



**DYFED ARCHAEOLOGICAL TRUST LTD**



01/02/95

# **PEMBROKE POWER STATION**

**ARCHAEOLOGICAL STUDY**

## **THE MATERIALS HANDLING PLANT**

DAT project record 30151 39114  
FEBRUARY 1995

**Commissioned by:** National Power PLC

**Report by:** K Murphy  
of  
Dyfed Archaeological Trust Ltd  
The Shire Hall  
8 Carmarthen Street  
Llandeilo  
Dyfed SA19 6AF

**Tel (0558) 823121**

**Fax (0558) 823133**



PEMBROKE POWER STATION ARCHAEOLOGICAL STUDY  
THE MATERIALS HANDLING PLANT  
DAT PROJECT RECORD 30151

CONTENTS

1	SUMMARY
2	INTRODUCTION
3	AIMS AND OBJECTIVES
4	METHODOLOGY
5	COMPARATIVE STUDIES
6	THE ALLUVIAL AND PEAT DEPOSITS WEST OF THE POWER STATION
7	RÉSUMÉ
8	RECOMMENDATIONS
9	FINANCIAL CONSIDERATIONS
10	SOURCES CONSULTED
11	FIGURES
	Fig. 1 Location map
	Fig. 2 The Materials Handling Plant
12	APPENDIX 1. EXTRACT FROM THE GIBBS GEOTECHNIC REPORT

1        **SUMMARY**

- 1.1      Analysis has been carried out of the archaeological and palaeoenvironmental potential of peats, organic clays and alluvium buried beneath made ground to the west of Pembroke Power Station, by reference to recent published and unpublished research.
- 1.2      Evaluation of these deposits has shown their palaeoenvironment potential to be high; their archaeological potential is probably low.
- 1.3      The future of these deposits is uncertain. If they are to be significantly disturbed, it is recommended that a limited programme of environmental sampling and analysis should be undertaken.



## 2 INTRODUCTION

- 2.1 On 3 January 1995, submitted an application for permission to burn emulsified hydrocarbons at its Pembroke Power Station in south-west Wales. An environmental statement (ES) has been produced to accompany the application.
- 2.2 The need for archaeological studies has been identified, and with this purpose in mind, National Power circulated a tender document (LC/2/0150), dated 21 December 1994, inviting applicants to submit specifications that would provide supplementary information to the existing ES on the proposal's potential impacts on archaeology.
- 2.3 This study is concerned with the proposed materials handling plant and its impacts upon peats and other deposits buried beneath made ground. The archaeological potential of these deposits has been recognised (RPS Clouston 1994, paragraph 4.23):

The two geotechnical surveys consulted show that the deepest part of the drowned valley is about 50' (16m) below Ordnance Datum and that the solid rock is covered by marine alluvium to the east and by river gravels and clays to the west. The deepest deposits tend to be towards the northern side of the valley corresponding closely to the line of the stream/drain in the area before the construction of the power station. The marine alluvium is likely to be relatively recent (post-Roman), but the river gravels and clay probably were laid down in the period 3,000BC to the Romans and may contain archaeological material. This could be of particular interest because one of the test pits (Gibbs TP no. 5) shows peat in the area of the drowned river channel at a depth of between 2.8 3.1m, above a clay layer. The other test pits with peaty deposits (Gibbs TPs 11, 12 and 13) are further to the west and south of TP5 and appear to be less coherent, as they are described as 'pockets'. The clay and gravel deposits containing them are as close to the surface as 0.6m (TP 13) and continue to a depth of at least 3m in all cases. The palaeo-ecological and archaeological potential of peat deposits is a major area of archaeological research. There is a case for further work to map the peat deposits and palaeochannels, and to assess the archaeological potential of the alluvial valley fill if future developments are likely to disturb them.

The study concludes (paragraph 6.4):

The area to the west of the power station would be of major importance if the archaeological potential of the alluvial and peat deposits is con-

firmed.

- 2.4 Two reports were requested by National Power. This report is concerned with the alluvial and peat deposits to the west of the power station. The second report is concerned with a proposed tunnel cutting and jetty access road.

### 3 AIMS AND OBJECTIVES

#### 3.1 The aims of this study are:

to map the extent of the former peat and alluvial deposits from historical sources

to evaluate the archaeological and palaeoenvironmental potential of the deposits by reference to studies in similar environments

to make recommendations for possible further archaeological and environmental programmes of work.

