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17 ACRE SITE
HIRWAUN INDUSTRIAL
ESTATE
P329

Explor

17 Acre Site, Hirwaun Industrial Estate

nterpretive Report on Ground Investigation

55102
uly 1995

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Glamorgan

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17 Acre Site, Hirwaun Industrial Estate

Interpretive Report on Ground Investigation

155102
July 1995

Client:
Welsh Development Agency
QED Centre
Main Avenue
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Pontypridd
Mid Glamorgan

Engineer:
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CONTENTS

155102

1. INTRODUCTION

On the instruction of Thomas Morgan & Associates a ground investigation was carried out by Exploration Associates Limited on behalf of the Welsh Development Agency. The instruction to proceed with the investigation was given in a letter from Thomas Morgan and Associates dated 7 June 1995, reference BLJ/SH/P329.03/G.

The investigation was required to determine the nature, depth, chemical and engineering properties of the materials underlying the site to assess bearing capacities and likely differential settlements together with information on groundwater and gas levels present on the site.

This report presents a description of the site, together with an account of the investigation procedures adopted, and interpretation of the factual data obtained from the site works and subsequent laboratory testing programmes.

The investigation was carried out in general accordance with the relevant British Standards and the General Notes appended.

2. TERMS OF REFERENCE

The terms of reference for this interpretive report were determined by the Thomas Morgan and Associates and requested that the report should comprise the analyses of data collected and geotechnical suggestions related to the mantle of Made Ground deposits and soils beneath, their engineering properties and the relationship to their design function.

Suggestions requested, comprised general details of bearing capacities for foundations and an assessment of potential long term differential settlements.

Subsequent to providing the draft report the brief was extended to include comments on trench fill footings, ground bearing floor slabs, possible removal of "soft" alluvial material and re-use of excavated materials.

3. THE SITE

The site is located on the Hirwaun Industrial Estate adjacent to the Penderyn Reservoir. The approximate National Grid reference for the site is SN 068 939.

The site comprises generally flat grass land, shrub vegetation and small seasonal boggy patches and standing water.

4. AVAILABLE INFORMATION

Information made available by Thomas Morgan and Associates and used in the preparation of this report is detailed below:

- Drawing P329 showing Location Plan
- Trial pit logs, dated 15 July, 1988
- Instructions to tenderers, dated February, 1995

5. FIELDWORK

5.1 General

The fieldwork was carried out during the period 12 June to 28 June, 1995 and comprised the drilling of cable percussion boreholes, excavation of trial pits and dynamic probing, together with soil and groundwater sampling. The scope of the works was determined by Thomas Morgan and Associates.

The fieldwork was carried out in general accordance with BS 5930: 1981.

5.2 Boreholes

A total of eight 200mm nominal diameter boreholes were drilled using standard cable tool percussion techniques to depths of between 3.10 metres and 10.00 metres below existing ground level.

The locations of the boreholes were predetermined by the Engineer and are shown on the Exploratory Hole Location Plan, Drawing 2.

During the course of cable percussion boring small and large (bulk) disturbed samples were taken of all strata encountered for descriptive and subsequent laboratory testing purposes. Undisturbed 100mm nominal diameter samples were obtained in cohesive strata using standard open drive equipment.

The depths and descriptive details of the strata encountered together with details of samples obtained, groundwater behaviour and rates of progress are presented on the Borehole Records, Enclosure A. The descriptions which are based on an examination of the samples obtained during drilling and supplemented by in situ and laboratory test results are in accordance with BS 5930: 1981, and the definitions contained therein, and amended in accordance with recommendations made by Norbury et al.

5.3 Trial Pits

A total of thirteen trial pits were excavated using a tyred mechanical excavator. Trial pits were logged from the surface by a geologist. Large (bulk) and small disturbed samples were taken for subsequent laboratory testing. The trial pit records are presented on the Exploratory Hole Records, Enclosure A.

The positions of the trial pits are shown on Drawing 2.

5.4 Dynamic Cone Penetration Tests

Eighteen dynamic cone penetration tests were carried out at positions shown on Drawing 2, the purpose of which was to provide an indication of penetration resistance and delineate the extent of any peat deposits on the site.

The results of the dynamic cone penetration tests are presented in Enclosure B.

6. LABORATORY TESTING

Laboratory testing schedules were prepared by Exploration Associates Limited and agreed by Thomas Morgan and Associates. The testing consisted of geotechnical and chemical analyses. The laboratory testing was carried out by Exploration Associates Limited in accordance with BS 1377 (1990) and comprised the following tests:

- Moisture Content
- Atterberg Limits
- Particle Size Distribution
- Specific Gravity
- pH
- Total Sulphate
- Standard Compaction Tests

Four samples were selected and tested for chemicals according to ICRCL guidelines, tables 3a/b and 4.

The results of the geotechnical testing are contained within Enclosure C.

7. GROUND CONDITIONS

7.1 Published Geology

The British Geological Survey 1:50,000 Scale Series, Drift Map 231, Merthyr Tydfil indicates the site to be underlain by Recent Alluvium and Glacial Boulder Clay.

7.2 Strata Encountered

The exploratory holes showed the site to be underlain by a mantle of Made Ground overlying alluvial clay deposits. Where alluvial deposits were not encountered the Made Ground was proved to be underlain by glacial sands and boulder clay. Several metres of Sand and Gravel were encountered in all boreholes. Bedrock was encountered as grey mudstone and grey sandstone.

Made Ground

Made Ground was encountered in all exploratory holes to a maximum depth of 3.20 metres below existing ground level in Trial Pit C.

The material generally consisted of very compact sandy clayey gravel and cobbles of sandstone with some stiff silty sandy gravelly clay and is believed to be Reworked Sand and Gravels and Boulder Clay.

Alluvial Deposits

Alluvial deposits were encountered in all boreholes except Boreholes 2 and 3 below the Made Ground at depths of between 1.70 metres and 6.10 metres below existing ground level. The alluvium generally consisted of brown grey silty slightly sandy gravelly clay with occasional woody relics.

In Trial Pits 1, 2, 3 and 4a dark grey black clayey stratum occurred directly below the clayey gravelly Made Ground and contained much partly decomposed plant material. This may be a relict grassed surface which has been subsequently buried by imported material.

Glacial Clay

Glacial boulder clay was encountered in Trial Pits 2 and 3 and consisted of a stiff grey silty sandy clay with some gravel and cobbles of sandstone.

Sand and Gravels

Sand and Gravels were encountered in all boreholes to a maximum depth of 10.00 metres in Borehole 5. The Sand and Gravels were generally brown very sandy angular to sub-rounded fine to coarse gravels of mudstone and sandstone, though at certain depths sand size material predominated.

Bedrock

Bedrock was encountered in Boreholes 1, 2, 3 and 7A and consisted of a fine grained grey sandstone.

7.3 Groundwater

Groundwater levels in all boreholes were recorded and drilling operations suspended for 20 minutes during which time the groundwater behaviour was monitored.

Strikes occurred between the depths of 2.8 metres and 6.5 metres below existing ground level, generally corresponding to the sand and gravel strata.

It should be noted, however, that groundwater levels fluctuate due to meteorological conditions and may, at times be different to those measured during the site works.

8. GEOTECHNICAL PARAMETERS

Geotechnical parameters of each of the soil types encountered have been assessed based on in situ testing and subsequent laboratory testing.

i) Made Ground

In situ Standard Penetration (SPT) 'N' values of between 9 and 50/95mm were recorded, the average being 35. However it is considered that due to the variable nature of the results an uncorrected SPT 'N' value of 20 should be used for design purposes.

Applying guidelines suggested by Peck, Hanson and Thorburn, an angle of shearing resistance ϕ' of 33° is suggested.

Atterberg limit analyses classify the more cohesive material encountered in the Made Ground as a clay with low plasticity as shown in Figure PC. Chemical analyses recorded pH values of between 7.5 and 11.2 and sulphate contents of between 0.03% and 1.7g/l.

Compactions carried out on samples of the made ground recorded optimum moisture contents of between 9.8% and 12%, averaging 11%. Corresponding maximum dry densities ranged from 1.99Mg/m^3 to 2.06Mg/m^3, averaging 2.0Mg/m^3.

ii) Alluvial Deposits

Atterberg limit analyses classifies the deposits as clay of intermediate plasticity as shown in Figure PC in the Appendix.

In situ SPT 'N' values of between 11 and 28 were recorded, the average being 18. Applying correlations suggested by Stroud and Butler for clay materials and assuming material of intermediate plasticity as is confirmed by the atterberg results, the following parameters are suggested.

$$m_v = 0.15m^2/MN$$

$$c_u = 60kN/m^2$$

iii) Sand and Gravels

In situ SPT 'N' values of between 15 and 50/80mm were recorded, with the average being 40. It is considered that due to the variable nature of the results an uncorrected SPT 'N' value of 30 should be used for design purposes.

Reference to Peck, Hanson and Thorburn suggests an angle of friction ϕ' in the order of 36°.

iv) Boulder Clay

No in situ SPT data was recorded for the boulder clay which was only encountered in Borehole 3 and Trial Pits 2, 3 and 6. However the field description of stiff indicates an expected undrained shear strength in the region of $75kN/m^2$ to $150kN/m^2$.

v) Bedrock

In situ SPT 'N' values showed the bedrock material to be very dense with refusals. No data was available relating to engineering parameters of the bedrock. It should also be noted that possibility of strata encountered being large boulders cannot be discounted without rotary coring.

vi) Groundwater

Chemical analysis on groundwater showed pH values of between 7.2 and 8.1 and sulphate contents of between 0.02% and 0.03%.

9. ENGINEERING ASSESSMENT

9.1 Introduction

As the exact nature of the proposed development is not known it has only been possible to give general guidelines in the engineering assessment.

The following assessment is made with relation to the proposed works employing the geotechnical and chemical parameters recorded during the investigation and laboratory testing programme.

9.2 Excavations

The Made Ground, Alluvium and sands and gravels excavated in the trial pits show that they would be possible to excavate using conventional plant. As the Made Ground is generally granular in nature any excavations will only be stable for a short term. Any excavation deeper than 1.20 metres will require some form of support or battered sides. Owing to the variable nature of the Made Ground and alluvium, support would need to be in the form of close timbers, or similar.

Water was only encountered in Trial Pit 3 at 3.20 metres as a slight seepage. In the boreholes water was encountered at various depths between 2.80 metres in Borehole 2 and 6.50 metres in Borehole 3, in the sand and gravel material. The rate of water inflow varied between 0.40 metres and 1.60 metres in 20 minutes respectively. If excavation were to take place at these depths it is suggested that pumping would be required. However, an adequate seal would be required to reduce the risk of leaching of fines.

9.3 Foundation Options

The options for foundations would be dependent on the size, load and sensitivity to movement of the structure to be constructed.

Small lightly loaded structures may be constructed on shallow rafts in certain areas of the site, particularly towards the centre of the site where there appears to be less or no alluvium. This would probably not be possible to the south of the site where there is between 1.00 metre and 2.00 metres of alluvium below the Made Ground.

Where it is intended to place footings at high levels within the made ground the following allowable bearing capacities are anticipated with associated settlments of less than 25mm.

Foundation Type	Width(m)	Depth(m)	Allowable Bearing Capacity(kN/m^2)
Strip	1.00	GL	75
Strip	1.00	1.00	110
Strip	2.00	GL	110
Strip	2.00	1.00	110
Pad	1.00	GL	35
Pad	1.00	1.00	40
Pad	2.00	GL	70
Pad	2.00	1.00	80

Table 1. Allowable Bearing Capacities in the Made Ground

Trench fill to the underlying sand and gravel strata may be possible in some parts of the site. Structure loadings and variability of thickness of the fill would be a significant factor for positioning of structures built on this type of foundation. Assuming the underlying sands and gravels to be medium dense then an allowable bearing capacity in the order of 300kN/m^2 could be attained provided the excavations were kept dry. However, due to the risk of high water tables it is suggested that a value of 150kN/m^2 is employed for design purposes.

Ground bearing floor slabs where employed would need to be designed for an allowable bearing capacity in the order of 15kN/m^2. Any soft spots should be removed proof rolled and replaced by a suitable granular infill.

Piles could be driven into the sand and gravel or alternatively bedrock for larger structures with higher loads. There may be problems using continuous flight auger (CFA) piles due to the possibility of 'necking' in soft zones of alluvium. The potential viability of piles should be confirmed with a specialist contractor once more information concerning the nature of the structure is known.

Vibrocompaction of the surface layers is potentially viable, and would be particularly useful for reducing the possibility of damage to concrete floor slabs. Again details should be confirmed with specialist contractors.

Vibrated Concrete Columns (VCC) may be suitable at the site and advise should be gained from a specialist contractor as to their viability at this particular site.

