Walney Offshore Windfarm, Cleveleys & Heysham, Lancashire

Palaeoenvironmental Assessment

Oxford Archaeology North

January 2006

RSK ENSR Environment Ltd

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Prepared by:	Denise Druce	
Position:	Project Officer	
Date:	October 2005	
Checked by:	Stephen Rowland	Signed…….
Position:	Project Manager	
Date:	December 2005	
Approved by:	Alan Lupton	Signed…….
Position:	Operations Manager	
Date:	January 2006	

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

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SUMMARY

Oxford Archaeology North (OA North) was commissioned by RSK ENSR Environment Limited to undertake a palaeoenvironmental assessment along two overland routes for electric cables, associated with the proposed Walney Offshore Windfarm, 21.8 km off the western coast of Lancaster. Electricity cabling between the proposed windfarm and two destinations at Heysham and Cleveleys would pass under the sea and onto intertidal deposits at Half Moon Bay, Heysham (NGR SD 3400 4613 – 3403 4607) and the foreshore at Cleveleys (SD 3308 4447 – 3311 4447).

A rapid walkover was first carried out along each of the proposed routes in order to identify the presence of any archaeological features, organic deposits, and palaeochannels, that might influence the location of core samples. The environmental archaeological fieldwork was undertaken from 7th to 9th September 2005 to take advantage of a period of low tides and comprised two stages: firstly, a total of nine palaeoenvironmental sampling cores, up to 2m deep, were taken at roughly 80m intervals along the cable route on the intertidal foreshore at Heysham, secondly, six 2m deep cores were taken roughly every 50m along the cable route on the foreshore at Cleveleys.

As a result of the coring and the walkover of the intertidal area, no alluvial clay/peat deposits or palaeochannels were evident on the routes of the cables; therefore, no further palaeoenvironmental analysis of the core samples is recommended, nor should further field investigations be necessary unless the cable route deviates from that examined. A nineteenth century boat wreck is situated roughly 100m west of the Heysham cable route (Plate 1).

ACKNOWLEDGEMENTS

OA North would like to thank Helena Kelly of RSK ENSR Environment for commissioning the report and for her assistance during the project. Thanks are also due to Trevor Owen who acted as sand pilot and safety advisor.

The mechanical coring was undertaken by Soil Mechanics Ltd who were supervised in the field by Denise Druce. Christina Clarke and David Tonks undertook the surveying of the core locations. The drawings were produced by Mark Tidmarsh while Denise Druce wrote the report, which was edited by Stephen Rowland. Stephen managed the project, with advice from Elizabeth Huckerby.

1. INTRODUCTION

1.1 CIRCUMSTANCES OF THE PROJECT

1.1.1 Following proposals for the construction of Walney Offshore Windfarm, RSK ENSR Environment Ltd requested that Oxford Archaeology North (OA North) submit a project design for a program of palaeoenvironmental coring at two locations on the Lancashire coast. The site of the proposed windfarm lies *c* 21.8 km off the western coast of Morecambe (Fig 1), and electricity cabling would pass beneath the sea to landfall destinations on the intertidal foreshore areas at Half Moon Bay, Heysham (NGR SD 3400 4613 – 3403 4607), and Cleveleys (SD 3308 4447 – 3311 4447). The proposed program affects a length of *c* 1km on the foreshore at Heysham and *c* 300m at Cleveleys and is likely to have an impact to a depth of *c* 2m at both sites.

1.1.2 The discovery of intercalated peat and clay deposits during the construction of Heysham Docks, plus the presence of areas of peat inland, east of Heysham and Cleveleys, suggests that the electricity cable route, where it traverses the intertidal foreshore area from mean low to mean high water, could pass submerged land surfaces and associated palaeochannels. Important for palaeoecological reconstruction, these peat and clay deposits represent changes in the coastline in response to Holocene relative sea level change.

1.1.3 To maximise the working time within periods of low tide and daylight, the program of fieldwork was conducted by OA North from 7th to 9th September 2005 and comprised mechanical coring and a rapid visual inspection. The purpose of the survey was to assess the nature of the deposits and their suitability for any palaeoenvironmental investigations.

