) location and altitude of sites along with a summary of chronological information and a history of palaeoenvironmental intervention.

4.3.10 ***Archaeological Desk-Based Study (Tasks 12-14):*** the study will be undertaken at two levels: at a generalised level for the whole of the region and in more detail for the individual pilot study areas. The generalised data capture will involve digital data transfer from the Lancashire and Lake District SMRs (both in compatible GIS systems) into the project GIS, ensuring that a direct link is provided between the Access tables and the ArcView graphic maps. For the pilot study areas, the SMR information will be augmented by incorporating the digital data from detailed surveys undertaken in each region. The LDNPS surveys for the West Cumbria study area (Quartermaine and Leech forthcoming) have been digitised by LDNPA, and will be transferred as a separate layer. The Anglezarke

and Rivington surveys have not as yet been digitised but will be digitally incorporated into the GIS as part of this process.

4.3.11 The study will also involve a search of relevant journals, and a selected range of unpublished work. The study will seek to establish the accurate (six or eight-figure NGR) location and altitude of sites, along with a summary of chronological information and a history of archaeological intervention.

4.3.12 ***Historical Desk-Based Study (Tasks 15-16):*** the study will need to examine the more recent history of activity on the peatland areas, in order to gauge the general pattern of usage. This will examine the medieval and post-medieval evidence for non-intensive exploitation of the peatlands, such as peat cutting, grazing, and transhumance, which is potentially reflected within the documentary record, as demonstrated by the detailed studies of medieval upland occupation of Cumbria by Angus Winchester (1987; 2000). This study will examine, initially, cartographic sources, such as OS 1st edition mapping, and, where possible, tithe maps and estate maps. In addition, the study will examine documentary evidence for turbary rights, although within the scope of the present project this will be limited to a study of secondary sources (eg Winchester 1987; Dilley 1973).

4.3.13 ***Quantification of Upland Threats:*** this key stage of the programme will involve close liaison with environmental national and regional agencies to investigate existing datasets realating to environmental change in the uplands. This will involve consultation with English Nature, the Lake District National Park Authority, DEFRA including the Rural Development Service (RDS) (Mervin Ewards (01768 865900), The Archaic Peat Deposits Project (Dr RP Money , Sheffield University), The Countryside Agency, and Cumbria and Lancashire County Councils. The intention is to undertake a detailed investigation of the research being undertaken by regional and national agencies to monitor the impact of climate change, tourism, agricultural change, and forestry upon the uplands genrally, and the peatlands in particular. The study will attempt to obtain existing datasets, where available, to quantify threats to the landscape, and will identify *lacunae* within the extant body of environmental research where there is a need for further targeted research. It will examine the evidence for the impact of visitor pressure, and what impact the introduction of the Countryside Rights of Way Act will have upon the uplands and peatlands.

4.3.14 Following on from the capture of the datasets, a programme of analysis will be undertaken to assess the pertinence of the data to the study of upland peats, and to provide a realistic quantified assessment of the what the impact of different threats are to the landscape and how these have changed following the foot and mouth crisis. This element of the programme will be closely linked to the palaeoenvironmental desk-based study (*Section 4.3.5*), and will be linked in with graphical datasets within the GIS where possible.

4.3.15 One further longer term aim of the study is to establish links with these agencies to provide the basis for the establishment of long term management proscriptions.

4.4 FIELD SURVEY METHODOLOGIES

4.4.1 *Tasks 22-35* (Aims i a; ii a/b; iii a/c)

4.4.2 The field survey will explore a broad range of techniques which are intended to identify an archaeological resource within an upland peat landscape, where that resource is wholly or partly covered by peat. The techniques applied will be adapted to each of the differing pilot study areas, reflecting the differential levels of site visibility.

4.4.3 ***Field Walking (Tasks 22, 26, 28):*** field walking will be undertaken in each of the four study areas in a systematic manner, even though it is anticipated that the walking of undisturbed peat landscapes, such as the Forest of Bowland, will be unproductive. This will test the effectiveness of the technique and so provide data for the refinement of the methodology in future phases of the project. This element of the survey will be undertaken in conjunction with aerial surveys of the peats, recording areas of exposure (*Section 4.3.8*), the survey of peats scars (*Section 4.4.5*), and peat coring (*Section 4.5.4*).

4.4.4 A 500m wide transect will be systematically walked through each of the study areas as defined within *Section 2.4* and will examine the full extent of the transect irrespective of the peat cover or the varying levels of improvement. The field walking will look for surface structural elements across the area, but particularly at the interface between the peatlands and the adjacent mineral soils where there is the potential for pre-peat features to survive on the mineralised surface. The survey will be mindful of the results of earlier surveys, and will examine those edges of the previously recorded site groups which are partly buried by peat. A limited rapid re-survey of some known sites will be undertaken in order to provide comparable data with which to assess changes in the condition of field monuments; in particular, this will mean resurveying the edges of peat and surveying the extent of monuments or flint scatters in areas of erosion or at the peat interface. In the case of Langdale, an area that has already been intensively walked, the finding of new axe factory sites by field walking will indicate areas of recent peat exposure (subsequent to the surveys of 1984).

4.4.5 ***Peat Scar Recording (Task 23):*** prospection of erosion patches and watercourse gullies will be undertaken to attempt to assess whether the present perceived density of archaeological monuments is genuine, or whether it is an artefact of the well-preserved nature of the peat cover. In these areas artefact surveys will be a priority. In the Anglezarke and Rivington and Great Langdale areas, a limited resurvey will be undertaken of those sites previously recorded in 1984 (Howard Davis 1996; Claris and Quartermaine 1989) which were identified as being within erosion scars, to assess the differences in condition, exposure, and survival occurring in the intervening 17 years.

4.4.6 The initial identification of peat scars will be by means of the aerial photographic element of the desk-based study, supplemented by field walking. The survey will record the depth and nature of the peat scars, and their extent will be surveyed to provide a comparison with the desk-based results and to inform an assessment of peat degradation. The depth of peat will also be recorded by means of probing where the erosion has not extended to the depth of the mineral soil (*Section 4.3.9*). The extent of the peat scars will be recorded by means of GPS survey in order to further the comparison with the aerial photographic and earlier survey work, but

also to provide a definitive base-line for subsequent survey work to monitor the condition of the peatlands.