Settlements

Settlements are a function of the load, foundation dimensions and founding depth and therefore it is difficult to be definitive as to possible settlement problems for the site. Most of the settlement should already have taken place due to self weight. The underlying clays may have been consolidated by the Made Ground above. This would be dependent on the length of time that the Made Ground has been on the site.

A sample of clay recovered from below the Made Ground in Borehole 5, when tested indicated a coefficient of volume compressibility (m_v) of $0.03m^2/MN$, corresponding to a clay of very low compressibility.

The peat thought to be present in the south west corner of the site was not encountered by any of the trial pits or boreholes carried out as part of this investigation.

The dynamic probe holes carried out generally showed high values of penetration resistance consistent with the very compact Made Ground encountered in the trial pits. However DP4A and TP1 showed a soft area between 2.00 metres and 3.00 metres which may indicate a pocket of peat or very soft clay. It is suggested that structures are not placed at this location without use of piled foundations.

9.4 Re-Use of Made Ground

Laboratory compactions suggest that the more granular Made Ground will attain a dry density in the order of $2.0Mg/m^3$ at moisture contents of approximately 11%. The laboratory testing indicated that the materials' dry density can reduce to around $1.8Mg/m^3$ at 15% moisture content and is thus particularly sensitive to wetting.

Particle Size Distribution plots for the Made Ground when related to the Specification for Highway Works, Table 6/2, suggests the data indicated in Table 2:

Position(depth m)	Class
2(1.00)	1A,1B,1C
3(3.00)	2C
7a(0.25)	2C

Table 2. Made Ground with relation To Specification for Highway Works

It is evident that the material is variable in nature and cannot readily be classified.

9.5 Groundwater Movement

The brief required an assessment of the potential for groundwater movement across the site. The data obtained from the site works did not prove any movement of the groundwater. However, the general topography suggests that water may move generally in a southerly direction.

9.6 Chemical Attack on Buried Concrete

The chemical analyses suggest that there may be a requirement for an increased class of concrete due to the low pH result of 4.5 for the sample at 2.00 metres in Borehole 1. The sulphate results are generally 0.02% to 0.05% except for the sample at 3.00 metres in Borehole 3 where a soluble sulphate value of 1.7g/l was recorded.

9.7 Voids and Swallow Holes

It should be noted that there is mining activity in the area and therefore we would recommend that a desk study be carried out to investigate for the possibility of disused mine workings below the site, particularly if major structures with high loads or piling to bedrock is proposed for the site.

9.8 Chemical Considerations

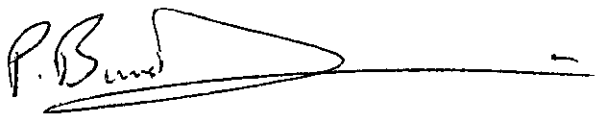
Four samples were tested to determine chemical concentrations. The results are shown in Table 3, compared with ICRCL limits:

Determinand	Remarks
Arsenic	TP4(1.55m) exceeds domestic threshold
Cadmium	TP4(1.55m) exceeds domestic threshold
Chromium	Below limit
Chromium(Hexa)	Below limit
Lead	Below limit
Mercury	Below limit
Nickel	Below limit
Selenium	Below limit
Zinc	Below limit
Water sol. Boron	Below limit
pH	Below limit
Sulphate	Below limit
Phenols	Below limit
Cyanide	Below limit
Sulphide	Below limit
Sulphur	Below limit
PAH	Below limit
Thiocyanate	Below limit

Table 3. Chemical Levels related to ICRCL Guidelines

Arsenic and cadmium both exceed the threshold limits set for domestic uses. The values do not approach the threshold levels for parks, playing fields or open spaces.

For and on behalf of
Exploration Associates Limited



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EXPLORATION ASSOCIATES LIMITED
PB/RG/CH/155102/JULY 1995

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Remarks

Laboratory— Plasticity chart

exploration associates

Project

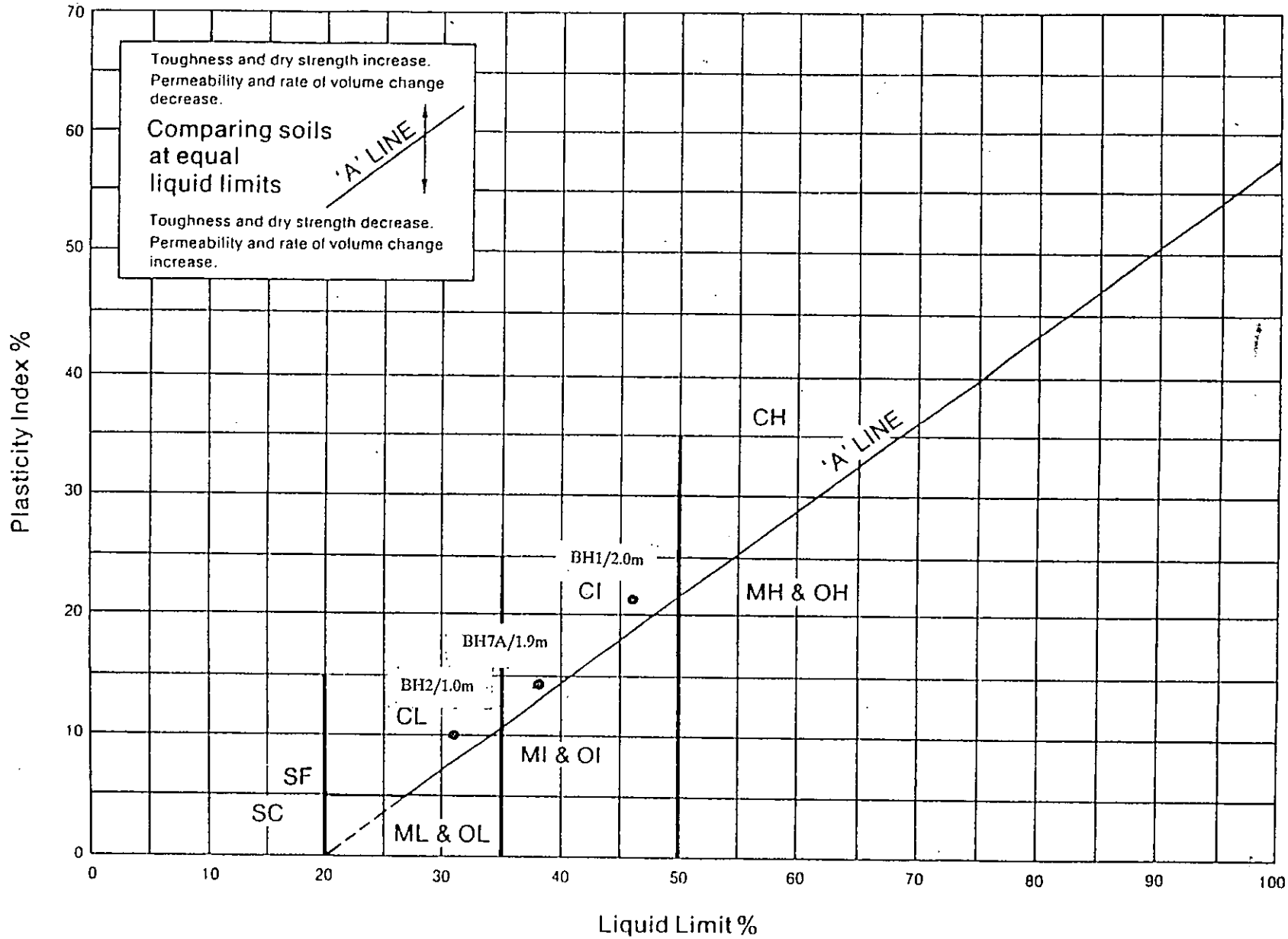
17, Acre Site, Hirwaun
Welsh Development Agency

Figure

PC

Contract

155102



EX 6

ENCLOSURE A

Exploratory Hole Records

KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

DESCRIPTIONS

**	:	Drillers Description

SAMPLES

U ( )	:	Undisturbed 102mm diameter sample, ( ) denotes number of blows to drive sampler
U ( )F, U ( )P	:	F - not recovered, P - partially recovered
U38	:	Undisturbed 38mm diameter sample
P(F),(P)	:	Piston sample, F - not recovered, P - partially recovered
B	:	Bulk sample - disturbed
D	:	Jar Sample - disturbed
W	:	Water Sample
CBR	:	California Bearing Ratio mould sample
G	:	Gas Sample and depth of hole at time of sampling

CORE RECOVERY AND ROCK QUALITY

TCR	:	Total Core Recovery %
SCR	:	Solid Core Recovery %
RQD	:	Rock Quality Designation %
FI	:	Fracture Index (discontinuities per metre) NI - not intact, NR - not recordable, NA - not applicable

GROUNDWATER

$\underline{\nabla}$	:	Groundwater strike
$\underline{\blacktriangledown}$	:	Groundwater level after standing period
Date/Water	:	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date.

IN SITU TESTING

S	:	Standard Penetration Test - split barrel sampler
C	:	Standard Penetration Test - solid 60° cone
V(H)(R)	:	Vane Test (Hand) (R) demonstrates remoulded strength
K(F), (C), (R), (P)	:	Permeability Test (falling, constant or rising head, packer)
PT	:	Pressuremeter Test
HP	:	Hand Penetrometer Test

MEASURED PROPERTIES

N	:	Standard Penetration Test - blows required to drive 300mm after seating drive
*/y	:	Denotes x blows for y mm within the Standard Penetration Test
**/y	:	Denotes x blows for y mm within the seating drive
c_u	:	Undrained Shear Strength (kN/m^2)
CBR	:	California Bearing Ratio

ROTARY DRILLING SIZES

Index Letter	NOMINAL DIAMETER (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

EXPLORATORY HOLE SYMBOLS	Project	Contract
Exploration Associates	17 Acre Site, Hirwaun Welsh Development Agency	155102 Figure

Sampling					Strata			
Depth	Type	Casing Depth	Date/ Water	SPT N (Cu)	Description	Depth (Thickness)	Level	Legend
			20/06 1995			G.L.	198.58	
0.25-0.75	B				Grass: TOPSOIL.**	0.20	198.38	
					MADE GROUND: Firm brown very silty sandy clay with some subangular fine to coarse gravel of sandstone with occasional cobbles.			
1.00-1.45	CB	-	DRY	17		(1.50)		
1.70	D					1.70	196.88	
2.00-2.45	CB	2.0	DRY	28	Soft brown grey very silty CLAY.	2.00	196.58	
					Firm brown grey very silty sandy CLAY with some fine to medium gravel.	(0.80)		
3.00-3.45	SD	3.0	DRY	13	Firm brown grey very clayey fine SILT.	2.80	195.78	
						(0.90)		
4.00-4.45	CB	4.0	DAMP	25	Medium dense to dense brown grey clayey very sandy angular to subangular fine to coarse GRAVEL of sandstone with many cobbles.	3.70	194.88	
4.50		4.50	DAMP 21/06 DAMP					
4.90	W					(2.05)		
5.00-5.45	CB	5.0	3.0	38				
5.75-6.25	B					5.75	192.83	
					Medium dense dark brown coarse SAND with some angular to subangular fine to medium gravel of mudstone and quartz.			
6.50-6.95	CB	6.50	4.80	20		(1.20)		
					Dense dark brown very sandy angular to subangular fine to coarse GRAVEL of sandstone and quartz with occasional cobbles.	6.95	191.63	
7.25-7.75	B							
7.90	D							
8.00-8.05	C	8.0	2.30	50/ 55	SANDSTONE **	7.90	190.68	
8.00		8.00			End of Borehole.			

Equipment: Cable Tool Percussion

Borehole Dia (mm): 200 to 8.00m
Casing Dia (mm): 200 to 8.00m

Groundwater

No.	Struck	Behaviour	Sealed
1	4.90	Rose to 4.20m in 20 minutes	

Ground Level 198.58 m OD

Drilled by NF
Logged by PCB
Checked by

Remarks

Chiselling from 0.80m to 1.00m (3/4hr), from 3.70m to 4.00m (1hr), from 7.20m to 7.30m (1hr), from 7.90m to 8.00m (1hr).
Digging out boulders at 0.20m to 0.30m, 0.30m to 0.50m (1hr).
** Denotes drillers description.

See key sheet and appendices for explanations.