2. METHODOLOGY

2.1 PROJECT DESIGN

2.1.1 Where possible, the Project Design (*Appendix 1*) approved by RSK ENSR Environment Limited was adhered to; however, due to the height of the tide during the fieldwork, nine rather than ten cores were drilled at Heysham (the tenth being under water). All archaeological work was consistent with the relevant standards and procedures of the Institute of Field Archaeologists, and generally accepted best practice.

2.2 PALAEOENVIRONMENTAL SAMPLING – ROUTE OF THE TERRESTRIAL CABLE

2.2.1 ***Visual inspection:*** a rapid walkover survey of an easement along the line of each cable route was carried out to record the presence of any archaeological features, organic deposits and palaeochannels. This was augmented by the examination of OS maps and offshore charts.

2.2.2 ***Cable coring fieldwork:*** at Heysham, nine palaeoenvironmental cores, up to 2m deep (commensurate with the planned depth of groundworks), were taken at roughly 80m intervals, while six 2m deep cores were taken at 50m intervals at Cleveleys. The cores were drilled by Soil Mechanics Ltd, using a hydraulic percussion Dando Terrier 2000 rig (Plate 2) and a series of 1m length windowless samples were retrieved. The positions of the cores were obtained by geo-referencing the route of the cable on a 1:50,000 OS map. The core points were then located in the field with the aid of a handheld GPS and the height of each core position relative to Ordnance Datum (OD) was surveyed using an optical level.

2.2.3 ***Cable coring assessment:*** the cores were sealed and transported back to the OA North offices in Lancaster where they were cut open and described. The data was entered into a field sediment log, which has been kept with the project archive. The original aim of the Project Design was to input the lithological data into the computer programme RockWorks (v.2004) in order to produce a terrain and stratigraphic model of the marine deposits along the routes of the proposed cables. However, given the uniformity of the deposits and, following consultation with the client, this was deemed unnecessary.

2.3 ARCHIVE

2.3.1 A full archive has been prepared to a professional standard in accordance with current United Kingdom Institute for Conservation (UKIC 1990) and English Heritage guidelines (English Heritage 1991), and will be deposited, along with a copy of this report, to the Lancashire County Record Office (CRO), Preston. A copy of the index to the archive and of this report will be sent to the Lancashire Sites and Monuments Record (SMR), Preston.

3. BACKGROUND

3.1 LOCATION, TOPOGRAPHY, GEOLOGY AND ARCHAEOLOGY

3.1.1 ***The Heysham cable route:*** the proposed route reaches dry land at Near Naze (SD 3403 4607), on the southern edge of Half Moon Bay. Although no map of the complete proposed offshore cable route was supplied, it was assumed that it will follow a straight north-westerly path, running at right angles to the foreshore, as indicated by the onshore cable route map, provided by the client. The offshore investigation reached the Mean Low Water mark at SD 3400 4613. The height of the intertidal deposits varied from -0.60m OD (furthest offshore) and 2.80m OD (*c* 100m from the sea wall).

3.1.2 The landscape of the surrounding areas includes extensive salt marshes, reclaimed mosses and marshland, and a small area of remnant peat exists east of Heysham (SD 4230 6060). Although at present, sand and shingle beaches are the main deposits visible on the foreshore, buried peat deposits have also been recorded at the base of marine deposits, again, to the east of Heysham. Intertidal peat deposits have also been observed on the foreshore of Half Moon Bay (E Huckerby *pers comm*). The underlying geology of the area consists of limited outcrops of carboniferous Millstone Grit sandstones and Triassic red sandstone, which form the rocky outcrops seen on the beaches at the site (Countryside Commission 1998, 83).

3.1.3 Archaeological evidence for activity in the area dates from the Neolithic to the twentieth century and a more complete historical background can be found in an environmental assessment of the area (Wessex Archaeology 2002) and also the North West Wetlands Survey of the area. This latter, English Heritage-funded project, undertaken by OA North in their former guise as Lancaster University Archaeological Unit (LUAU), studied the area in great detail and further information can be found in Middleton *et al* (1995). The most important archaeological features within the area comprise a Neolithic polished flint axehead from Red Nab point, *c* 1km south of the proposed Heysham cable route, and a Bronze Age perforated stone hammerhead along with a number of earthworks and possible barrows of indeterminate date (*ibid*).