4.4.7 ***Site Recording:*** sites will be located by means of Global Positioning System (GPS) techniques. The use of GPS techniques has proved to be an essential and extremely cost-effective means of locating monuments. The Leica system used by OAN uses a post-processed differential system, which provides a comparison between a roving receiver and a static receiver to achieve high levels of accuracy, typically resulting in accuracies of better than +- 0.25m. The survey will record the outlines of archaeological sites, or site groups, but will not involve the detailed recording of monuments. Where appropriate, it will cross reference with the results of the earlier surveys, so as to ensure consistency of record. Digital descriptions of the monuments will be recorded on *pro-forma* record sheets, designed with the input requirements of the Access database in mind. The descriptions will record the character and form of the monument and the relationship of the site with the adjacent peat.

4.4.8 ***Survey Processing (Tasks 24, 25, 27, 28, 30, 33 and 34):*** the survey data from the GPS will be transferred directly into the ArcView GIS and the descriptive data will be entered into the database and linked via a primary record number. The extent of peat scars will be incorporated onto a separate layer in the GIS to provide a comparison with vertical air photographs that will be scanned and incorporated into the CAD system. The raster VAP images will be scaled and adjusted in order to be superimposed onto the survey data although, by virtue of the latent distortions within the photographs (caused by the sloping topography), it will not be possible to provide a perfect match with the survey data.

4.4.9 ***Recording in Areas of Identified Resource:*** the work of the NWWS has demonstrated that site visibility is a major issue in peatlands, and that archaeological sites only emerge as or after the peat cover is destroyed. As air photography is largely ineffective as a prospection method for the location of buried archaeological features within or below deep peat, it is essential to develop a predictive model, to enable the management of areas of high potential. The techniques for the identification of a buried resource in the upland peats differ from those typically applicable to lowland peats, in that there will be little or no opportunity to undertake fieldwalking of ploughed fields to reveal artefacts brought to the surface. However, in the case of the NWWS project there was also relatively little ploughed ground available, and this necessitated the development of a strategy that, amongst other methods, provided a greater emphasis on the palaeoenvironmental record in order to overcome the limited site visibility. The results of the NWWS have indicated that a number of techniques should be investigated or tested in areas of peatland adjacent to an identified resource, such as around the Barnscar cairnfield in West Cumbria, where there is a high probability of identifying buried remains. The techniques will also be used in a similar topographical area without identified monuments, and they will be assessed for their success in identifying archaeological features, and their efficiency (that is the area that can be examined for a given cost), as well as their ability to identify features beneath peat of greater depth than 1m. The techniques that will be considered are probing, test pitting and resistivity survey. None of these techniques can provide for rapid identification, but may be considered as exploratory techniques in areas identified as having potential by the field walking surveys.

4.4.10 ***Probing (Task 31):*** it is proposed that probing, which is effectively non-destructive, might be used to trace partially buried landscape features such as field boundaries beyond the point at which they disappear beneath the peat, thus contributing to the reconstruction of buried field patterns. This approach has been used on LDNPS surveys within cairnfields (Quartermaine and Leech forthcoming) and at Shoulthwaite hillfort, Thirlmere, Cumbria, where transect probing through ditch deposits provided information about the original profile of the feature (LUAU 1999). It is also proposed that this technique should be enhanced by the use of specially designed probes, to follow identified features. In addition, it is proposed that probing be undertaken in areas without identified monuments; probing shall be established on a grid pattern across an area of peat which will be up to 2ha in extent. The extent and shape of any stone features will be established by intensive probing and this may serve to establish if they are of anthropogenic origin. The technique will, at the same time, provide an indication of the depth of peat which will inform geophysical survey (*Section 4.4.13*). The location of the features will be recorded by means of GPS survey.

4.4.11 ***Test Pitting (Task 32):*** test pitting will involve the excavation of small holes (*c*200mm x 200mm) with a shovel into the peat on an approximate 10m grid across a given area of *c*2ha, and these pits will be taken down, where possible, to mineral soil. The exploratory investigation will look primarily for artefacts, and any identified within the spoil will be recovered, bagged, recorded, and their positions mapped to provide a distribution of the material across the site. In addition, test pitting will be used to follow up probing to inform the interpretation of the sites identified by that means. The technique will be limited to gently-sloped areas, as such techniques can become a focus for erosion of the peat on steeper ground, as was found during works to the Langdale Axe Factories (Quartermaine 1994). The technique will not be applied, however, to the Great Langdale area as the technique has already been successfully applied by Bradley and Edmonds (1993) and it is considered that there is no need to waste resources repeating their work. The results of their test pitting programme will, however, be incorporated into the present study

4.4.12 ***Resistivity Survey (Task 35):*** following discussions with Chris Gaffney, of Geophysical Surveys of Bradford Ltd (GSB), it is suggested that resistivity may be a pertinent technique for the identification of shallow stone monuments or features within a peat subsoil. Resistance survey exploits the differential conductivity of wet soils and stone elements, and, by virtue of the wet nature of the peat, should be able to identify any substantial stone elements beneath the peat. Its principal limitation is that the depth of the record may be limited. While the technique will be only appropriate for detailed investigation of the peatland landscape, it is appropriate to undertake a small trial in this instance to assess its potential for later stages of exploration, for ground truthing features identified by airborne/satellite remote sensing. For reasons of econony the extent of the resistivity survey will be restricted. It is proposed that transects be undertaken along the same line as the landscape survey, within peatlands and extending out from areas of known archaeology. The transect would generally be 20m wide, but this may be varied to suit local conditions and the depth of the peat. Where features are identified by this technique then they will be tested by means of higher resolution survey and by probing in order to clarify the character and

interpretation of any structural element. The resistivity survey would be undertaken by Geophysical Surveys of Bradford Ltd.