Form 1/0

Borehole Record

Exploration Associates

Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Borehole 1(1 of 1)

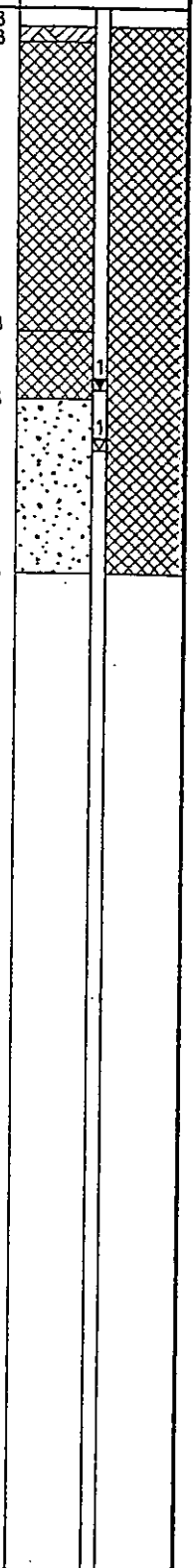
Sampling

Depth	Type	Casing Depth	Date/ Water	SPT N (Cu)
			26/06 1995	
0.25-0.75	B			
1.00-1.45	CB	1.0	DRY	50/ 170
2.00-2.45	CB	2.0	1.80	50/ 95
2.80	W			
3.00-3.45	CB	3.0	2.45	50/ 70
3.50-3.95	C	3.50	2.75	50/ 20
3.60	D	3.50	2.75	
3.60				

Strata

Description	Depth (Thickness)	Level
Grass: TOPSOIL.**	G.L. 0.10	199.88 199.78
MADE GROUND: Very stiff brown silty sandy clay with some angular to subangular fine to coarse gravel and cobbles of sandstone.	(1.90)	
MADE GROUND: Very dense brown clayey sandy angular fine to coarse gravel of sandstone.	2.00 (0.45)	197.88
Very dense brown grey sandy angular fine to coarse GRAVEL of sandstone with occasional cobbles. (Possible Bedrock).	2.45	197.43
End of Borehole.	3.60	196.28

Legend



Equipment: Cable Tool Percussion

Borehole Dia (mm) 200 to 3.60m

Casing Dia (mm) 200 to 3.50m

Groundwater

No.	Struck	Behaviour	Sealed
1	2.80	Rose to 2.40m in 20 minutes	

Ground Level 199.88 m OD

Drilled by FF
Logged by PCB
Checked by

Remarks Chiselling from 0.25m to 0.60m (1 1/2hrs), from 1.30m to 1.80m (1 3/4hrs), from 2.25m to 2.60m 1 1/4hrs)
. Water added from 1.50m to 2.00m.
** Denotes drillers description.

See key sheet and appendices for explanations.

Form 1/0

Borehole Record

Exploration Associates

Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Borehole 2(1 of 1)

Sampling

Depth	Type	Casing Depth	Date/ Water	SPT N (Cu)
			27/06 1995	
0.25-0.75	B			
1.00-1.45	CB	1.0	DRY	50/ 105
2.00-2.45	CB	2.0	DRY	48
3.00-3.45	CB	3.0	2.60	44
		3.50	3.30	
3.50			28/06 DAMP	
4.00-4.45	CB	4.0	3.80	15
5.00-5.45	CB	5.0	4.90	15
5.75-6.25	B			
6.50-6.95	C	6.30	6.10	50/ 95
6.50	W			
6.50-6.60	D			
		6.60	6.10	
6.60				

Strata

Description	Depth (Thickness)	Level
Grass: TOPSOIL.**	G.L. 0.10	200.46 200.36
MADE GROUND: Firm brown silty very sandy clay with some angular fine to coarse gravel.	(0.90)	
MADE GROUND: Very dense brown very silty medium sand with some angular fine to coarse gravel and occasional cobbles.	1.00	199.46
... becoming medium dense.	(3.20)	
Medium dense brown sandy angular to subangular fine to coarse GRAVEL of sandstone mudstone and quartz.	4.20	196.26
Grey brown silty sandy CLAY with some angular fine to coarse gravel and some cobbles. (Boulder Clay)	(1.60)	
SANDSTONE.**	5.80	194.66
End of Borehole.	(0.70)	
	6.50	193.96
	6.60	193.86

Legend

Equipment: Cable Tool Percussion

Borehole Dia (mm): 200 to 6.60m

Casing Dia (mm): 200 to 6.60m

Groundwater

No.	Struck	Behaviour	Sealed
1	6.50	Rose to 4.90m in 20 minutes	

Ground Level 200.46 m OD

Drilled by FF
Logged by PCB
Checked by

Remarks

Chiselling from 0.60m to 1.00m(1 3/4hrs), from 1.30m to 1.70m (1 1/4hrs), from 1.90m to 2.00m(1/2hr), from 4.70m to 5.00m (1hr), from 5.90m to 6.20m (1hr), from 6.50m to 6.60m(1 1/4hrs).
Water added from 1.90m to 3.50m, 3.50m to 6.00m.
** Denotes drillers descriptions.

See key sheet and appendices for explanations.

Form 1/0

Borehole Record

Exploration Associates

Project: 17 Acre Site, Hirwaun
Welsh Development Agency

Contract: 155102

Borehole: 3(1 of 1)

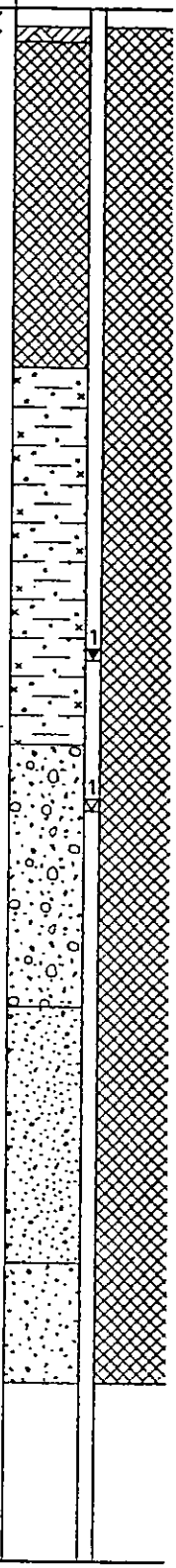
Sampling

Depth	Type	Casing Depth	Date/ Water	SPT N (Cu)
			12/06 1995	
0.25-0.75	B			
1.00-1.45	CB	1.0	DRY	19
2.00-2.45	CB	2.0	DRY	9
3.00-3.45	SD	2.90	DRY	24
3.00-3.45	B			
4.00-4.45	SD	3.90	DRY	16
4.00-4.45	B			
5.00-5.45	CB	4.80	DRY	22
5.20	W			
5.75-6.25	B			
6.50-6.95	CB	6.50	2.65	47
		7.00	3.90	
7.00			13/06 4.0	
7.25-7.75	B			
8.00-8.45	CB	8.0	4.25	50/ 210
8.50-9.00	B			
9.00	D			
9.00-9.45	C	9.0	4.50	50/ 85
		9.00		
9.00				

Strata

Description	Depth (Thickness)	Level
	G.L.	198.57
Grass: TOPSOIL.**	0.10	198.47
MADE GROUND: Medium dense orange brown clayey silty sandy subangular to subrounded fine to coarse gravel of sandstone.	(2.15)	
... becoming very clayey and loose below 2.00m.		
Firm brown very silty CLAY with a little subangular fine to coarse gravel of sandstone.	2.25	196.32
	(2.50)	
	4.75	193.82
Medium dense brown very sandy subangular to subrounded fine to coarse GRAVEL of sandstone with occasional cobbles.	(1.75)	
	6.50	192.07
Very dense brown coarse SAND with some angular to subangular fine to coarse gravel of sandstone and some subrounded cobbles.	(1.70)	
	8.20	190.37
Very dense grey very sandy angular fine to coarse GRAVEL of mudstone with some cobbles of mudstone.		
	9.00	189.57
End of Borehole.		

Legend



Equipment: Cable Tool Percussion

Borehole Dia (mm): 200 to 9.00m

Casing Dia (mm): 200 to 9.00m

Groundwater

No.	Struck	Behaviour	Sealed
1	5.20	Rose to 4.20m in 20 minutes.	

Ground Level 198.57 m OD

Drilled by FF
Logged by PCB
Checked by

Remarks Chiselling from 0.60 to 0.80m (3/4hr), from 6.75 to 7.00m (1hr), from 7.30m to 7.60m (1hr), from 8.20m to 8.50m (3/4hr), from 8.80m to 9.00m (1hr).

See key sheet and appendices for explanations.

Form 1/0

Borehole Record

Exploration Associates

Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Borehole 4(1 of 1)

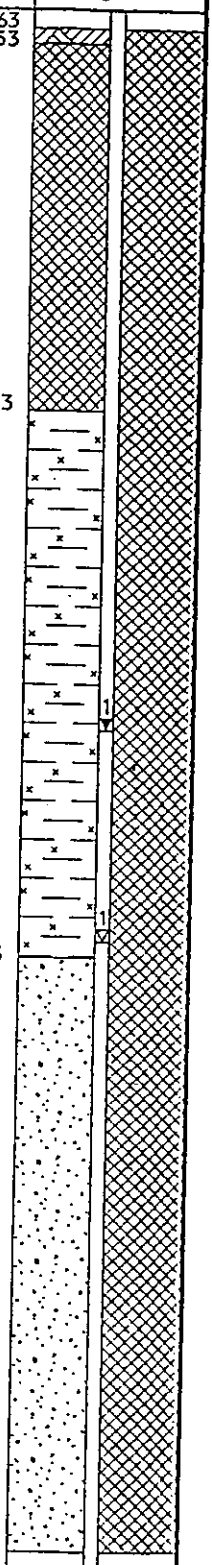
Sampling

Depth	Type	Casing Depth	Date/ Water	SPT N (Cu)
			13/06 1995	
0.25-0.75	B			
1.00-1.45	CB	1.0	DAMP	50/ 120
2.00-2.45	C	2.0	DAMP	22
		2.00	DAMP	
2.00			14/06 DAMP	
2.00-2.45	B			
2.50-2.95	B			
3.00-3.45	SD	2.80	DAMP	17
3.00-3.45	B			
4.00-4.45	U(40)	3.50	DRY	
4.50	D			
5.00-5.45	SD	4.0	DRY	11
5.00-5.45	B			
5.75-6.25	B			
6.00	W			
6.50-6.95	C	6.50	3.70	50/ 210
6.50-6.95	B			
		6.50	3.75	
6.50			15/06 2.80	
7.25-7.75	B			
8.00-8.45	CB	8.00	2.75	50/ 190
8.75-9.25	B			
9.50-9.95	CB	9.50	2.80	50/ 125
		10.00	2.75	
10.00				

Strata

Description	Depth (Thickness)	Level
Grass: TOPSOIL.**	G.L. 0.10	198.63 198.53
MADE GROUND: Very dense brown silty sandy very clayey subangular fine to coarse gravel of sandstone with occasional cobbles.	(2.40)	
... medium dense at 2.00m.		
... with some peaty clay below 2.30m. ... slightly peaty between 2.50m and 3.00m.	2.50	196.13
Firm to stiff brown grey very silty slightly sandy CLAY.	(3.60)	
... with closely spaced <1mm thick silty sandy laminae below 5.75m.	6.10	192.53
Very dense brown very sandy angular to subangular fine to coarse GRAVEL of sandstone with occasional cobbles.		
End of Borehole.	10.00	188.63

Legend



Equipment: Cable Tool Percussion

Borehole Dia (mm): 200 to 10.00m

Casing Dia (mm): 200 to 10.00m

Groundwater

No.	Struck	Behaviour	Sealed
1	6.00	Rose to 4.60m in 20 minutes.	

Ground Level 198.63 m OD

Drilled by FF
Logged by PCB
Checked by

Remarks

See key sheet and appendices for explanations.

Chiselling from 2.00m to 2.30m (1 3/4hrs), from 6.20m to 6.50m (1 1/4hrs), from 6.50m to 7.75m (4hrs), from 8.10m to 9.20m (2 1/2hrs), from 9.60m to 10.00m (1 1/2hrs), from 0.50m to 1.00m (1 1/2hrs), from 1.20m to 1.50m (1/2hr).
Water added in small amounts between 0.50m and 2.00m.
** Denotes drillers description.