- 4.1 This is an entirely desk-based study. Reference was made to historic maps and aerial photographs in order to map the alluvium and peat. A search was made for studies carried out in comparable environments. Particular attention was paid to a thesis devoted to the study of coastal peats on the Pembrokeshire coast (Lewis 1992).

## 5 COMPARATIVE STUDIES

### 5.1 Coastal Peats

- 5.1.1 At numerous locations on the south-west Wales coast a deposit commonly known as the 'submerged forest' occurs. This is a peat, up to 1m thick but usually less, often containing tree stumps and trunks, exposed at low tide. Artefacts of mesolithic date have been collected for over a century from deposits directly underlying this peat (Jacobi 1980). A systematic study comprising pollen and other analyses supported by radiocarbon dates of the peat was undertaken by Lewis in 1992.
- 5.1.2 Integral to Lewis's study was a review of current work on Flandrian sea level change. Most recent work for the Cardigan Bay area suggests rapidly rising sea level from c. 10,000 - 9000 BP (before present) with a slowing of the rise from c. 7500 - 6000 BP to 0BP. These studies involved the examination of intercalations of minerogenic and biogenic sediments in coastal contexts. Lewis suggested that between 7500 - 3600 BP spits or barrier beaches allowed the development of shallow lagoons, fen and alder carr. These environments were exploited by mesolithic hunter gathers. Continuing rising sea levels breached the barrier beaches and inundated the peat deposits.
- 5.1.3 An unusual coastal peat site is Castlemartin Corse, 5km to the south-west of Pembroke Power Station, as here the beach barrier was not breached by rising sea levels and lagoon and fen environments persisted. Concomitant with rising sea levels was a rise in the water table; this has allowed uninterrupted biogenic deposition. Current peat depths at Castlemartin are 4.3m. A radiocarbon determination of  $4140 \pm 80$  BP dates the onset of peat development.
- 5.1.4 Of all the sites studied by Lewis, Penybont, in the Nevern estuary, 40km north of Pembroke Power Station, bears the greatest resemblance to the environment of the Pembroke river. At Penybont, situated at the head of an estuary, 1.4m of peat lies beneath riverine/estuarine silt (which is still being formed). Mesolithic artifacts have been found beneath the peat. The surface of the peat was levelled to + 3.0m. A radiocarbon determination of  $3650 \pm 80$  BP dates the onset of peat development. Lewis considers that the relatively thick peat sequence at Penybont reflects a balance between the rate of peat accumulation and rising water-tables, in turn influenced by rising sea-levels.

### 5.2 Interglacial deposits at West Angle

- 5.2.1 At West Angle, 6km to the west of Pembroke Power Station, analysis of clays and muds exposed in a low cliff section provided a pollen assemblage zone dominated by temperate forest taxa (Stevenson and Moore 1982). The authors



considered that this sequence was of the Hoxnian interglacial, though this was not conclusive.

### 5.3 Late Glacial airfall deposits

- 5.3.1 Case (1984) has studied airfall deposits in South Wales including sites at Martin's Haven (1km to the west of the power station) and on the south shore of the Pembroke river. At these two locations the airfall deposits comprise thin bands of reddish-brown loam. Analysis of them demonstrated that they were laid down in a cold arid climate after the Late Devensian Glacial maximum, c. 30,000 - 10,000 BP.

### 5.4 Laugharne Marsh

- 5.4.1 Ongoing work at Laugharne marsh (32km east of Pembroke Power Station) has involved the mapping and analysis of buried biogenic and minerogenic deposits (Walley, pers. comm. School of Ocean Sciences, University College of North Wales). Augering has revealed two peat layers buried beneath a wide area of this large marsh. These organic layers seem to be the result of biogenic material having been washed into shallow fresh or brackish-water lagoons rather than the result of *in situ* peat development. The date of these deposits is as yet unclear, but initial results would seem to suggest formation in the same period as the beach peats studied by Lewis, ie. 7500-3600 BP.

### 5.5 The Severn Levels

- 5.5.1 In Wales, by far the greatest concentration of work on wetland sites has been undertaken in the Severn Levels, Gwent (Bell 1993). Here multidisciplinary studies have uncovered artifacts and structures dating from the Neolithic with particularly rich sites of bronze age, iron age and Roman Period. This is a different environment to Pembroke and consists of extensive tidal flats and large tracts of reclaimed land.