4.5 PALAEOECOLOGICAL METHODOLOGIES

4.5.1 ***Tasks 36-51*** **(Aims i a; iia/b; iii a)**

4.5.2 A programme of palaeoecological work will form an integral element of the pilot study and will, in consequence, be closely linked with the archaeological investigation. The principle requirement of the palaeoecological work is to explore the potential for using palaeoecological techniques as a means of identifying anthropogenic activity in the locale and in order to highlight the archaeological potential for specific peatlands. It will serve to explore the recent history of the peatlands; identifying evidence of peatcutting and similar truncation of the peatlands, serving to highlight the impact of past damege and present-day threats. The methods used to address the palaeoecological objectives will be used as appropriate in all four of the field study areas proposed for the pilot study, and will follow the same transects as the archaeological survey.

4.5.3 Where the search for published and unpublished palaeoecological literature (*Section 4.3.5*) shows the existence of undated sites within the study areas, these will be visited in the field, cored with a gouge auger in order to assess the present state of the peat, and samples taken to assess pollen preservation within the deposits and to relocate zone boundaries with a view to radiocarbon dating. Subject to this assessment a series of spot-dates will be compiled which will be intended to provide a chronology for the inception of the peat and other key horizons.

4.5.4 ***Archaic Peat Deposits Project:*** the pilot study will make full use of data accrued and curated by the Archaic Peat Deposits Project, led by English Nature with financial support from English Heritage. However, it is of only relatively limited value as it presently addresses the issues of lowland peat resources, but may be able to inform the peats at the lower fringe of the study areas. It is hoped to achieve a close liaison with this project in order to encourage the free exchange of information between the two projects. To this end, if possible, the data formats will be configured so as to be compatible with both databases. As a consequence of this liaison, it is hoped that the scope of the Archaic Peat Deposits Project will be broadened by the addition of upland data.

4.5.5 ***Transect Coring (Tasks 38, 40 and 42):*** large-scale stratigraphic studies of the proposed archaeological transects are essential if the peat stratigraphy, its extent, the degree of preservation, depth, and morphology of the underlying ground surfaces are to be determined. Such studies will provide a framework for more detailed work.

4.5.6 ***Methodology:*** a lightweight gouge auger will be used to obtain variably-spaced peat borings along the transect lines. The depth, type, and preservation of the peat will be recorded on *pro-forma* record sheets, and the survey will seek to record the presence of basin and valley mires in addition to the blanket peats. 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 GPS survey. The data will be transferred into the GIS in order to

facilitate 3-D modelling of the buried terrain. Sampling intervals will be dependent on the nature of the upland peat deposits, such as blanket, basin and valley mires, and the complexity of the underlying land formation. 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 peat. Particularly in areas such as the Forest of Bowland, where there is extensive largely undisturbed peat, an attempt will be made to locate suitable sites with palaeoenvironmental evidence that demonstrates the use of the uplands but with little, if any, visible archaeological remains, to assess the potential of the palaeoenvironmental record as a predictive tool in the location of settlement or cultivation activity.

4.5.7 Particular attention will be paid to peat hags and erosion gullies, especially in areas of deep peat, and in areas of serious erosion, to maximise the likelihood of encountering associated archaeological remains. Such exposures will be sampled as appropriate for palaeoecological analysis and in order to provide radiocarbon dating for the inception of peat growth at the site. Erosion gullies will be checked for buried peat deposits, as at Carlingill (Cundill 1976) and Seathwaite (Wild *et al* 2001).

4.5.8 ***Analysis of stratigraphic data (Tasks 39, 41 and 43)***: 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 (for method see *Section 4.5.11*) and some will be assessed for pollen sampling (for methods to be used see *Section 4.5.10*). It is hoped to take larger samples from basal peat for Radiocarbon dating to investigate the date of inception of the peat (*Section 4.5.12*). By means of the dating of selected cores, the palaeoenvironmental methods will be used to help establish the chronology of previously undated monuments, in particular those partially buried by subsequent peat-growth.

4.5.9 ***Palynological Analysis (Tasks 36 and 37)***: this will be used selectively, but will comprise a major analytical tool of the palaeoecological aspect of the project. It is proposed that it will be used at five levels:

1) to assess the palynological potential of peat deposits to sustain more detailed research in the future;

2) to undertake more detailed analysis in order to interpret the changes through time of landscapes associated with known archaeological remains, to determine whether this is more closely related to climate change, the influence of the human population, or the interplay of both;

3) to undertake rapid analysis of samples for selected pollen taxa known to be associated with particular conditions or landuse, for example *Narthecium ossifragrum* may suggest in creased water flow or disturbance of the peat (Moore *et al* 1986, 213), increases in *Potentilla* may indicate contemporary sheep grazing of thbe bog (*op cit*, 215), Cereal pollen indicates cultivation and *Plantago lanceolata* is indicative of clearance activity. It is envisaged that this level of analysis will be used for horizons closely associated with proven archaeological resources, and the peat produced at inception;

4) to relocate particular horizons in earlier undated pollen diagrams, in particular those of Pennington (1970; 1975) and Walker (1966) in West Cumbria;

5) to provide by means of the transect coring, palynological assessment and radiometric dating of peat inception and spread (Tipping 1999).

4.5.10 ***Palynological Laboratory Methodology***: the preparation of pollen samples will be standard throughout, except for the addition of exotic spores (Stockmarr 1971) to calculate pollen concentration / accumulation for more detailed research. The samples will be prepared by the standard procedures of Sodium hydroxide, Hydrofluoric acid if necessary, acetolysis, staining and mounting in silicone oil (Faegri and Iverson 1989). The prepared residues will be examined with a high-powered microscope and the results recorded on standard *pro-formas*. Analysis and the storage of analytical data will be accomplished electronically using computer-based tools, particularly the TILIA software package, to categorise data and facilitate its interpretation (Grimm 1991). Pollen count record sheets, microscope slides, and the residues of the prepared samples will be stored at OAN offices in Lancaster, under appropriate conditions. Data will be analysed in order to ascertain possible human and climatic influences on the natural environment, and to attempt to relate this to known and newly discovered archaeological remains.