3.1.4 ***The Cleveleys cable route:*** the proposed Cleveleys cable route leaves dry land at SD 3114 4472 and crosses roughly 0.3km of intertidal deposits in a westerly direction, where the level of Mean Low Water on the day of the fieldwork was at SD 3084 4474. The surface of the foreshore deposits ranged from -3.21m OD (furthest offshore) to 0.01m (nearest sea wall).

3.1.5 The study area is situated on the coast of the Fylde, which is underlain by Triassic sandstones, siltstones, and mudstones (Middelton *et al* 1995). Overlying the solid geology is a substantial thickness of glacial deposits, largely boulder clays laid down at the end of the last glacial period (Devensian). Much of the area around Cleveleys is now reclaimed and heavily built upon; however, much of area inland from Cleveleys is home to extensive

deposits of marine/freshwater alluvium and terrestrial peat. Middleton *et al* (1995) has carried out an extensive study of these deposits and of the archaeology of the area as part of the North West Wetlands Survey. Results of this study indicate that the recognition of, and situation of, sites is directly related to Holocene fluctuations in sea-level and changes in coastal sedimentation. Many prehistoric sites, for example, are likely to have been completely masked by clay and silt laid down by rising sea levels.

4. PALAEOENVIRONMENTAL SURVEY RESULTS

4.1 RESULTS

4.1.1 ***The Heysham Cable Route****:* a total of nine cores, spaced roughly 80m apart, were taken along 1km of the line of the proposed cable route at Half Moon Bay, Heysham, from SD 34033 46071 to SD 34009 46131 (Fig 2). All nine cores were drilled to 2m, and each core consisted of sand with a varying clay content. An observed change in colour is consistent in each core at 1m depth, in which the sand changes from olive brown (2.5Y 4/4) to dark brown (10YR 3/3); however, this is likely to represent post-depositional processes as opposed to any changes in actual deposition. The Heysham log descriptions are given in *Appendix 2.* A boat wreck, which is believed to have run aground in the 1890s (Trevor Owen *pers comm*) (Plate 1), was observed during the visual inspection, situated 100m west of the Heysham cable route.

4.1.2 ***The Cleveleys Cable Route:*** the six cores taken along the line of the proposed cable route at Cleveleys were spaced roughly 50m apart and covered a distance of *c* 300m in a westerly direction, from SD 33114 44472 to SD 33084 44474 (Fig 3). The surface of the ground along the transect ranged from -3.31m OD (Core 6; nearest MHW), to –0.01m OD (Core 6; near to sea wall). All six cores were drilled to 2m and the general stratigraphy consisted of *c* 1-1.9m of olive brown (2.5Y 4/4) sand overlying stiff brown (7.5YR 4/2) silt, which is likely to represent weathered boulder clay. The Cleveleys log descriptions are given in *Appendix 3*.

5. DISCUSSION, IMPACT AND RECOMMENDATIONS

5.1 THE PALAEOENVIRONMENTAL SURVEY

5.1.1 The tidal flat deposits within the cores from the route of the Heysham cable consist of marine sand for the entire 2m depth investigated, very similar to the results of a previous palaeoenvironmental survey on Middleton sands, just to the south of the present survey at Heysham, which found only sand deposits to a maximum depth of 1.67m (OA North 2005). The observed deposits within the 2m deep cores from Cleveleys consists of sand overlying stiff brown silt that is likely to represent weathered boulder clay. Although the deposits at Cleveleys are likely to represent changes in tidal levels and coastal processes in the area, the lack of organic and marine clay deposits in both areas means that there is no potential for the preservation of palaeoenvironmental indicators.

5.2 IMPACT

5.2.1 The rather limited potential for archaeological remains along the cable route and the depth of the recorded sand deposits (which exceed the depth of any groundworks associated with the development) mean that the proposed development will have little to no impact upon archaeological and palaeoecological deposits. Although peat deposits have been observed in Half Moon Bay, Heysham in the past (E Huckerby *pers comm*), it appears that none lie within a depth of 2m of the modern ground surface along the proposed development route. This impact assessment is based emphatically on the proposed route following our line of investigation, and on the basis that the ground works will not exceed 2m in depth.