Form 1/0

Borehole Record

Exploration Associates

Project

17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Borehole 5(1 of 1)

Sampling					Strata			
Depth	Type	Casing Depth	Date/ Water	SPT N (Cu)	Description	Depth (Thickness)	Level	Legend
			16/06 1995			G.L.	199.17	
0.25-0.75	B				Grass: TOPSOIL.**	0.10	199.07	
					MADE GROUND: Very dense to dense brown silty very sandy very clayey angular to subangular fine to coarse gravel of sandstone with some cobbles and occasional boulders.			
1.00-1.45	CB	1.0	DRY	50/ 120				
						(2.30)		
2.00-2.45	CB	2.0	DRY	34				
						2.40	196.77	
					MADE GROUND: Firm brown silty sandy clay with some angular to subangular fine to coarse gravel of sandstone and limestone with some cobbles.			
3.00-3.45	C	3.0	DRY	17				
		3.00	DRY			(1.20)		
3.00			19/06					
			DRY					
3.00-3.45	B							
						3.60	195.57	1
4.00-4.45	CB	4.0	3.70	29	Medium dense to very dense brown clayey sandy angular to subangular fine to coarse GRAVEL of sandstone and quartz conglomerate with occasional cobbles.			
4.30	W							1
5.00-5.45	CB	5.0	3.70	27				
						(3.65)		
5.75-6.25	B							
6.50-6.95	CB	6.50	4.80	50/ 195				
						7.25	191.92	
7.25-7.75	B				Dense to very dense brown.grey coarse SAND with much angular fine to coarse gravel of sandstone and quartz with occasional cobbles.			
8.00-8.45	CB	8.0	6.90	31				
8.50-8.95	C	8.50	6.20	50/ 120				
8.50-8.80	B	8.50	6.90					
8.50			20/06					
		8.80	5.70			8.80	190.37	
8.80					End of Borehole.			

Equipment: Cable Tool Percussion

Borehole Dia (mm): 200 to 8.80m

Casing Dia (mm): 200 to 8.80m

Groundwater

No.	Struck	Behaviour	Sealed
1	4.30	Rose to 3.70m in 20 minutes	

Ground Level 199.17 m OD

Drilled by NF
Logged by PCB
Checked by

Remarks

Chiselling from 1.20m to 1.50m (1 1/2hrs), from 1.80m to 2.00m (3/4hr), from 3.60m to 3.80m (1hr), from 4.50m to 4.70m (1hr), from 6.60m to 7.00m (1 3/4hrs), from 8.50m to 8.80m (2hrs).
Water added from 0.40m to 3.00m.
** Denotes drillers description.

See key sheet and appendices for explanations.

Form 1/0

Borehole Record

Exploration Associates

Project

17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Borehole 6(1 of 1)

Sampling

Depth	Type	Casing Depth	Date/ Water	SPT N (Cu)
			21/06 1995	
0.25-0.75	B			
		0.70	DRY	
0.70			22/06	
			DRY	
1.00-1.45	CB	1.0	DRY	39
		1.00	DRY	
1.40				

Strata

Description	Depth (Thickness)	Level
	G.L.	199.51
Grass: TOPSOIL.**	0.10	199.41
**MADE GROUND: Dense brown silty sandy clayey angular to subangular fine to coarse gravel of sandstone and quartz conglomerate with some cobbles and boulders.		
	1.40	198.11
End of Borehole.		

Legend

Equipment: Cable Tool Percussion

Borehole Dia (mm): 200 to 1.40m

Casing Dia (mm): 200 to 1.00m

Groundwater

No. Struck: Not Encountered

Behaviour: Sealed

Ground Level: 199.51 m OD

Drilled by: NF
Logged by: PCB
Checked by:

Remarks

Digging out boulders from 0.10m to 0.50m (1 1/2hrs). Chiselling 0.30m to 0.70m (2hrs), from 0.70m to 1.40m (3hrs). Borehole abandoned at 1.40m due to boulder obstruction.
** Denotes drillers description.

See key sheet and appendices for explanations.

Form 1/0

Borehole Record

Exploration Associates

Project

17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Borehole 7(1 of 1)

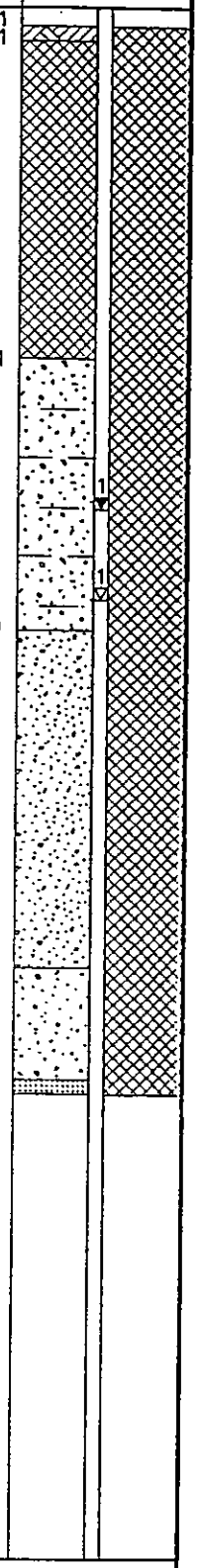
Sampling

Depth	Type	Casing Depth	Date/ Water	SPT N (Cu)
			22/06 1995	
0.25-0.75	B			
1.00-1.25	CB	1.0	DRY	47
1.90	D			
2.00-2.45	CB	2.0	DRY	25
		2.40	DRY	
2.40			23/06 DAMP	
3.00-3.45	CB	3.0	DRY	50/ 90
3.80	W			
4.00-4.45	CB	4.0		50/ 195
5.00-5.45	CB	5.0		23
5.75-6.25	B			
6.50-6.95	CB	6.0		49
7.00-7.45	C	7.0		50/ 30
7.10	D	7.00		
7.10				

Strata

Description	Depth (Thickness)	Level
	G.L.	199.51
Grass: TOPSOIL.**	0.10	199.41
**MADE GROUND: Dense brown silty clayey sand with much angular to subangular fine to coarse gravel of sandstone with some cobbles.	(2.10)	
Very dense brown clayey sandy subangular fine to coarse GRAVEL of sandstone.	2.20	197.31
	(1.80)	
Very dense becoming medium dense brown coarse SAND with some subangular to subrounded fine to coarse gravel of sandstone and mudstone with occasional cobbles.	4.00	195.51
	(2.25)	
Dense brown very sandy angular to subrounded fine to coarse GRAVEL of sandstone and mudstone with occasional cobbles.	6.25	193.26
	(0.75)	
SANDSTONE.**	7.00	192.51
End of Borehole.	7.10	192.41

Legend



Equipment: Cable Tool Percussion

Borehole Dia (mm): 200 to 7.10m

Casing Dia (mm): 200 to 7.00m

Groundwater

No.	Struck	Behaviour	Sealed
1	3.80	Rose to 3.20m in 20 minutes	

Ground Level 199.51 m OD

Drilled by NF
Logged by PCB
Checked by

Remarks

Chiselling from 1.20m to 1.40m (1hr), from 1.60m to 1.80m (1 3/4hrs), from 2.20m to 2.50m (1hr), from 2.70m to 3.00m (1 1/2hrs), from 3.40m to 3.70m (1 1/2hrs), from 7.0m to 7.10m(1hr).
** Denotes drillers description.

See key sheet and appendices for explanations.

Form 1/0

Borehole Record

Exploration Associates

Project

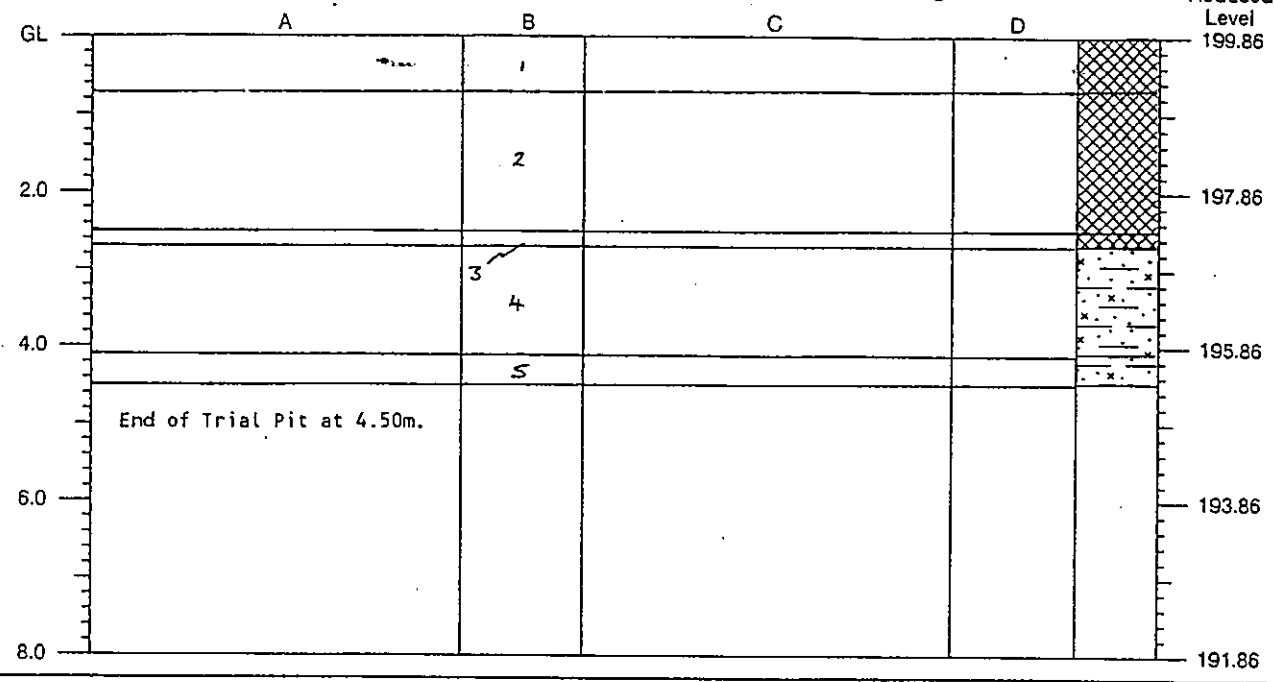
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Borehole 7A(1 of 1)

Dimensions : 1.5 x 3.0

Orientation : E



Strata

Depth (m)	No.	Description
0.00-0.70	1	MADE GROUND: Very compact orange brown clayey sandy subangular to subrounded fine to coarse gravel of sandstone with some cobbles and occasional boulders.
0.70-2.50	2	MADE GROUND: Firm grey brown silty sandy clay with much subangular to subrounded fine to coarse gravel of sandstone with some cobbles and boulders.
2.50-2.70	3	MADE GROUND: Very loose black silty clayey sand of colliery ash with much fibrous partly decomposing plant matter.
2.70-4.10	4	Soft orange brown silty slightly sandy CLAY (Alluvium).
4.10-4.50	5	Soft grey silty sandy CLAY with occasional woody relicts.

Samples and Tests

Depth (m)	Type	Results
2.60	D	
3.00	D	

Date of Excavation 20/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Not Encountered

Ground Level 199.86 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

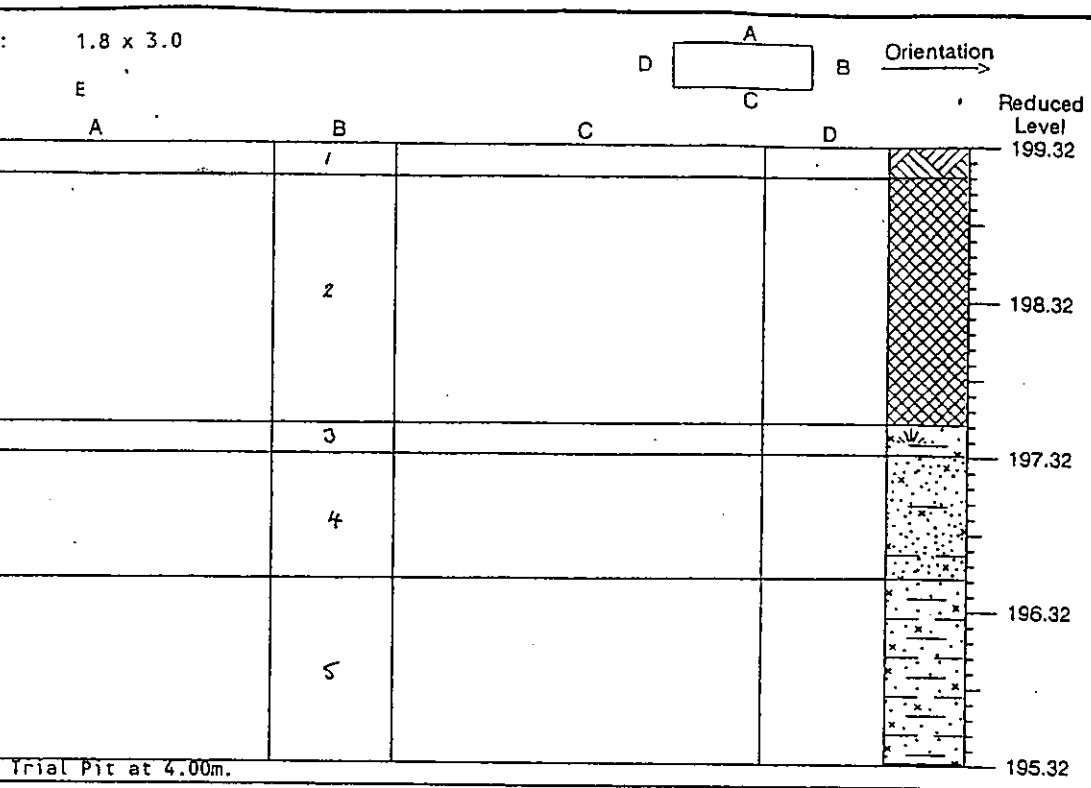
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit 1

Dimensions : 1.8 x 3.0

Orientation : E



Strata

Depth (m)	No.	Description
0.00-0.20	1	Soft brown silty sandy clayey TOPSOIL with many rootlets.
0.20-1.80	2	MADE GROUND: Very compact orange brown sandy clayey angular to subrounded fine to coarse gravel of sandstone with some cobbles and occasional boulders. (Reworked Sand and Gravels).
1.80-2.00	3	Soft brown silty sandy CLAY with much fibrous decomposing plant matter and a tree trunk. (Buried original grassed surface).
2.00-2.80	4	Very loose white clayey silty fine to medium SAND with a little subangular fine gravel of quartz and occasional cobbles of quartz. .... becoming orange brown below 2.50m.
2.80-4.00	5	Stiff grey silty slightly sandy CLAY with a little subangular fine to coarse gravel. (Glacial Boulder Clay).