4.5.11 ***Plant Macrofossil Analysis (Task 52)***: this will be the principal means by which information on environmental conditions in the immediate vicinity of archaeological remains is obtained. It will also be used to enable reconstruction of the ecological development of mires and the changes through time therein. The preparation of samples for plant macrofossils is simpler than that for pollen, with samples being soaked in water and then sieved through a set of graded sieves; the sample size will vary depending on the type of sediments, and method of original sampling (ie core, monolith or bulk sampling). After soaking the samples will be passed through a set of graded sieves of mesh sizes 2mm, 500µ and 250µ. The residues will be examined with a low-powered binocular microscope and the plant macrofossils recorded in either a semi-quantitative or qualitative manner. Where possible, wood recovered from peat deposits will be identified, as this can contribute evidence for the composition of ancient woodland.

4.5.12 ***Radiocarbon Dating (Task 44)***: the relatively precise radiocarbon dating of sampled organic material will be essential to the success of the project. The interpretation of archaeological and palaeoecological material recovered will rely in no small part on the availability of reliable dates. The project will consult and seek the advice of the appropriate English Heritage Regional Scientific Advisors and Drs Alex Bayliss and Peter Marshall of the English Heritage Ancient Monuments Laboratory on the suitability of material for dating. Other methods of radiometric dating appropriate for more recent sediments, such as Pb^{210}, will be considered, and advice sought as appropriate.

4.5.13 ***Tephra Horizons (Tasks 45 and 46):*** if present, tephra provides an accurate dating horizon in the archaeological context. Tephra sherds from volcanic eruptions can be characterised to specific volcanoes and eruptions, which have been closely dated either by radiocarbon assay or historical records. Upland peats in Northern England, in areas of relatively high rainfall, can provide suitable sites for the

deposition of tephra, and therefore its presence should be determined. It is proposed to take a total of four cores, one from each transect, through as complete a sequence as is available. These cores will be sampled, processed and analysed at Queens University, Belfast by Dr Valerie Hall and her colleagues. The cores will be assessed after loss on ignition by microscopic analysis, and if appropriate, the tephra will be characterised.

4.5.14 ***Chemical Analysis (Task 48):*** certain chemical attributes of peat, such as the degree of humification as measured by colorimetry, specific chemical elements, and mineral content, can provide evidence for past climates and human activity. Therefore, selected chemical analysis of peat, in conjunction with other palaeoenvironmental investigations, will be considered if appropriate.

4.5.15 ***Dendrochronology (Task 49):*** the precise dating of preserved wood by dendrochronology will be used assuming that suitable material is identified from peat deposits or surviving archaeological sites.

4.5.16 ***Arthropods (Task 50):*** the analysis of the remains of arthropods can greatly aid palaeoecological interpretation, as particular assemblages can act as qualitative indicators of environmental conditions which are sometimes difficult to gauge from other forms of evidence. For example, some species require very specific hosts, temperature values, and moisture regimes. Arthropod samples will be processed by the appropriate specialists using paraffin flotation with the flots collected on a 250μ mesh. Advice will be sought from the appropriate English Heritage specialist regarding sample size.

4.5.17 ***Soil Composition (Task 51):*** the investigation of soil composition can reveal details about soil formation and processes below archaeological monuments, beneath blanket peat, and adjacent to peat bodies. Micromorphological studies may assist in some determination of past landuse processes, however, it is more likely to be of value to site specific questions arising from exposed stratigraphy. If buried soils are identified in peat erosion scars or under monuments, they will form an important component in the interpretation and identification of past settlement systems, and this is particularly important for relationships between layers or post-depositional effects. Appropriate specialist advice will be sought.

4.5.18 Where the geomorpohology of the landscape is vital to an understanding of the development of the peat, appropriate experts from, Lancaster University will be consulted.

4.6 ASSESSMENT REPORT

4.6.1 ***Tasks 53-59*** **(Aims i b; ii d; iii c; iv a/b/c ; v a)**

4.6.2 ***Assessment and Review (Tasks 53, 58):*** the primary aim of the pilot study is to develop a methodology which is both effective and economically productive for the identification of the palaeoenvironmental and archaeological resource. To this end the results of the programme will be subject to a basic level of review in order to assess the potential of the various methods. This review will examine the potential for cross comparison between the datasets for topographic context, documentary, and field observations within the GIS to provide for a predictive site model. The analysis will be used to examine the topographic context, and altitude where peat erosion is most severe, and where there is the greatest potential for site

identification as a means of informing an effective methodology for subsequent phases.

4.6.3 The assessment process will review the site identification methodologies, and will examine their productivity, limitations, cost-effectiveness and general applications. From this will be devised a fully justified methodological approach intended to identify buried archaeology over an extensive area and which will define the parameters necessary to target further investigations into areas of greatest erosion and archaeological potential. It is recognised that in the course of the programme additional methodologies, not fully outlined within the present project design, but developing from the present experimental techniques, will be identified and explored. The assessment will review any potential additional techniques in conjunction with those explored as part of the present programme in order to establish recommendation for future site identification methodologies.

4.6.4 The palaeoecological studies will be subject to review to examine their potential for establishing the character, date, condition and development of the peat lands within the transects; the potential for using palaeoecological techniques to identify the archaeological resource will be reviewed. The results of this assessment will also be used to develop an appropriate palaeoecological strategy.

4.6.5 ***Assessment Report (Tasks 54-59):*** an assessment of the findings will be compiled in accordance with Appendix 4 of *Management of Archaeological Projects* (English Heritage 1991). This report will describe and examine the results of the desk-based study, the archaeological surveys, and the palaeoenvironment of the transects, and will assess the success of the varied techniques in their capacity to identify the extent and character of the archaeological resource and the palaeoenvironment.