- 6 THE ALLUVIAL AND PEAT DEPOSITS WEST OF THE POWER STATION
- 6.1 Areas of marsh with active peat formation exist in many of the sub-estuary heads of Milford Haven. Such deposits can be found at Martin's Haven, 1km to the west of the power station, and on several of the small inlets on the south side of the Pembroke river.
- 6.2 The position of the coastline prior to the construction of the power station is shown on Figure 1. Also shown is saltmarsh and an area of rough pasture which may have been a patch of marshy ground. This information was transcribed from large scale Ordnance Survey maps dating back to 1864 and from 1955 vertical aerial photographs. Analysis of these maps and aerial photographs shows that the position of the coast and extent of rough pasture and saltmarsh has remained stable in the historic period. Peat formation in the small area of marsh depicted as rough pasture may have been active up to the construction of the power station.
- 6.3 A Geotechnical survey (reproduced as an appendix to the RPS Clouston report) of the area to the west of the power station located alluvial and peat deposits beneath made ground. The thickness of the made ground over these deposits varies from 0.9m to 2.8m; the thickest area being over the former salt marsh - TP5 (test pit 5). The alluvium and organic deposits located in the test pits broadly conforms to the marsh and saltmarsh recorded on Ordnance Survey maps. An exception is the area on the south and south-west side of the study area - TP18 and 21. The geotechnical data from test pits relevant to this study are included in Appendix 1.
- 6.4 TP5 revealed a 0.3m thick deposit of firm peat and clay between 2.8m and 3.1m directly below made ground. This was the only substantial peat deposit encountered in the test pits. It is undoubtedly the remains of rough pasture and saltmarsh shown on Ordnance Survey maps. Clay and sand and gravel underlie the peat.
- 6.5 Organic peats and clays in TP8 seem to have been disturbed as they are incorporated into the made ground.
- 6.6 In TPs 11, 12 and 13 clay with fine to medium gravels contained a mottling of organic clay and pockets of peat; these deposits started at 0.6m to 1.0m below made ground. The test pits were terminated at about 3.5m before the bottom of these deposits was reached.
- 6.7 In TPs 18 and 19 clay with pockets of silty, peaty clay was encountered between 2.3m and 4.3m beneath clay with gravels and cobbles.
- 6.8 The amount of disturbance to the alluvial and peat deposits caused by the construction of the power station is uncertain from the test pit evidence. The incorporation of organic deposits in TP5 indicates a degree of distur-

bance. It seems likely that the clay deposit with organic clays and peat pockets encountered in TPs 11, 12 and 13 has been truncated. The peat in TP5 may be undisturbed, but will have certainly experienced compression. Clays with pockets of peats in TPs 18 and 19 are undisturbed. The degree to which organic deposits have experienced degradation due to changes to hydrology caused by power station construction is unknown.

## 7 RÉSUMÉ

- 7.1 Minerogenic and biogenic deposits around the south-west Wales coast were formed by a wide range of processes, in varied environments over a long period of time.
- 7.2 Peat analysed by Lewis at Penybont is the closest parallel to the peat deposit in TP5 at the power station. A bronze age date was obtained for peat inception at Penybont. The thinner deposit at the power station may indicate later development.
- 7.3 The data from TPs 11-13, 18 and 21 are not sufficiently detailed to assess whether intercalated clays and peats are present. It is however likely that these clays and peats developed in marine or brackish environments. The closest parallel is probably at Laugharne marsh where organic material was washed into shallow lagoons. As at Laugharne, this process of peat accumulation may have taken place between *c.* 7500 - 3000 BP.
- 7.4 No artifacts or organic remains indicative of a human presence were recorded in the test pits.
- 7.5 The date of sands and gravels recorded in the test pits is unknown. Comparative studies have shown that sands, loams, clays and gravels dating from the Hoxnian interglacial to *c.* 10,000 BP exist in and around Milford Haven. These comparative studies do not support the statement in the RPS Clouston report that the river gravels and clays were probably laid down in the period 3,000 BC to the Romans.
- 7.6 Any value of the buried peat and organic clay deposits resides in their palaeoenvironmental potential. Their location, method of deposition and disturbed nature means that they are probably of low archaeological potential.

- 8.1 Construction of a materials handling plant may involve disturbance of the peat and organic clay deposits. If this disturbance were to involve the digging of deep foundation or other trenches which would substantially damage or lead to the degradation of the organic clay and peat then a watching brief should be undertaken. This watching brief needs only to be carried out in the vicinity of TPs 5, 12 and 13. Its purpose is to examine the nature of the buried peat and alluvial deposits. If these deposits are well preserved then samples of them should be taken in order to conduct palaeoenvironmental analyses. These analyses should be supported by radiocarbon dates.