Samples and Tests

Depth (m)	Type	Results
1.00	D	
2.50	B	
3.50	D	

Date of Excavation 20/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Not Encountered

Ground Level 199.32 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

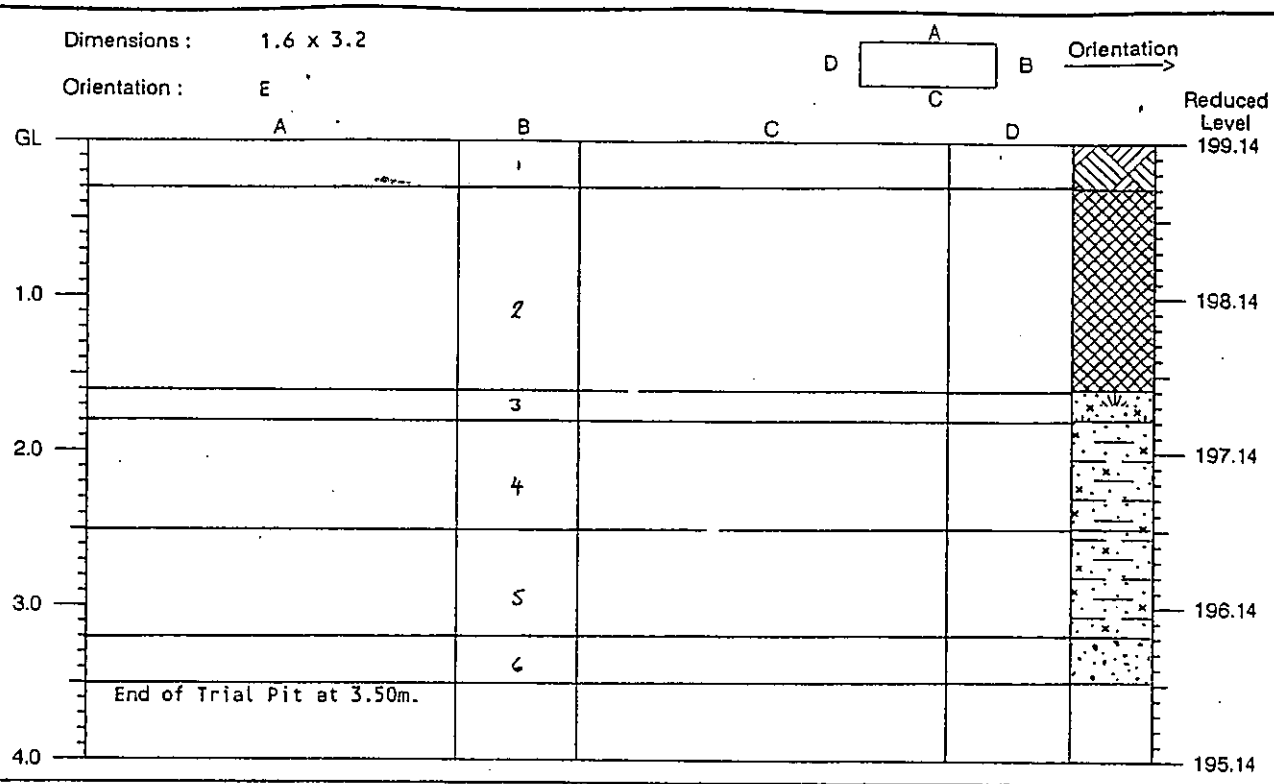
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit 2

Dimensions : 1.6 x 3.2

Orientation : E



Strata

Depth (m)	No.	Description
0.00-0.30	1	Soft brown silty sandy clayey TOPSOIL with some rootlets.
0.30-1.60	2	MADE GROUND: Very compact orange brown silty sandy clayey angular to sub-rounded fine to coarse gravel of sandstone with some stiff brown silty sandy gravelly clay and some cobbles and boulders. (Reworked Sand and Gravels and Glacial Boulder Clay).
1.60-1.80	3	Soft dark brown silty sandy clayey fibrous PEAT. (Buried grassy surface).
1.80-2.50	4	Soft light grey mottled orange silty very sandy CLAY with occasional sub-rounded fine to coarse gravel of sandstone. (Glacial Deposit).
2.50-3.20	5	Stiff grey silty sandy CLAY with some sub-angular to sub-rounded fine to coarse gravel of sandstone. (Boulder Clay).
3.20-3.50	6	Very compact brown clayey sandy angular to sub-angular fine to coarse GRAVEL of sandstone.

Samples and Tests

Depth (m)	Type	Results
2.00	D	
3.50	B	

Date of Excavation 20/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Slight seepage at 3.20m

Ground Level 199.14 m OD

Logged by PCB
Checked by

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

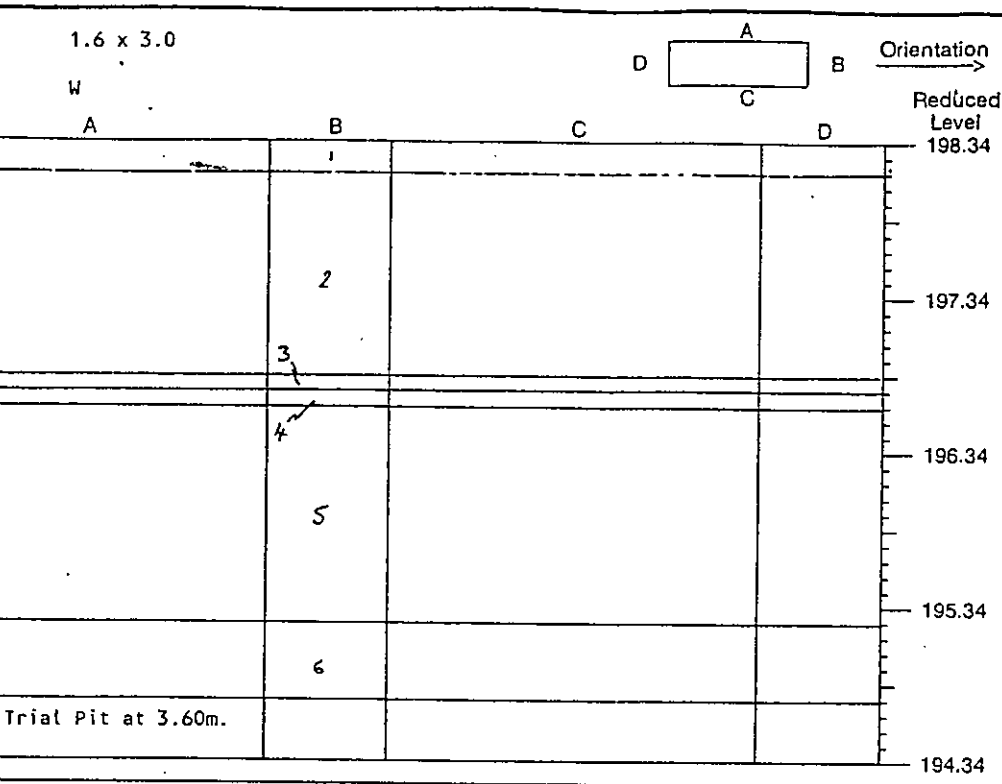
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit 3

Dimensions : 1.6 x 3.0

Orientation : W



Strata

Depth (m)	No.	Description
0.00-0.20	1	Soft brown silty sandy gravelly clayey TOPSOIL with many rootlets.
0.20-1.50	2	MADE GROUND: Very compact light brown silty very sandy angular to sub-rounded fine to coarse gravel of sandstone and limestone with some brown stiff silty sandy gravelly clay and some cobbles and occasional boulders. (Reworked sand and Gravels and Boulder Clay).
1.50-1.60	3	Soft to firm dark brown clayey silty fine to medium SAND with much partly decomposed fibrous plant and grass matter. (Buried grassy surface).
1.60-1.70	4	Soft light brown grey silty sandy CLAY. (Alluvium).
1.40-3.10	5	Firm orange mottled blue silty sandy CLAY becoming dark grey with depth.
3.10-3.60	6	Firm grey clayey slightly sandy SILT with a little sub-angular to sub-rounded fine to coarse gravel of sandstone.

Samples and Tests

Depth (m)	Type	Results
1.55	D	
2.50	B	
3.50	D	

Date of Excavation 20/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Groundwater not encountered

Ground Level 198.34 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

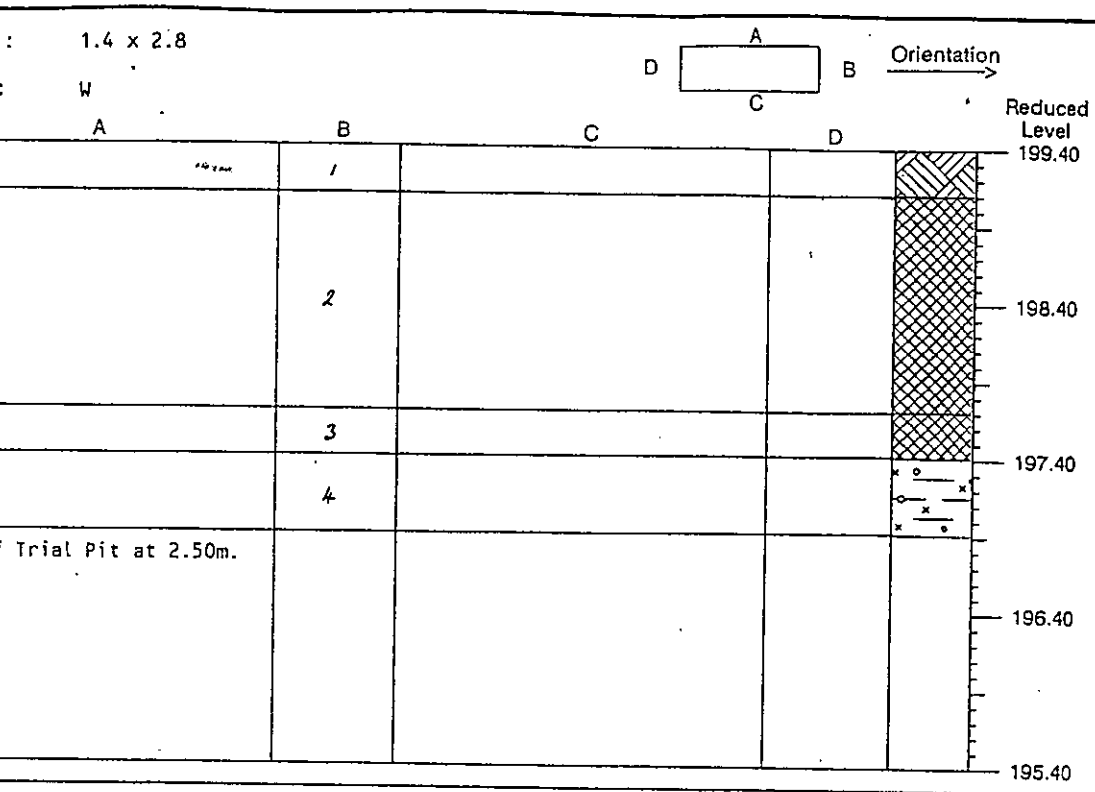
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit 4

Dimensions : 1.4 x 2.8

Orientation : W



Strata

Depth (m)	No.	Description
0.00-0.30	1	Soft dark brown silty slightly sandy clayey TOPSOIL with many rootlets.
0.30-1.70	2	MADE GROUND: Very compact brown silty sandy clay with much subangular to subrounded fine to coarse gravel of sandstone and limestone with some cobbles and occasional boulders.
1.70-2.00	3	MADE GROUND: Very compact dark brown silty clay with some subangular to subrounded cobbles of sandstone.
2.00-2.50	4	Firm grey mottled brown silty CLAY with some subangular to subrounded cobbles of sandstone.