4.6.6 ***Factual Data:*** the assessment will present the results of the pilot programme and will include a full index of archaeological sites identified in the course of the project; it will also define the quantity/quality of the sites, the dating evidence, and the relationship with the peat deposits. The report will assess the palaeoenvironment of the transects, incorporating dating evidence for the peat inception; it will examine the condition of the peat within the extent of the transects and will assess the degree to which the extent and depth of peat has altered. The report will present the quantity, condition, range and variety of the artefactual assemblage recovered from field walking.

4.6.7 ***Threats:*** by cross referencing between the survey data, palaeoecological dtata and data obtained from the external, national agencies, it is intended to provide a quantitative assessment of the threats that are impacting upon the peatland resource, and to identify those areas and topographic contexts where deterioration is most evident. This data set will enable the basis for furthering a management programme, targeted on types of peatland that are under greatest threat.

4.6.7 ***Statement of Potential:*** an assessment and statement of the actual and potential archaeological significance of the archaeological resource within the peatlands, coupled with the palaeoenvironment, will be set within the broader context of comparable upland and lowland landscapes from across the country. The palaeoecological results will also be assessed with reference to local palynological studies from both upland and lowland contexts as a means of setting the

palaeoenvironment of the transects within a broader context. The report will examine any new research questions highlighted by the results of the pilot study.

4.6.8 The report will assess in detail the methodological approaches undertaken as part of the recording programme, and will examine their success, their cost-effectiveness, their application for larger areas, and for varying depths of peat. On this basis, if appropriate, a methodology for further phases of work will be compiled, incorporating strategies presented in this project design which will be adapted to improve their efficiency and effectiveness. An updated project design will be prepared in accordance with Appendix 5 of *Management of Archaeological Projects* (English Heritage 1991). This will design an appropriate programme of further field recording work and documentary studies in accordance with the assessment results, and will examine the wider dissemination requirements of the project at both a regional and national level.

4.7 DISSEMINATION AND OUTREACH

4.7.1 ***Tasks 3, 60-64 (Aims: v a/b)***

4.7.2 As embodied in English Heritage's *Power of Place* (2000), outreach to the wider community is an essential pre-requisite of such a management-orientated project. The dissemination of the aims and objectives of the project to the local community from the outset is important to encourage ownership of their archaeological heritage, and to enable access to the land, as well as the long-term implementation of management schemes; land-owners and tenants need to be reassured that the archaeological resource is an asset not a financial liability.

4.7.3 ***Leaflet (Task 3):*** it is proposed that a two-colour A4 leaflet be produced. The leaflet will explain the aims, purpose and form of the project and will also provide primary contacts; this will be desk-top published in-house. The leaflets will be distributed by post to land-owners, and through local societies; it will also be passed to libraries and museums in the respective areas.

4.7.4 ***Public Talks:*** a series of talks will be offered to local groups and societies, the material for which will include slides and OHP transparencies. The talks will initially be provided by the project manager.

4.7.5 ***Educational Outreach (Task 64):*** in the longer term a schools' pack of information about the project will be produced which will present the aims and results of the project and will highlight the wealth of archaeological remains within the uplands; this will be distributed to schools local to the study areas, and via local museums. As required, talks can be provided to individual schools to reinforce the message within the schools' pack. As part of the pilot study, however, initial discussions will be established with local schools to ensure that the information pack fits in with the appropriate key stages of the National Curriculum. The outcome of these discussions will serve to inform the assessment report, but no pack will be produced at this stage.

4.7.6 ***Occasional Paper Publication (Task 60-63):*** at the completion of the pilot project a short, well-illustrated publication will be produced; it will be comparable to *Peat and the Past* (Howard Davis *et al* 1988), which was produced at the completion of the NWWS pilot study. It will outline the aims of the project, the management needs of the resource, the results of the pilot project, and the scope

for further work. It is intended that this should have a broad distribution, and will be aimed at both lay and academic audiences.

5. RESOURCES AND PROGRAMMING

5.1 OXFORD ARCHAEOLOGY NORTH

5.1.1 Oxford Archaeology North (formerly Lancaster University Archaeological Unit) has considerable experience of undertaking landscape studies across the uplands of Northern England during the past 20 years, including identification surveys, detailed surveys, and landscape analysis. Surveys undertaken by OAN, pertinent to the present study, include the Lake District National Park Surveys (Quartermaine and Leech forthcoming), the Forest of Bowland survey (LUAU 1997b), the Great Langdale Surveys, the Anglezarke / Rivington Survey (Howard Davis 1996), and the Haweswater NWW estate survey (LUAU 1997a). OAN has also had the benefit of undertaking the extensive North West Wetlands Survey of the lowland peatlands of the North West, which, coupled with the experience of the upland landscape surveys, places OAN in a unique position to be able to undertake the proposed project. OAN has specialists in Palaeoenvironmental studies (Elizabeth Huckerby) who was a key member of the NWWS programme. OAN also has specialists in upland landscape studies (Jamie Quartermaine) and later prehistoric archaeology (Chris Howard-Davis), both of whom will be involved with this project.

5.1.2 OAN has the professional expertise and resource to undertake the project detailed below to a high level of quality and efficiency. OAN and all its members of staff operate subject to the Institute of Field Archaeologists' (IFA) *Code of Conduct*, and OAN is one of their registered organisations (no 17).