9            **FINANCIAL CONSIDERATIONS**

- 9.1        A estimate for the watching brief and environmental analyses recommended in Section 8 is provided here. The estimate should be considered only as a rough guideline and not as a quotation. The figures are exclusive of VAT
- 9.2        Palaeoenvironmental analyses, estimate of cost £3000 - £7000.



10            SOURCES CONSULTED

Bell, M. (ed), 1993 *Archaeology in the Severn Estuary, 1993*, annual report of the Severn Estuary Levels Research Committee.

Case, D. J., 1983 'Quaternary airfall deposits in South Wales: Loess and coversand', Ph.d Thesis, University of Wales.

Caseldine, A. E., 1990 *Environmental archaeology in Wales*, St. David's University College, Lampeter.

Jacobi, R. M., 1980 'The early Holocene settlement of Wales', in J. A. Taylor (ed), *Culture and environment in prehistoric Wales*, BAR British Series 76, 131-206.

Lewis, M. P., 1992 'The prehistory of south west Wales, 7500-3600BP: An interdisciplinary palaeoenvironmental and archaeological investigation', Ph.d Thesis, University of Wales.

Meridian Airmaps Ltd, 1955 vertical aerial photographs 190/200 25437-39.

Ordnance Survey - various large scale maps from 1864 onwards.

RPS Clouston, 1994 'National Power Archaeological Study. Pembroke Power Station'

Stevenson, A. C. and Moore, P. D., 1982 'Pollen analysis of an interglacial deposit at West Angle, Dyfed, Wales', *New Phytologist*, 90, 327-37.

Wainwright, G. J., 1963 'A reinterpretation of the microlithic industries of Wales', *Proc Prehistoric Society*, 29, 99-132.