Samples and Tests

Depth (m)	Type	Results
1.00	B	
2.00	D	

Date of Excavation 21/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Not Encountered

Ground Level 199.40 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

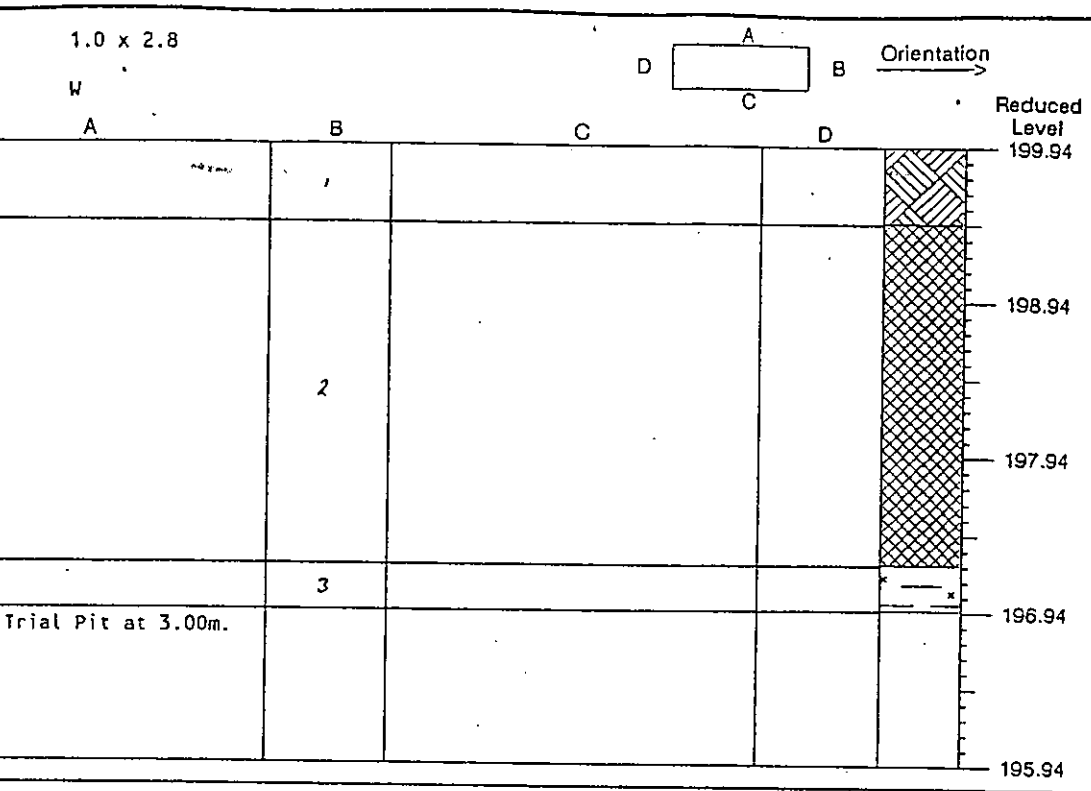
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit 5

Dimensions : 1.0 x 2.8

Orientation : W



Strata

Depth (m)	No.	Description
0.00-0.50	1	Soft dark brown silty sandy gravelly clayey TOPSOIL with many rootlets.
0.50-2.70	2	MADE GROUND: Very compact orange brown silty sandy very clayey angular to subangular fine to coarse gravel of sandstone and limestone with some cobbles and occasional boulders.
2.70-3.00	3	Stiff grey mottled orange brown silty slightly sandy CLAY with a little subangular to subrounded coarse gravel.

Samples and Tests

Depth (m)	Type	Results
1.00	B	
2.80	D	

Date of Excavation 21/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Not Encountered

Ground Level 199.94 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

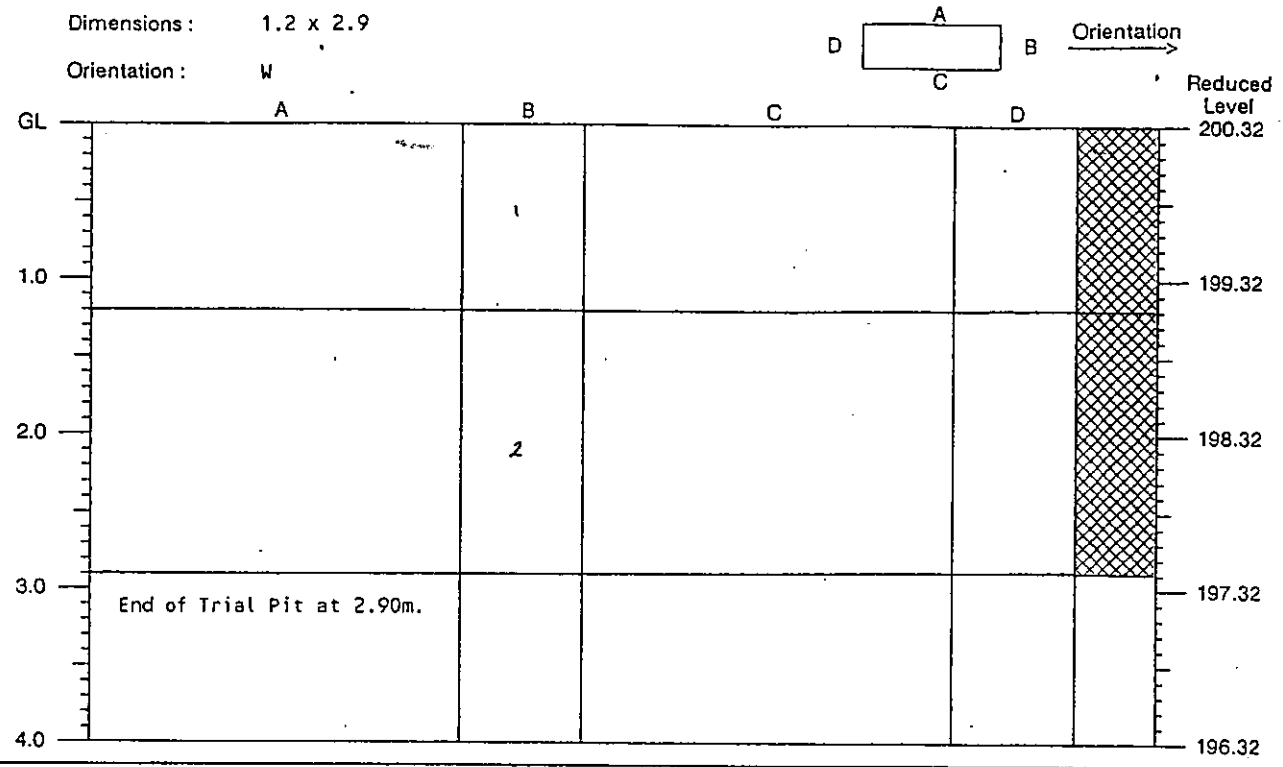
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit 6

Dimensions : 1.2 x 2.9

Orientation : W



Strata

Depth (m)	No.	Description
0.00-1.20	1	MADE GROUND: Very compact brown silty sandy very clayey angular to subangular fine to coarse gravel of limestone and sandstone with some cobbles and occasional boulders.
1.20-2.90	2	MADE GROUND: Very compact orange brown silty sandy clay with much subangular fine to coarse gravel of limestone and sandstone with some cobbles and occasional boulders.

Samples and Tests

Depth (m)	Type	Results

Date of Excavation 21/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Not Encountered

Ground Level 200.32 m OD

Logged by PCB
Checked by

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

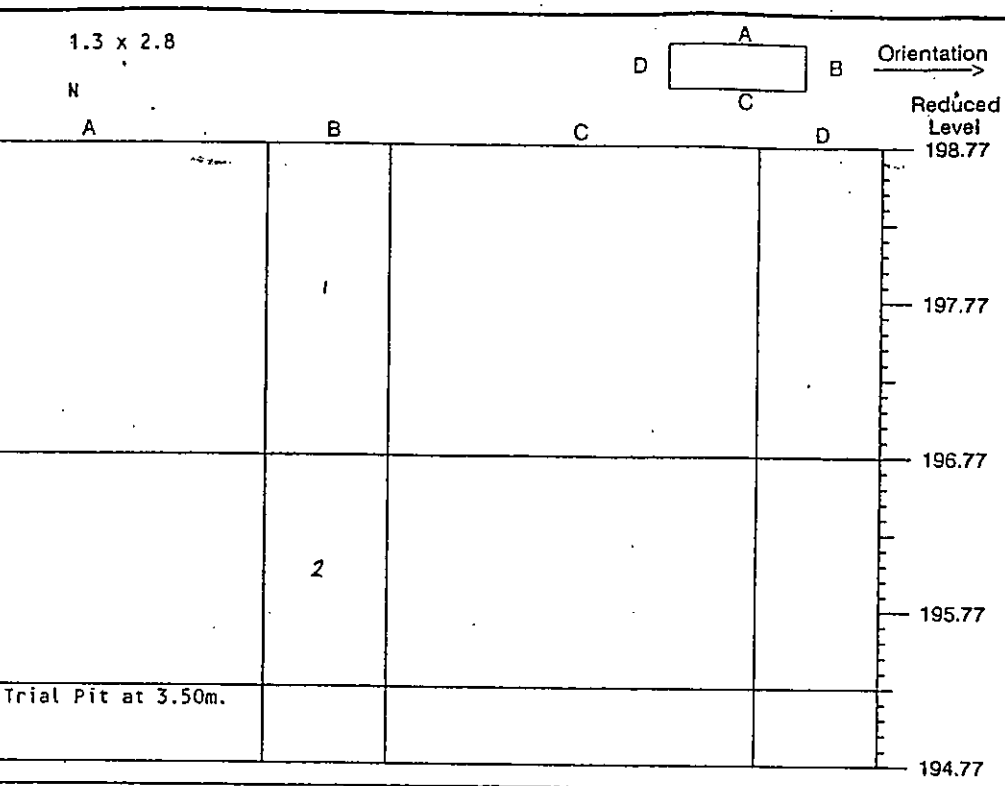
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit 7

Dimensions : 1.3 x 2.8

Orientation : N



Strata

Depth (m)	No.	Description
0.00-2.00	1	MADE GROUND: Very compact brown silty very sandy angular to sub-rounded fine to coarse gravel of sandstone and limestone with some brown stiff sandy gravelly clay. (Reworked Glacial Sand and Gravel and Boulder Clay).
2.00-3.50	2	Soft to firm grey silty sandy CLAY with a little sub-angular fine to coarse gravel and occasional cobbles of sandstone and limestone. (Glacial Boulder Clay). .... becoming firm to stiff below 3.00m.