5.2 STAFFING AND EQUIPMENT

5.2.1 ***Project Team:***

Senior Management and editorial control

Project Manager	Jamie Quartermaine (OAN Senior Project Manager)
Editorial overview	Rachel Newman (OAN Director)

GIS

GIS development	Paul Miles (OA Project Manager)
GIS input and administration	J Cook (OAN Supervisor)
	Niall Donald (OA Informations Officer)

Desk-top data-gathering

Archaeology	Jo Cook (OAN Supervisor)
PalaeoenvironmentalElizabeth Huckerby (OAN Project Officer)	
Other, including APsJo Cook (OAN Supervisor)	

Field teams(s)

PalaeoenvironmentalElizabeth Huckerby (OAN Project Officer)	
Palaeoenvironmental assistant Tba	
Extensive/intensive survey	Chris Wild (OAN Project Officer)

	Dan Elsworth (OAN Supervisor)
Palynology	Elizabeth Huckerby (OAN Project Officer)

Palaeoenvironmental Analysis Specialists

Soils Analysis	(Provisionally) Raimonda Usai (Environmental Unit, University of York)
Arthropods Analysis	Harry Kenwood (Environmental Unit, University of York)
Dendrochrnology	Cathy Groves (University of Shefield)
Tephra Analysis	Valerie Hall (Palaeoecological Centre, Queens University, Belfast) Stephen McFarland (Queens University, Belfast)
Palynology / Chemical analysis	Jim Innes (Queen Mary and Westfield College, University of London)

Geophysical Survey Specialists

Geophysical Consultancy	Andrew David (Centre for Archaeology (English Heritage))
Resistivity Survey	Geophysical Surveys of Bradford Ltd

Data synthesis and Report Production

Chris Howard Davis (OAN Project Officer)
Chris Wild (OAN Project Officer)
Elizabeth Huckerby (OAN Project Officer)
Jamie Quartermaine (OAN Senior Project Manager)

5.2.2 The palaeoenvironmental study will be led by Elizabeth Huckerby, but will be subject to advice and consultancy support from Dr Jim Innes, reflecting his vast experience of palynological research on the blanket peast of the North York Moors, and will be invaluable to a survey of the upland peats in North-West England.

5.3 TIMETABLE

5.3.1 See attached documentation.

5.4 OTHER MATTERS

5.4.1 ***Access:*** establishing ownership will be in consultation with the Land Registry Record Office, the Lake District National Park Authority and Lancashire County Council. The land-owners will be contacted by letter, in which the aims of the project will be outlined and permissions requested for access onto their land. They will also be asked for details of any tenants farming within the study areas. The tenants will then be approached to ensure that access is permitted and that the survey will not have any impact upon their farming activities.

5.4.2 ***Health and Safety:*** full regard will, of course, be given to all constraints (services) during the survey, as well as to all Health and Safety considerations. All site procedures are undertaken in accordance with the guidance set out in the *Health and Safety Manual* compiled by the Standing Conference of Archaeological Unit Managers (1991, rev 1993). Risk assessments will also be undertaken as a matter of course, and these will anticipate the potential hazards arising from the project. Training in mountain craft will be given to any member of staff on the project not experienced in working in upland landscapes. Copies of OAN's health and safety policy are lodged with Englsh Heritage.

5.4.3 ***Insurance:*** the insurance in respect of claims for personal injury to or the death of any person under a contract of service with OA North and arising in the course of such person's employment shall comply with the employers' liability (Compulsory Insurance) Act 1969 and any statutory orders made thereunder. For all other claims to cover the liability of OAN in respect of personal injury or damage to property by negligence of OAN or any of its employees, there applies insurance cover of £10m for any one occurrence or series of occurrences arising out of one event.

5.4.4 ***Working Hours:*** survey will be undertaken on the basis of a five day week, within daylight hours only.

5.4.5 ***Timing:*** the initial desk-based elements of the proposed project will be undertaken on commission of the project. In order to maximise site visibility, survey fieldwork will be undertaken in the spring, before vegetation growth reaches its maximum, or in late autumn and winter when it has died back.

5.5 FINANCIAL RESOURCES

UNIT STAFF

		Per day	Days	Cost
RMN	Director	209	6	1254
JQ	Project manager	155	37	5735
PM	Project manager	155	3	465
ND	Project officer	130	27	3510
EH	Project officer	130	138	17940
CW	Project officer	130	42	5460
CHD	Project officer	130	21	2730
JC	Project supervisor	88	89	7832
DE	Project supervisor	88	33	2904
Illust	Project supervisor	88	30	2640
tba	Assistant	70	43	3010
Total salary costs				**53480.00**

NON-STAFF COSTS

Travel and Accommodation	2115.00
Computer Equipment	1645.00
GIS Software	458.00

Satellite Images		700.00
Books		150.00
Ph Meter		510.00
Chemicals		150.00
Leaflet Printing		700.00
Total non-staff costs		**6428.00**

EXTERNAL CONSULTANTS

	Days	Cost
GSB (Resistivity Survey)	1 day field	800.00
J Innes (Palynology)	5	1000
EH Processing of C14 dates	3	N/A
S McFarlane (Tephra Identification)	3	416.00
Arthropod Processing	3	625.00
H Kenward (Arthropods)	7	N/A
V Hall (Tephra Analysis)	7	2470.00
R Usai (Soils Analysis)	6	N/A
Dendrochronology	4	N/A
SURRC	(subject to results and discussions with A Bayliss	N/A
Total Specialists		**5311.00**
Unit overheads @ 25%		14977.00
Overheads on Specialist @ 10%		531.10
Total Overheads		**15,508.10**

Total Costs

80,727.00

Notes:

1. Salaries and wages inclusive of NI and Superannuation
2. Costs incorporate all office work necessary to produce the assessment report
3. It is understood that the costs for the arthropod assessment by H Kenward will be directly funded by EH and will not be subject to project funding
4. The costs for the C14 dates will be funded directly by EH and are not defined here.
5. It is proposed that radiocarbon dates be undertaken by the Scottish Universities Research and Reactor Centre (SURRC)