5.3 RECOMMENDATIONS

5.3.1 The cores taken from each of the sites have little or no potential for analysis of botanical and faunal remains. The sandy make-up of the cores would suggest that such remains are highly unlikely to be preserved, and any further analysis is unlikely to produce significant results. The cores have been adequately recorded and it is recommended that they be disposed of. No further coring along the route of the cable is recommended unless it deviates from that extrapolated from the plans provided by RSK ENSR Environment Ltd, in which case, should the actual development alter, then it is recommended that a watching brief be implemented during groundworks associated with the development.

6. BIBLIOGRAPHY

6.1 PRIMARY AND CARTOGRAPHIC SOURCES

Ordnance Survey, First Edition 1891, 1:25 000, Sheet **XXIX**

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Ordnance Survey, 1974, 1: 50 000, Sheet **102**

6.2 SECONDARY SOURCES

Countryside Commission, 1998 *Countryside Character; the Character of England's Natural and Manmade Landscape, vol 2: the North West*, Cheltenham

English Heritage, 1991 *Management of Archaeological Projects*, second edition, London

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UKIC, 1990 *Guidelines for the Preparation of Archives for Long-Term Storage*, London

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7. ILLUSTRATIONS

7.1 LIST OF FIGURES

7.2 LIST OF PLATES

APPENDIX 1: PROJECT DESIGN

WALNEY OFFSHORE WINDFARM,

CLEVELEYS AND HEYSHAM,

LANCASHIRE

ENVIRONMENTAL ASSESSMENT PROJECT DESIGN

Oxford Archaeology North

September 2005

RSK ENSR Environment Ltd

OAN Job No: L9578

Commercial and in Confidence

1. INTRODUCTION

1.1 As part of an environmental impact assessment undertaken by RSK ENSR Environment Ltd (hereafter referred to as the client), Oxford Archaeology North (OA North) was commissioned to prepare a project design for an environmental archaeological sampling strategy. This strategy was devised to evaluate two of several proposed potential cable routes connecting the Walney Offshore Windfarm with electricity substations on the foreshore areas of Heysham and Cleveleys, Lancashire. The main development area lies 21.8 kilometres off the western coast of Lancaster and will be linked to several substations by undersea cables, which, upon reaching the foreshore, will run through service trenches at a depth of *c*2m.

1.2 Development Proposal

The wind farm comprises the construction of 30 turbines with associated sub-sea cabling between each of the turbines and up to 5 parallel cables running from the centre of the wind farm to a landfall points at Heysham and at Cleveleys. Subsequent 33/132kv underground cabling will connect the wind farm to the electricity network via an existing electrical sub-station.

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

2 OBJECTIVES

2.1 The following programme has been designed to provide for adequate palaeo-environmental sampling of any archaeological deposits that are likely to be disturbed during groundworks relating to the laying of sub-sea and terrestrial cables on the foreshore area.

2.2 A written report will assess the significance and the potential within a local and regional context of the data generated by the palaeoenvironmental sampling and the walkover survey. To achieve these aims, the following methodology is proposed:

3 METHOD STATEMENT

3.1 RECONNAISSANCE

3.1.1 The OA North environmental archaeologist will reconnoitre each of the foreshore areas of the proposed cable route that will be subjected to environmental coring. This process will highlight any areas of potential that may merit particular attention, as well as identifying any constraints to the coring.

3.2 PALAEOENVIRONMENTAL SAMPLING - ROUTE OF THE TERRESTRIAL CABLE

3.2.1 ***Cable coring fieldwork:*** commensurate with the planned depth of the groundworks, cores will be taken to a depth of 2m by a mechanical windowless terrier rig under the supervision of an OA North Environmental archaeologist. Provisionally a total of 10 cores will be taken at 50m -100m intervals along the line of the proposed cable route at Heysham, and six cores will be taken at 50m intervals along the line of the proposed cable route at Cleveleys. The geographical position of the cores will be determined by GPS and optical level. Cores will be labelled with an indication of their location, depth and orientation and will be capped in the field. The locations of any palaeo-channels identified during this coring will be carefully recorded, and recommendations may be made for a more intense programme of coring and

assessment within the evaluation report. It is not, however, proposed to conduct a more intensive programme of coring at this preliminary stage of evaluation.