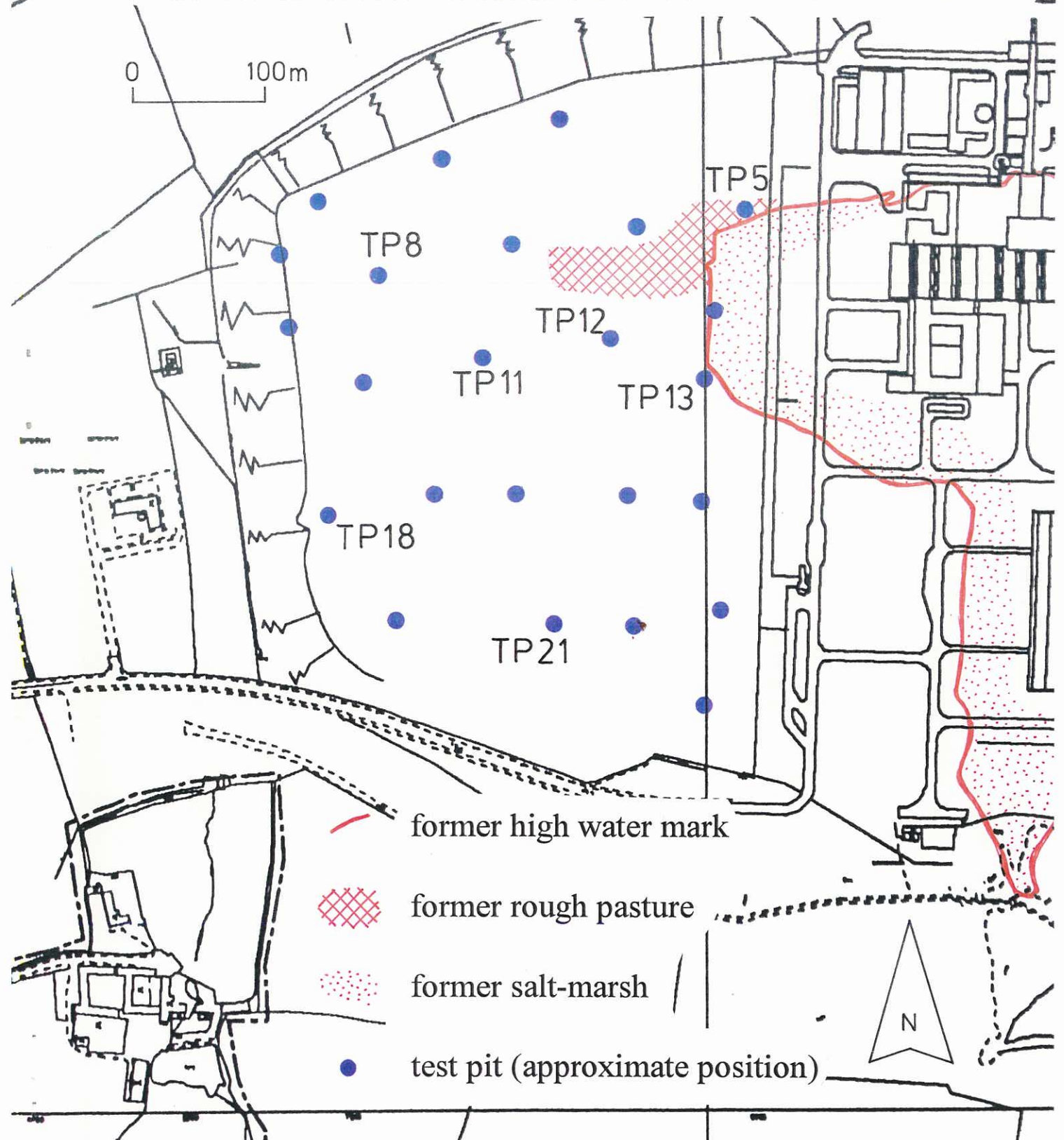




# PEMBROKE POWER STATION

FIG. 2

## THE MATERIALS HANDLING PLANT



Details of Test Pits 5, 8, 11, 12, 13, 18 and 21

<b>Method of Investigation:</b> JCB 3CX Excavator	<b>TRIAL PIT LOG</b>		<b>Trial Pit No:</b> 5
	<b>Site:</b> Pembroke Power Station		
<b>Depth (m)</b>  0.0 -	0.0  Δ 0.3 0.4-1.1	Grass over soft reddish brown sandy clay FILL with subangular and subrounded medium to coarse gravel, cobbles, boulders. Soil sample Water seepage	
1.0 -	1.1	Firm, orange brown with occasional grey mottling, slightly silty, gravelly clay FILL with subangular cobbles.	
2.0 -			
3.0 -	Δ 2.8  3.1	Soft to firm, dark brown and black, silty, CLAY and firm PEAT with partially decomposed roots. (Soil sample at 2.9m) Soft, reddish grey, sandy CLAY with subangular coarse gravel and cobbles.	
4.0 -	4.2  4.6	Loose, wet, reddish brown, medium to coarse silty SAND and subangular and subrounded, medium to coarse GRAVEL with subangular and subrounded cobbles. Pit terminated	
<b>Logged by:</b> Mark Williams	<b>COMMENTS</b>  Δ Disturbed Sample  Trial pit terminated at 4.6m. Water sample obtained from standing water in pit.		
<b>Date:</b> 30/8/94			
<b>Scale:</b> Not to Scale			



<b>Method of Investigation:</b> JCB 3CX Excavator	<b>TRIAL PIT LOG</b>		<b>Trial Pit No:</b> 8
	<b>Site:</b> Pembroke Power Station		
<b>Depth (m)</b>  0.0 -          1.0 -          2.0 -          3.0 -          4.0 -	0.0  Δ 0.2-0.4          0.9          1.4          3.3	Grass over soft dark brown, sandy, clay FILL with coarse subrounded gravel, cobbles and boulders, and roots. Soil sample          Firm, light brown, sandy clay FILL with subangular and subrounded cobbles and boulders and pockets of firm, grey green clay and firm, dark brown, silty, organic clay and peat.          Firm, dark brown, silty, slightly sandy CLAY          Pit terminated	
<b>Logged by:</b> Mark Williams	<b>COMMENTS</b>  Δ Disturbed Sample  Trial pit terminated at 3.3m. Pit remained dry.		
<b>Date:</b> 31/8/94			
<b>Scale:</b> Not to Scale			

<b>Method of Investigation:</b> JCB 3CX Excavator	<b>TRIAL PIT LOG</b>		<b>Trial Pit No:</b> 11
	<b>Site:</b> Pembroke Power Station		
<b>Depth (m)</b>  0.0 -	0.0  0.2	Grass over soft, medium brown, silty clay FILL.	
	Δ	Firm, reddish brown, silty clay FILL with subangular and subrounded cobbles and boulders. (Soil sample at 0.3m)	
1.0 -	1.0	Firm to stiff, orange brown, silty CLAY with occasional fine to medium, subangular gravel and occasional mottling of firm, dark brown organic clay and peat.	
2.0 -	Δ	2.3	Soil sample
3.0 -		3.4	Pit terminated
4.0 -			
<b>Logged by:</b> Mark Williams	<b>COMMENTS</b>  Δ Disturbed Sample  Trial pit terminated at 3.4m. Pit remained dry.		
<b>Date:</b> 31/8/94			
<b>Scale:</b> Not to Scale			