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APPENDIX 1
GANTT CHART

APPENDIX 2
TASK LIST

	Aim	Task Name	Resources	Duration
		Project Management	JQ	5 days
		Project preparation	JQ	3 days
	i / iv	Liaison with LCC/EH/LDNPA	JQ EH	3 days 1 day
	v b	Design and Dtp Leaflet	PS	3 days
	i a/b; iv a	Design GIS System	ND JQ PS PM	15 days 2 days 2 days 3 days
	i a	Design Data Base	JQ PS	1 day 3 days
	i a	GIS Training	ND PS	5 days 5 days
	i a	Incorporate Mapping into GIS	JQ PS	1 days 3 days
	ii	Soil Map Data Processing	PS	3 days
	ii a/b/c	Acquire Satellite Images	JQ	2 days
	ii a/b/c	Satellite Data Processing	JQ PS	1 day 7 days
	ii a/b/c	Satellite GIS Input	PS	5 days

	ii ia	Capture of SMR Data	JQ PS	2 days 2 days
	iii a	SMR Data Processing Into GIS	PS	5 days
	iii a	Archaeological data Processing	JQ PS	2 days 8 days
	iii a/c	Documentary Study	PS	12 days
	iii a/c	Documentary GIS Input	PS	3 days
	ii b/	Palaeoenvironmental Study	EH	10 days
	ii	Palaeo' GIS Input	PS	4 days
	ii a/b/c	Examination of Aps	JQ PS	1 day 15 days
	ii c/d	Analysis of AP Data	JQ PS	1 days 5 days
	ii	Input of AP data to GIS	PS	14 days
	Ia iib/c/d Iva	Quantification of Upland Threats	JC	XXXdays
	iii a/c	Anglezarke Survey	CW PA	5 days 5 days
	Ia ii a/b iii b	Peat Scar Recording	CW PA	5 days 5 days
	iii a/c	Processing of Anglezarke Survey Data	CW	3 days
	iii a/c	GIS data Input	PS	3 days

	iii a/c	Forest of Bowland Survey	CW/PA	6 days
	iii a/c	Processing of FOB Data	CW	2 days
	iii a/c	GIS Data Input	PS	3 days
	iii a/c	SW Fells Survey	CW/PA	7 days
	iii a/c	Processing of SW Fells Survey Data	CW	1 day
	i a iii a	Probing	CW PA	3 days 3 days
	i a iii a	Test Pitting	CW PA	4 days 4 days
	iii a/c	GIS Processing	PS	3 days
	iii a/c	Great Langdale Survey	CW/PA	4 days
	iii a/c	Processing of Langdale Survey Data	CW	1 day
	iii a/c	GIS Data Input	PS	3 days
	iii	Illustrations	Illust	6 days
	i a; iii a	Resistivity Survey	GSB	1 day
	i a	Coring	EH PA	2 days 2 days
	i a; ii b iii a	Pollen Analysis	EH	26 days

	iia iii a	Transect Survey Anglezarke	EH PA	3 days
	iii a	Processing Strat Survey	EH	5 days
	ii a; iii a	Transect Survey FOB	EH PA	3 days 3 days
	iii a	Processing Strat Survey	EH	5 days
	iia iii a	Transect Survey SW Fells	EH PA	3 days 3 days
	iii a	Processing Strat Survey	EH	5 days
	iii a	Preparation of C14 Samples	EH	9 days
	ii a iii a	Transect Survey Great Langdale	EH PA	3 days 3 days
	iii a	Prcoeessing Strat Survey	EH	3 days
	i a	Tephra Analysis	VH	7 days
	i a	Characterise Tephra	SM	3 days
	ia; ii b iii a	Pollen Analysis	EH	43 days
	i a	Chemical Analysis	EH	6 days
	i a	Dendrochronology	CG	7 days
	i a	Arthropods	HK	5 days
	i a	Soil Composition	RU	4 days

	i a	Macrofossil Analysis	EH	10 days
	i b; ii d iv a/c	GIS Analysis	ND PS PA	7 days 14 days 2 days
	iii c iv a/b/c	Survey Report production	CW	6 days
	iii c iv a/b/c	Illustrations	Illust	7 days
	iii c iv a/b/c	Palaeobotanic Report	EH	7 days
	iiic iv a/b/c	Compilation of Assessment Report	CHD	8 days
	iv c	Updated Project Design	JQ	8 days
	iii / iv	Editing	JQ/RMN	3 days
	v a	Occasional Paper Production	CHD	10 days
	v a	editing of Occasional Paper	JQ/RMN	3 days
	v a	Illustrations	Illust	5 days
	v a	DTP	Illust	12 days
	v b	Consultation with Schools	JQ CHD	1 day s

ILLUSTRATIONS

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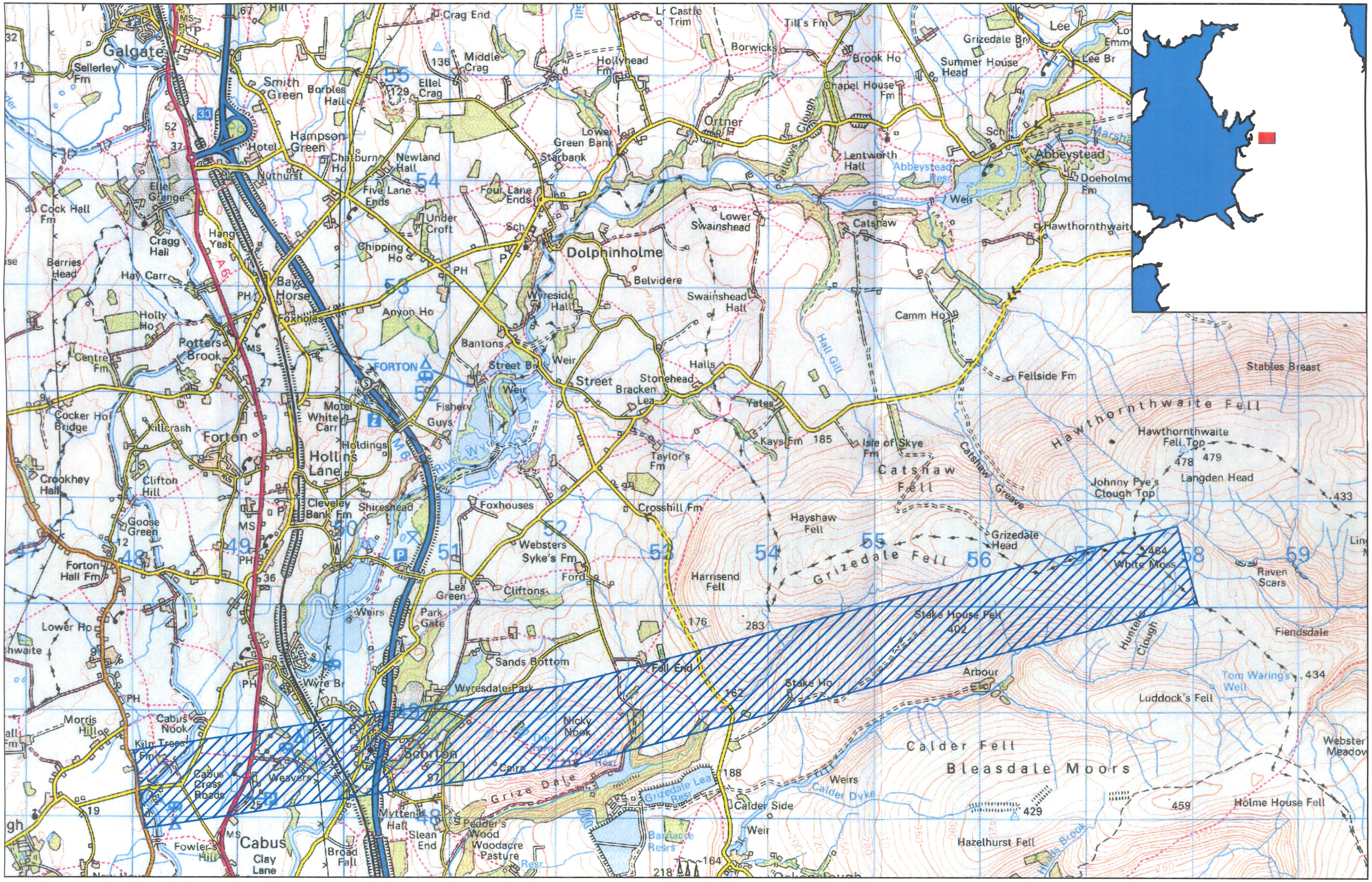
Figure 1: Location of West Cumbria Transect