Samples and Tests

Depth (m)	Type	Results
1.00	B	
2.80	D	

Date of Excavation 20/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Groundwater not encountered

Ground Level 198.77 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

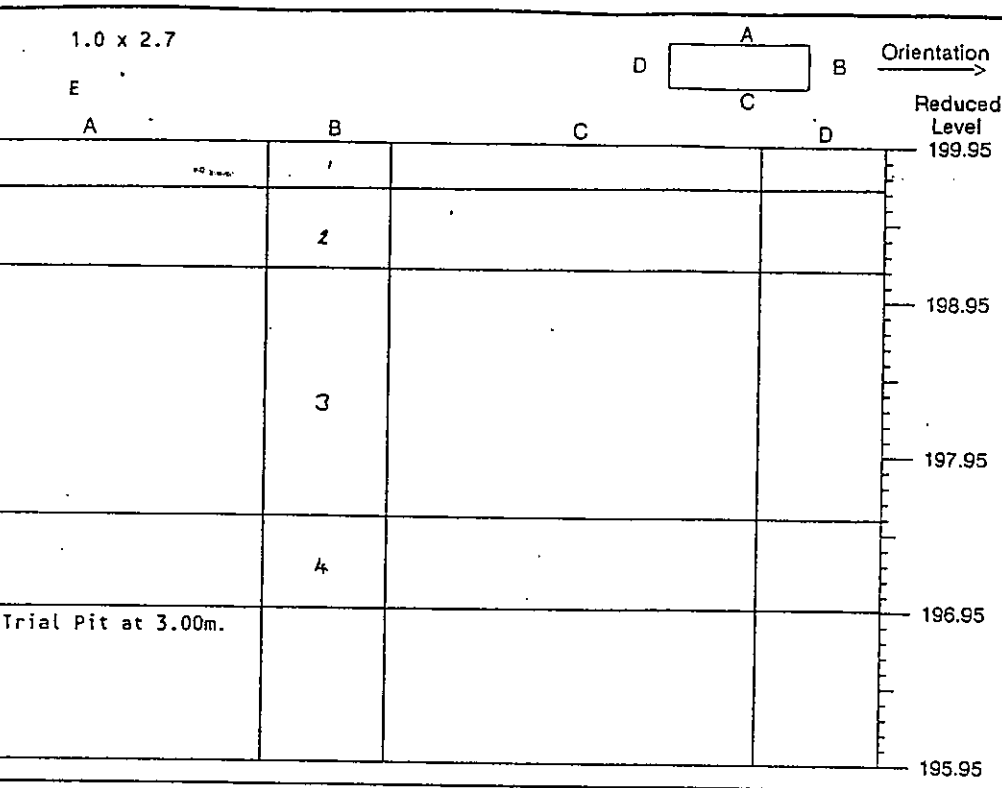
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit A

Dimensions : 1.0 x 2.7

Orientation : E



Strata

Depth (m)	No.	Description
0.00-0.30	1	Soft brown silty gravelly clayey TOPSOIL with many rootlets.
0.30-0.80	2	MADE GROUND: Soft black silty sandy clay with some partly decomposed root materials.
0.80-2.40	3	MADE GROUND: Firm grey brown silty slightly sandy clay with some angular to sub-rounded fine to coarse gravel of sandstone and with some cobbles and occasional boulders.
2.40-3.00	4	Compact brown sandy clayey angular to sub-rounded fine to coarse GRAVEL of sandstone with some cobbles and boulders.

Samples and Tests

Depth (m)	Type	Results
2.00	D	
2.50	B	

Date of Excavation 21/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Inflow at 2.10m

Ground Level 199.95 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

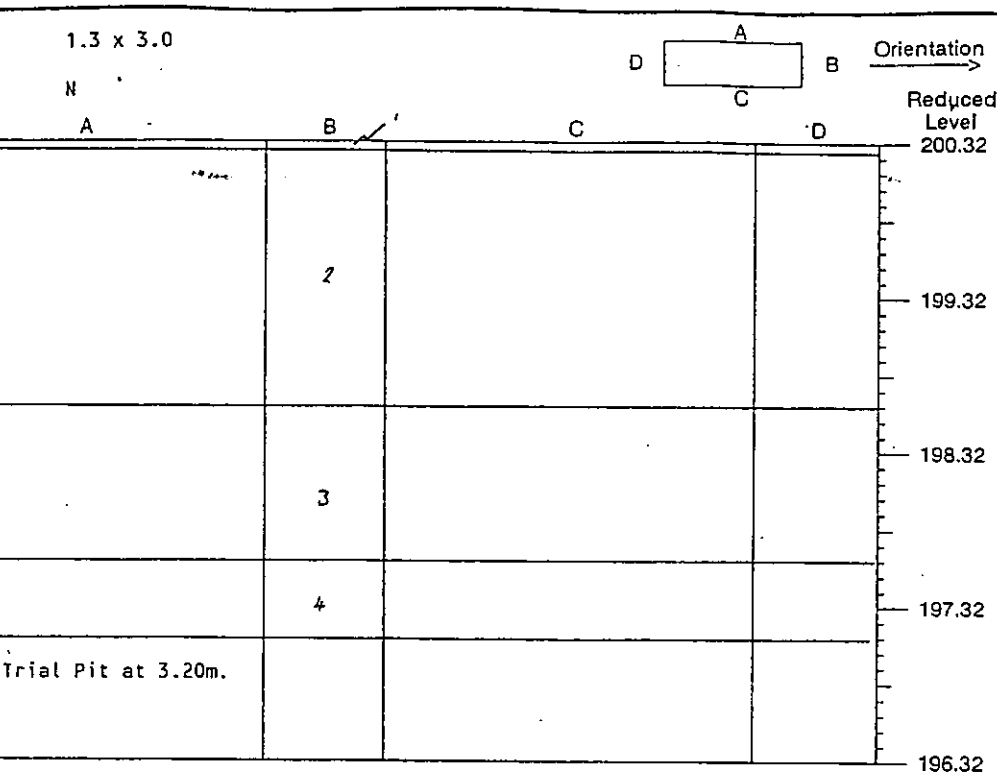
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit B

Dimensions : 1.3 x 3.0

Orientation : N



Strata

Depth (m)	No.	Description
0.00-0.05	1	Loose brown silty sandy clayey gravelly TOPSOIL with many rootlets.
0.05-1.70	2	MADE GROUND: Very compact brown silty clayey sandy angular to sub-rounded fine to coarse gravel of sandstone with some cobbles and boulders.
1.70-2.70	3	MADE GROUND: Brown silty sandy sub-angular fine to coarse GRAVEL with many cobbles and some boulders bound by stiff brown sandy gravelly clay.
2.70-3.20	4	MADE GROUND: Firm dark grey silty sandy clay with some angular to sub-angular fine to coarse gravel of sandstone with large boulders of quartz conglomerate at 2.70m and a wooden sleeper across pit at 3.20m.

Samples and Tests

Depth (m)	Type	Results
1.00	B	
2.80	B	

Date of Excavation 20/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Groundwater not encountered

Ground Level 200.32 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

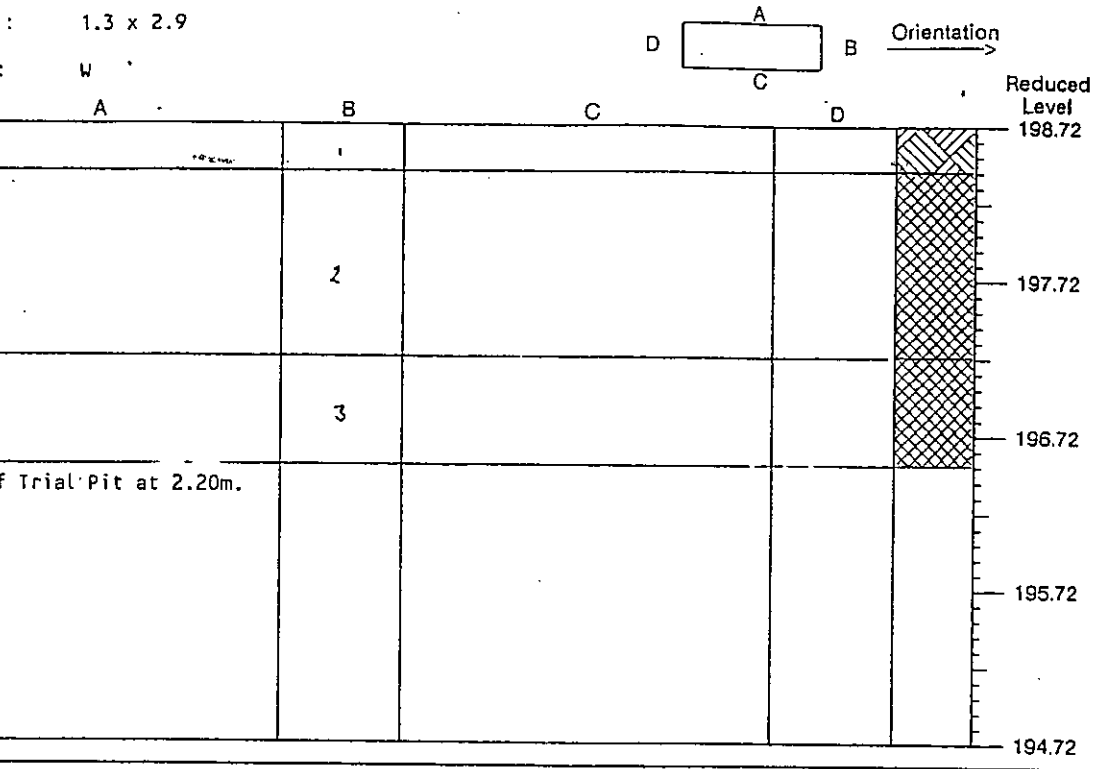
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit C

Dimensions : 1.3 x 2.9

Orientation : W



Strata

Depth (m)	No.	Description
0.00-0.30	1	Soft to firm brown silty sandy gravelly clayey TOPSOIL with many rootlets.
0.30-1.50	2	MADE GROUND: Firm orange brown silty sandy clay with some subangular fine to coarse gravel of sandstone and limestone with some cobbles.
1.50-2.20	3	MADE GROUND: Firm dark brown silty sandy clay with some angular to subangular fine to coarse gravel of limestone and sandstone with occasional cobbles.

Samples and Tests

Depth (m)	Type	Results
1.00-1.50	B	

Date of Excavation 21/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Not Encountered

Ground Level 198.72 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2/0

Trial Pit Record

Exploration Associates

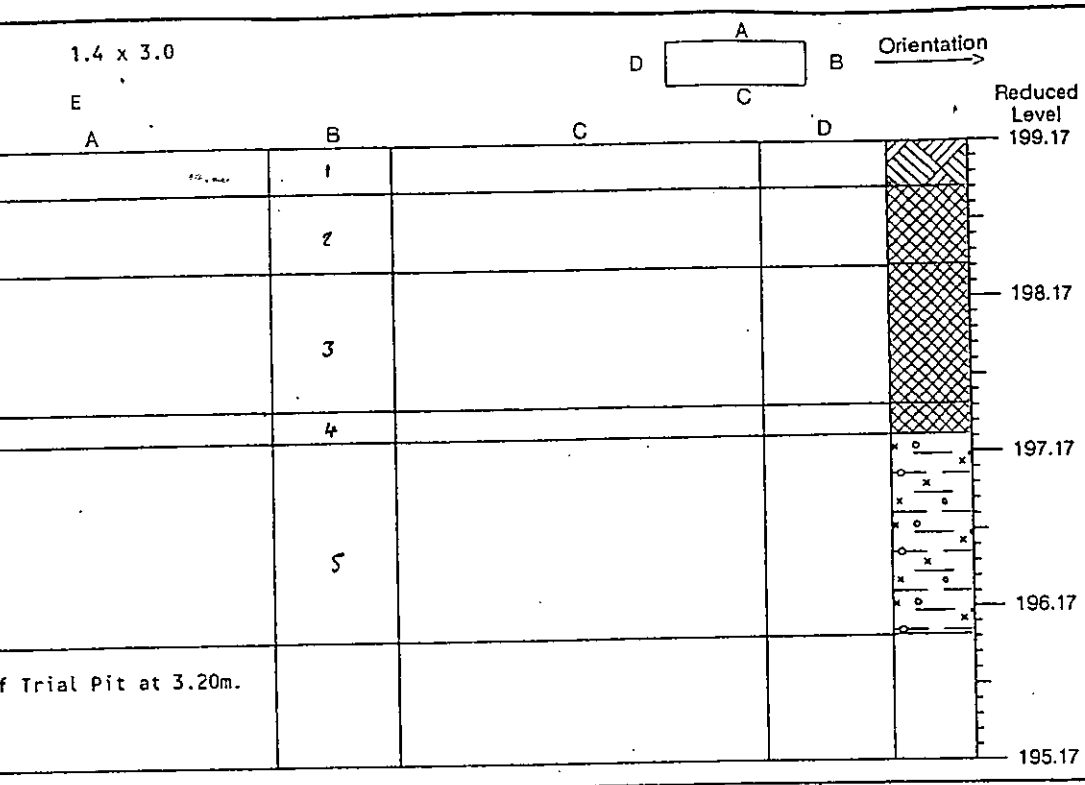
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit E

Dimensions : 1.4 x 3.0

Orientation : E



Strata

Depth (m)	No.	Description
0.00-0.30	1	Soft to firm brown silty sandy gravelly clayey TOPSOIL with many rootlets.
0.30-0.80	2	MADE GROUND: Very compact orange brown slightly sandy silty very clayey angular to subrounded fine to coarse gravel of sandstone and limestone with some cobbles.
0.80-1.70	3	MADE GROUND: Very compact brown slightly sandy silty very clayey angular to subrounded fine to coarse gravel of limestone and sandstone with some cobbles and two plastic oil drums.
1.70-1.90	4	MADE GROUND: Soft black silty clayey fine sand of colliery ash with much partly decomposed plant material.
1.90-3.20	5	Soft brown grey silty CLAY with some subangular to subrounded cobbles and boulders of sandstone.