Method of Investigation: JCB 3CX Excavator	TRIAL PIT LOG		Trial Pit No: 12
	Site: Pembroke Power Station		
Depth (m)			
0.0 -	0.0		Grass over firm, reddish brown, silty, clay FILL with subrounded cobbles and boulders and occasional silty clay pockets.
	Δ 0.4		Soil sample
	0.6		
	Δ 0.9		Firm, silty, gravelly, clay FILL with subangular cobbles. (Soil sample at 0.7m)
1.0 -			Stiff, orange brown, slightly silty CLAY with occasional fine to medium, subangular and subrounded gravel and occasional dark brown silty, peaty clay pockets.
2.0 -			
3.0 -			
	3.3		Pit terminated
4.0 -			
Logged by: Mark Williams	<u>COMMENTS</u>		
Date: 31/8/94	Δ	Disturbed Sample	
Scale: Not to Scale	Trial pit terminated at 3.3m. Pit remained dry.		

Method of Investigation: JCB 3CX Excavator	<b>TRIAL PIT LOG</b>		Trial Pit No: 13
	Site: Pembroke Power Station		
Depth (m)			
0.0 -	0.0		
	Δ	Grass over firm, greyish brown, clay FILL with subrounded cobbles and boulders. (soil sample at 0.2m)	
		0.6	
		Stiff, reddish brown silty CLAY with occasional fine to medium, subangular gravel and pockets of dark brown, silty, peaty clay.	
1.0 -			
	Δ	1.2	Soil sample
2.0 -			
3.0 -			
		3.5	Pit terminated
4.0 -			
<b>Logged by:</b> Mark Williams	<b><u>COMMENTS</u></b>		
<b>Date:</b> 31/8/94			
<b>Scale:</b> Not to Scale			
	Δ	Disturbed Sample	
		Trial pit terminated at 3.5m. Pit remained dry.	

<b>Method of Investigation:</b> JCB 3CX Excavator	<b>TRIAL PIT LOG</b>		<b>Trial Pit No:</b> 18
	<b>Site:</b> Pembroke Power Station		
<b>Depth (m)</b>  0.0 -          1.0 -          2.0 -          3.0 -          4.0 -	0.0          Δ 0.4                    2.3          Δ                    4.3	<hr/> Grass over stiff, orange brown to reddish brown, slightly sandy, silty CLAY with occasional subangular and subrounded limestone cobbles.  Soil sample          <hr/> Stiff, light orange brown, silty, slightly sandy CLAY with occasional fine to medium, subangular gravel, and occasional pockets of firm, dark brown, silty peaty clay. (Soil sample at 0.5m)          <hr/> Pit terminated	
<b>Logged by:</b> Mark Williams	<b>COMMENTS</b>  Δ Disturbed Sample  Trial pit terminated at 4.3m. Pit remained dry.		
<b>Date:</b> 31/8/94			
<b>Scale:</b> Not to Scale			

Method of Investigation: JCB 3CX Excavator	TRIAL PIT LOG		Trial Pit No: 21
	Site: Pembroke Power Station		
Depth (m)			
0.0 -	0.0	Grass over loose, soft brown, silty, sandy clay FILL with fine to coarse subangular gravel.	
	Δ 0.3	Soil sample	
	0.6	Soft, orange brown, silty, slightly sandy CLAY with occasional fine to medium subangular gravel and subrounded limestone cobbles. (Soil sample at 0.8m)	
1.0 -	Δ		
2.0 -			
	2.3	Soft, grey, silty CLAY with occasional pockets of dark brown silty, peaty clay. Soil sample.	
3.0 -	Δ		
	3.8	Grey mudstone. (Soil sample at 3.9m)	
4.0 -	Δ		
	4.1	Pit terminated	
Logged by: Mark Williams	<u>COMMENTS</u>  Δ Disturbed Sample  Trial pit terminated at 4.1m. Pit remained dry.		
Date: 1/9/94			
Scale: Not to Scale			