based upon the Ordnance Survey 1:50000
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0 250 500 metres

Figure 2: Location of Forest of Bowland Transect

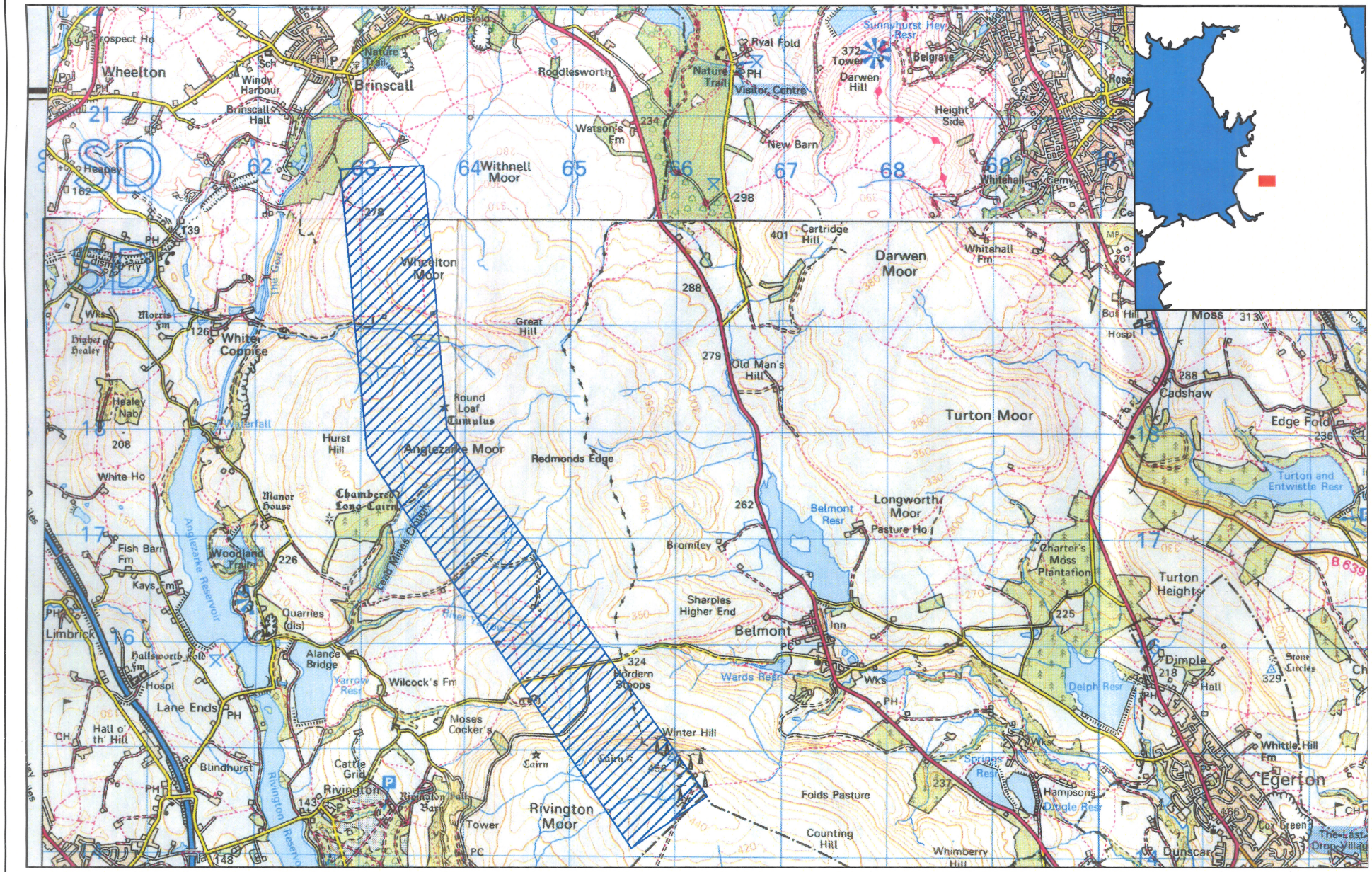

Figure 3: Location of Anglezarke and Rivington Transect

Figure 4: Location of Great Langdale Transect