3.2.2 ***Cable coring assessment***: in the laboratory, cores will be cut open, cleaned, photographed and the stratigraphy and lithology of each core recorded on *pro-forma* recording sheets by an OA technician and environmental specialist. In cases where the standard descriptions may be supplemented by the results of laboratory examination, these will be recommended for further work (see sections 3.2.6-3.2.10). The lithological data will be inputted into the specialist computer programme ROCKWORKS. The data will be correlated and a terrain model of the transect will be produced which will illustrate possible mechanisms for sediment formation along the cable corridor. The stratigraphy of the deposits is likely to be complex in nature because of the modern dynamics of Morecambe Bay and because the Lancashire coast is known to have been greatly influenced by changing sea-level in the Holocene following the retreat of the ice after the last glaciation (Tooley 1978, Sea Level changes, Oxford). It is not proposed to subsample the cores for the assessment of pollen, plant macrofossils, diatoms, foraminifera and ostracods at this stage. Cores will be repackaged and will be retained for any further assessment and analysis that may be required.

3.2.3 ***Cable coring report***: the data will be presented as a written report in which the development of the sediments will be described and the possible implications for the archaeological record of the present inter-tidal zone will be discussed. The report will assess the impact of the cable route upon the palaeoecological resource. Areas of potential for further work, analysis and/or mitigation will be highlighted and recommendations for any strategy of palaeoecological assessment will be made within the framework of the likely impact of the proposed development and the nature of the lithology encountered during the coring. In consultation with the client, an appropriate methodology in the form of a project design will outline any further coring and laboratory work required prior to the commencement of the development.

4 REPORT AND ARCHIVE

4.1 ***Interim Statement***: in the event that further work is recommended, and because of the tight schedule, an interim statement will be issued. In this instance, or in the event that the client specifically requests an interim statement, it should be noted that the statement would not be fully illustrated.

4.2 ***Final Report:*** two copies of the final report will be submitted to the client. Both paper and digital copies will be provided on CD-ROM in pdf format. The report will present the following information:

(i) ***Summary:*** a summary statement of the findings;

(ii) ***Introduction:*** the background to the project including location details;

(iii) ***Methodology:*** an outline of the methodology of all elements of the programme of work;

(iv) ***Geological context:*** an outline of the topography, geology and brief sedimentary history of the study area;

(v) ***Results:*** the results cable coring assessment for each of the sampled areas;

(vi) ***Discussion:*** a discussion of the relative significance of the palaeoenvironmental results and of newly identified archaeological sites within the study area;

A description of the significance of the study area in its local and regional context;

(vii) ***Impact/Recommendations:*** the identification of areas where further development will impact upon the palaeoenvironmental and archaeological resource in addition to the

impacts of the current development; a proposed strategy for the assessment of palaeoecological remains from an appropriate sample of cores

(viii) ***Illustrations:*** maps, plans, sections and copies of the site photographic archive;

(ix) ***Appendices:*** a copy of this project design, also a gazetteer of raw data pertaining to the lithological assessment of the core samples;

4.3 Provision will be made for a summary report to be submitted to a suitable regional or national archaeological journal within one year of completion of fieldwork, if relevant results are obtained.

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

4.5 ***Archive:*** the results of all archaeological work carried out will form the basis for a full archive to professional standards, in accordance with current English Heritage guidelines (*Management of Archaeological Projects*, 2nd edition, 1991).

5. PROJECT MONITORING

5.1 Monitoring of this project will be undertaken through the auspices of the RSK ENSR Archaeologist, who will be informed of the start and end dates of the work.

6 WORK TIMETABLE AND STAFFING

6.1 The project will be under the direct management of Stephen (OA North Project Manager) to whom all correspondence should be addressed. The reconnaissance, palaeoenvironmental coring and lithological assessment will be undertaken by a team of archaeologists led by **Denise Druce PhD** whom, as a result of extensive work experience and a doctorate studying intertidal sediments using pollen and plant macrofossils as palaeoenvironmental indicators, has vast practical and academic knowledge of coring in the intertidal zone.

6.2 Coring: it is estimated that it will take two days at each site to take the requisite number of cores using the mechanical terrier rig (total duration four days). Coring will be carried out at Heysham between the 7th and 8th of September, and at Cleveleys on the 9th and 12th September.

6.3 Lithological Assessment: it is estimated that it will take two days to open, assess and record the lithology of the cores from each of the sites (total duration four days). This assessment will be undertaken between the 13th and 16th September.

6.4 Interim report: it is estimated that the interim report will take about two days to compile, and will be submitted to the client by email before 21st September.

6.5 Evaluation report: the evaluation report, including the full ROCKWORKS analysis and illustrations will be submitted within eight weeks of the completion of fieldwork.

7 INSURANCE

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

8 HEALTH AND SAFETY

8.1 The study area is located along the foreshore of Middleton Sands, Morecambe Bay. This is an intertidal zone renowned for soft pockets of sand and the extreme force of the tidal race. In the interests of health and safety a sand guide has been employed for the duration of the fieldwork and discussions have taken place as to safe working procedures. The field team has been instructed to comply with all instructions issued by the sand guide. A risk assessment has been compiled which all member of the field team are obliged to read.

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Faegri, K, and Iversen, J, 1989, *Textbook of modern pollen analysis*, 4th edn (Rev by K, Faegri, PE, Kaaland and K, Krzywinski), Chichester

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APPENDIX 2: HEYSHAM LOG DATA

Core	Easting	Northing	Elevation m OD	Depth 1 m	Depth 2 m	Description
1	340332	460718	2.69	0	1.3	Orange sand
1				1.3	2	Dense grey sand
2	340295	460776	2.8	0	1.3	Orange sand
2				1.3	2	Dense grey sand
3	340273	460831	2.75	0	1.4	Orange sand
3				1.4	2	Dense grey sand
5	340251	460896	2.75	0	1.2	Orange sand
5				1.2	2	Dense grey sand
6	340217	460969	2.03	0	1.2	Orange sand
6				1.2	2	Dense grey sand
7	340190	461061	0.29	0	1.2	Orange sand
7				1.2	2	Dense grey sand
8	340158	461150	-0.31	0	1.3	Orange sand
8				1.3	1.4	Manganese? stained sand
8				1.4	2	Dense grey sand
9	340121	461248	-0.4	0	1.3	Orange sand
9				1.3	1.4	Manganese? stained sand
9				1.4	2	Dense grey sand
10	340090	461314	-0.6	0	1.4	Orange sand
10				1.4	2	Dense grey sand

APPENDIX 4: CLEVELEYS LOG DATA

Core	Easting	Northing	Elevation m OD	Depth 1 m	Depth 2 m	Description
1	330840	444740	-3.21	0	1.3	Orange sand
1				1.3	1.4	Orange sand with cobbles
1				1.4	2	Dense red brown silt
2	330897	444724	-2.16	0	1.3	Orange sand
2				1.3	1.4	Orange sand with cobbles
2				1.4	1.9	Dark brown sand
2				1.9	1.92	Manganese? stained sand
2				1.92	2	Dense red brown silt
3	330954	444723	-1.59	0	1.2	Orange sand
3				1.2	1.7	Orange grey sand
3				1.7	1.8	Manganese? stained sand
3				1.8	2	Grey sand with cobbles
4	331018	444725	-1.8	0	1	Orange sand
4				1	1.2	Orange grey sand
4				1.2	1.25	Manganese? stained sand
4				1.25	1.3	Grey sand with cobbles
4				1.3	1.45	Dense red brown silt
4				1.45	1.55	Red brown sand
4				1.55	2	Dense red brown silt
5	331077	444725	-0.7	0	1.2	Orange sand
5				1.2	1.3	Orange grey sand
5				1.3	1.4	Grey sand with cobbles
5				1.4	1.5	Gravelly sand
5				1.5	2	Dense red brown silt
6	331143	444726	0.01	0	1	Orange sand
6				1	1.45	Orange grey sand
6				1.45	1.5	Manganese? stained sand
6				1.5	1.55	Grey sand with cobbles
6				1.55	2	Dense red brown silt

based upon the Ordnance Survey 1:250,000
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Figure 1: Location Map

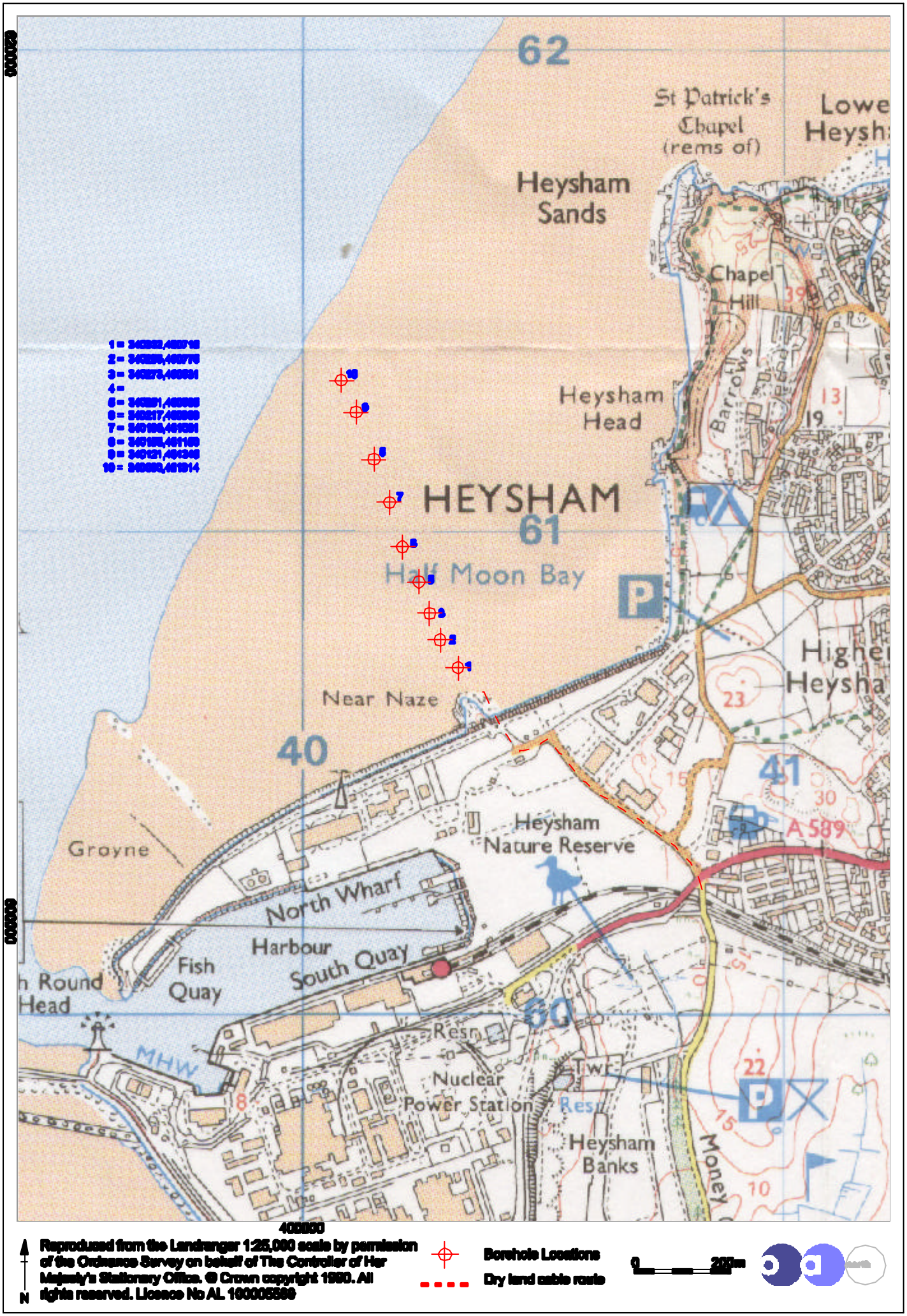

Figure 2: Core locations : Heysham cable route

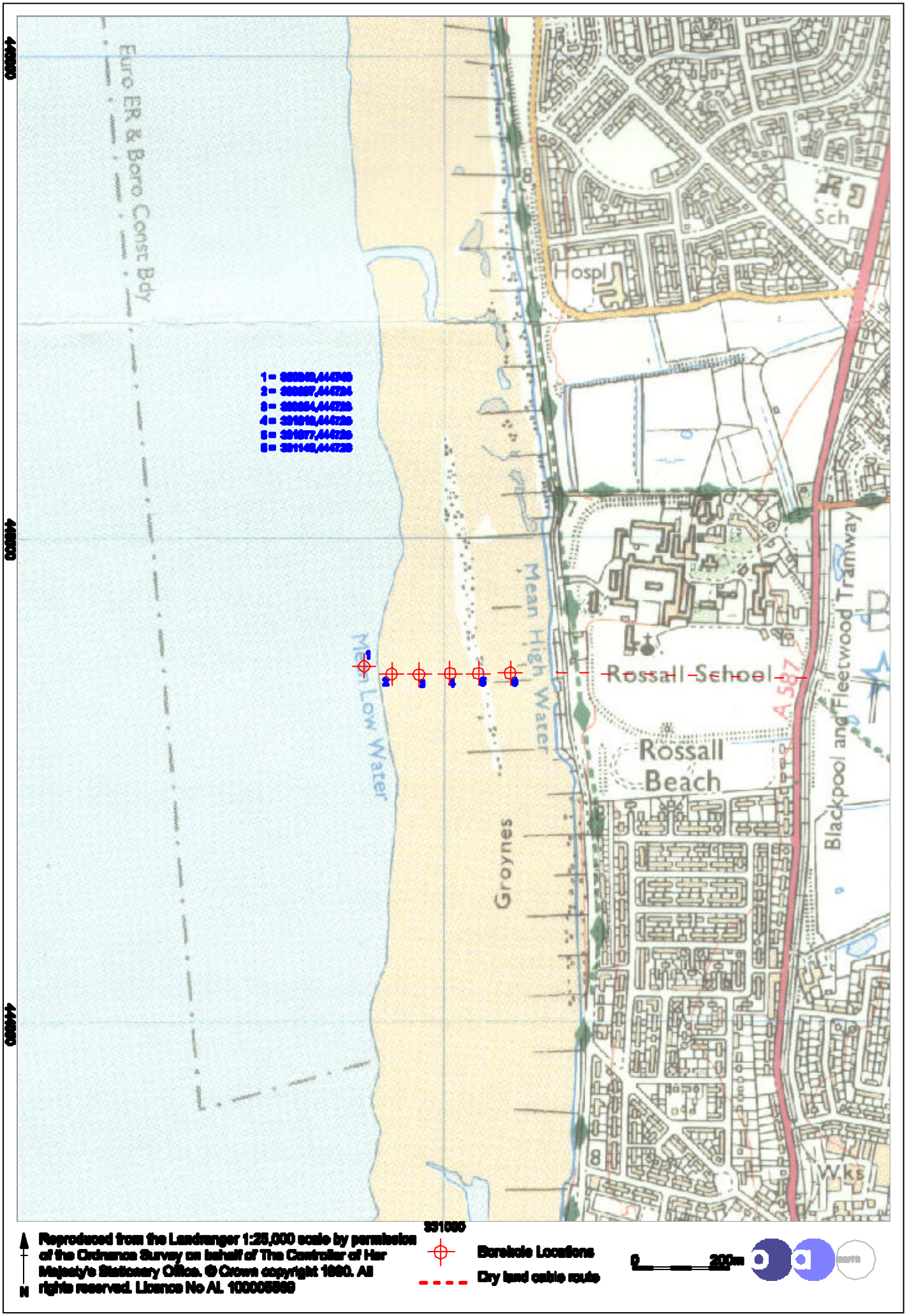

Figure 3: Core locations : Cleveleys cable route

Plate 2: Working Shot of mechanical corer at Heysham