Samples and Tests

Depth (m)	Type	Results
2.00	B	

Date of Excavation 21/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Not Encountered

Ground Level 199.17 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2/

Trial Pit Record

Exploration Associates

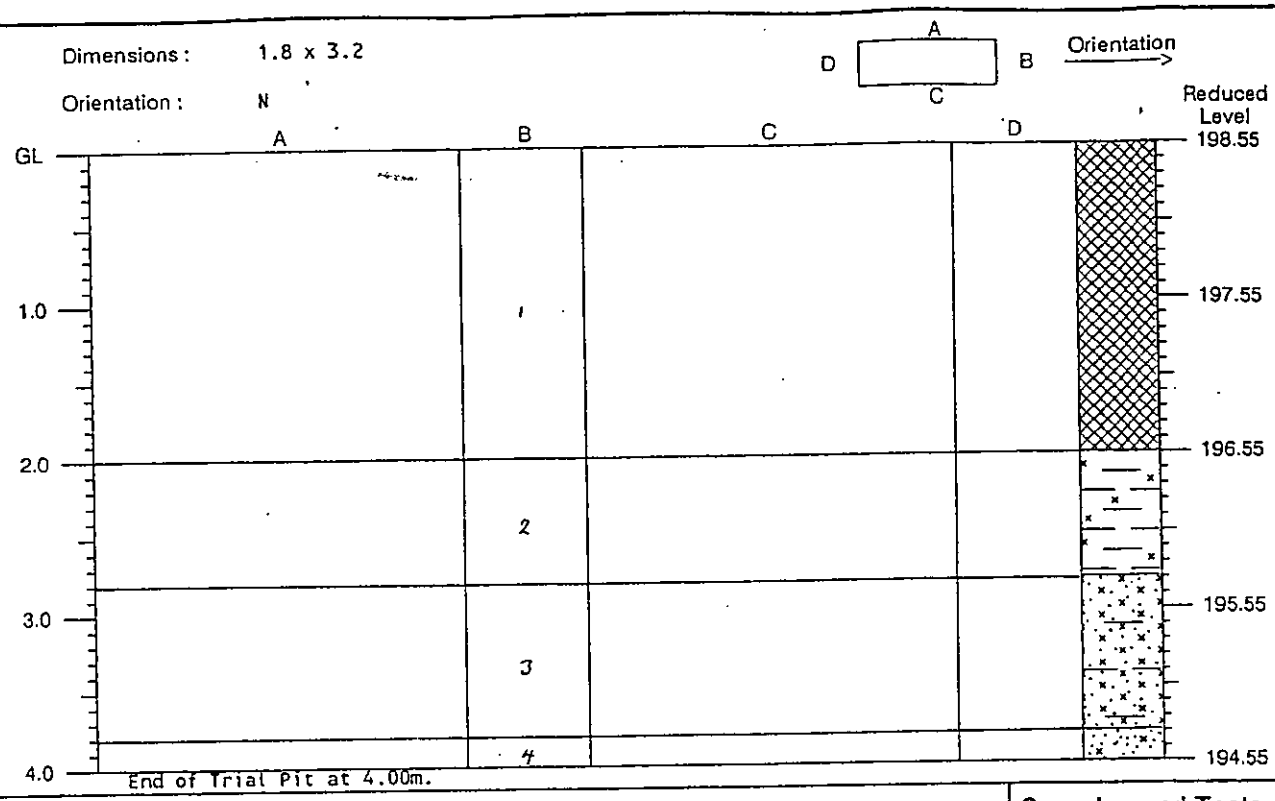
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit F

Dimensions : 1.8 x 3.2

Orientation : N



Strata

Depth (m)	No.	Description
0.00-2.00	1	MADE GROUND: Very compact brown silty clayey sandy angular to subrounded fine to coarse gravel of sandstone with some cobbles and occasional boulders and some stiff grey brown silty sandy gravelly clay. (Reworked Sand and Gravels and Boulder Clay).
2.00-2.80	2	Soft orange brown silty CLAY with rare subangular medium to coarse gravel of sandstone.
2.80-3.80	3	Firm grey clayey sandy fine SILT.
3.80-4.00	4	Moderately compact grey clayey silty medium to coarse SAND with a little angular fine to coarse gravel of sandstone.

Samples and Tests

Depth (m)	Type	Results
1.50	B	
2.50	D	
3.80	D	

Date of Excavation 20/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Not Encountered

Ground Level 198.55 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form 2

Trial Pit Record

Exploration Associates

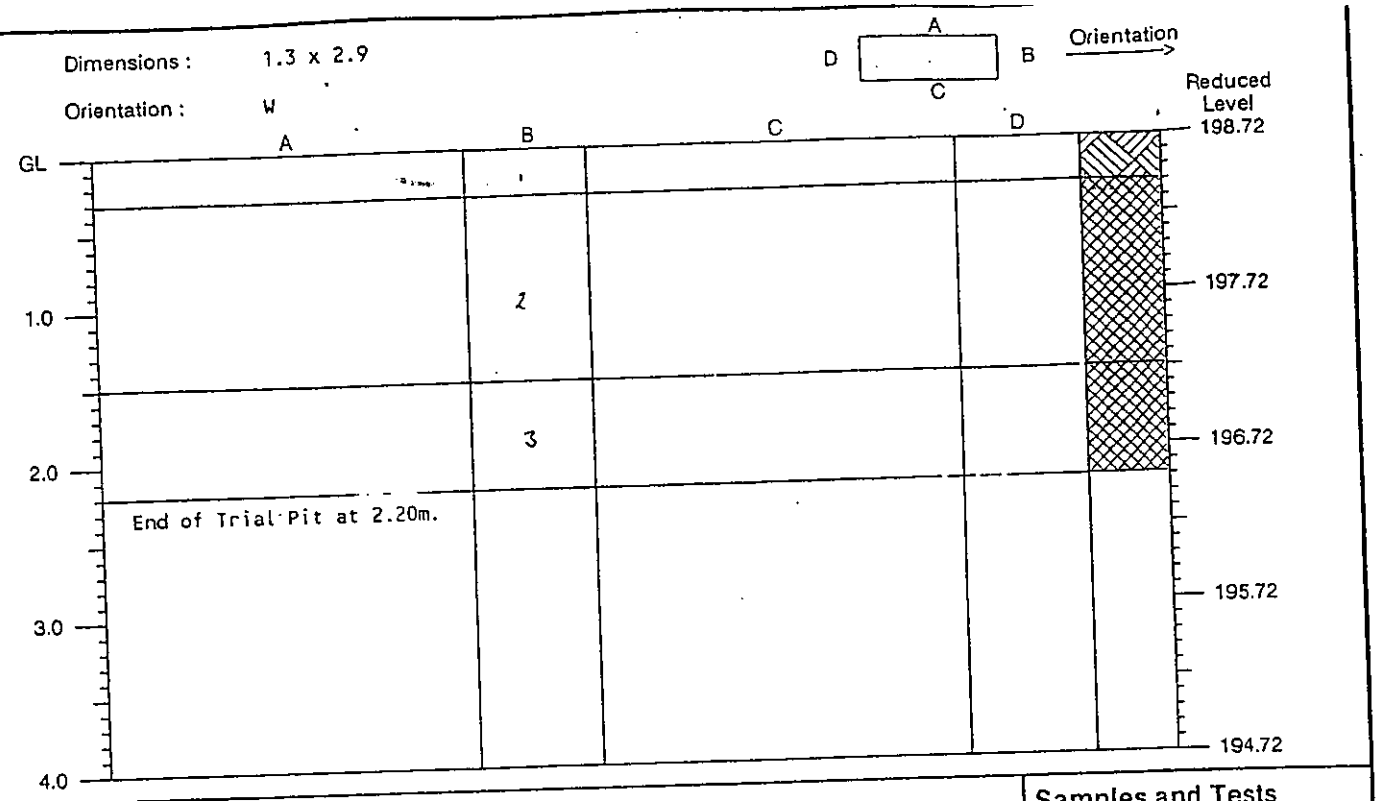
Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit D

Dimensions : 1.3 x 2.9

Orientation : W



Strata

Depth (m)	No.	Description
0.00-0.30	1	Soft to firm brown silty sandy gravelly clayey TOPSOIL with many rootlets.
0.30-1.50	2	MADE GROUND: Firm orange brown silty sandy clay with some subangular fine to coarse gravel of sandstone and limestone with some cobbles.
1.50-2.20	3	MADE GROUND: Firm dark brown silty sandy clay with some angular to subangular fine to coarse gravel of limestone and sandstone with occasional cobbles.

Samples and Tests

Depth (m)	Type	Results
1.00-1.50	B	

Date of Excavation 21/06/95
Equipment JCB 3CX
Stability Stable

Groundwater
No. Struck Behaviour
Not Encountered

Ground Level 198.72 m OD

Logged by PCB
Checked by PRB

Remarks

See key sheet and appendices for explanations.

Form

Trial Pit Record

Exploration Associates

Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Trial Pit E

ENCLOSURE B

Laboratory Test Results

KEY TO SYMBOLS ON LABORATORY TEST RESULTS SHEETS

U	Undisturbed Sample
P	Piston Sample
B	Bulk Sample - Disturbed
D	Jar Sample - Disturbed
W	Water Sample
pH	Acidity/Alkalinity Index
SO_3	Total Sulphate Content (acid) - Soluble Sulphate
++	Soluble Sulphate Content (2:1 Water/Soil extract)
I_p	Plasticity Index
<u>%</u>	% of material in sample passing 425 micron sieve
w_L	Liquid Limit
w_p	Plastic Limit
w	Water Content
γ_b	Bulk Density
U	Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
T	Single Stage Triaxial
M	Multistage Triaxial
100/40	Sample Diameter (mm)
REM	Remoulded Triaxial Test Specimen
LVT	Laboratory Vane Test
DSB	Drained Shear Box
RSB	Residual Shear Box
σ_3	Cell Pressure
σ_1-σ_3	Deviator Stress
c	Cohesion
c'	Effective Cohesion Incercept
ϕ	Angle of Shearing Resistance - Degrees
ϕ'	Effective Angle of Shearing Resistance
m_v	Coefficient of Volume Decrease
c_v	Coefficient of Consolidation
γ_d	Dry Density
Opt	Optimum
Std	Standard Compaction
Hvy	Heavy Compaction
CBR	California Bearing Ratio
*	Failed under 1st Load
**	Failed under 2nd Load
#	Untestable
##	Excessive Strain
+	Calcareous Reaction
¶	CBR Remoulded with 2.5kg rammer
§	CBR Remoulded with 4.5kg rammer
•	CBR Undisturbed Sample
••	CBR Remoulded to 5% air voids at Natural Moisture Content
VT	Hand Vane Test
Cl	Chloride Content
S.G.	Particle Density
Sat m.c.	Saturation Moisture Content
p'o	Effective Overburden Pressure

LABORATORY SYMBOLS	**Project**	**Contract**
Exploration Associates	17 Acre Site, Hirwaun Welsh Development Agency	155102 **Figure**

Samples				Classification					Strength			Other Tests
Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γb_3 Mg/m	Test	σ_3 kPa	C kPa	
2A	2.80	W	GROUNDWATER									pH = 7.2 SO3 Total = 0.02%
7A	0.25	B	MADE GROUND:Brown silty sandy gravel with cobbles				9.0					pH = 7.5 SO3 Total = 0.03% Ps=2.68 Measured Particle Size Analysis
7A	1.90	D	MADE GROUND:Brown silty sandy gravel with cobbles	68% 14	WASHED 38	24	20					
7A	3.80	W	GROUNDWATER									pH = 7.2 SO3 Total = 0.02%
TP5	1.00	B	MADE GROUND:Brown silty gravelly sand									w% / Dry Density
TPC	1.00	B	MADE GROUND:Brown clayey gravel									w% / Dry Density
TPD	1.50	B	MADE GROUND:Brown silty sandy gravel									w% / Dry Density
1	0.25	B	MADE GROUND:Brown sandy gravelly clay									w% / Dry Density
1	2.00	B	Brown very silty sandy CLAY	95% 21	WASHED 46	25	18					pH = 4.5 SO3 Total = 0.05% Ps=2.58 Measured Particle Size Analysis
1	4.00	B	Brown clayey sandy GRAVEL with cobbles				11					Particle Size Analysis
2	0.25	B	MADE GROUND:Stiff brown silty sandy gravel with cobbles									w% / Dry Density
2	1.00	B	MADE GROUND:Stiff brown silty sandy clay with cobbles	75% 10	WASHED 31	21	20					Ps=2.69 Measured Particle Size Analysis

Remarks

Form 10/2

Laboratory - Results Summary

Exploration Associates

Project
17 Acre Site, Hirwaun
Welsh Devolopment Agency

Contract 155102

Sheet L1/1

Samples				Classification					Strength			Other Tests
Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γ_{b_3} Mg/m	Test	σ_3 kPa	C kPa	
2	3.60	D	Brown GRAVEL									Gs Untestable due to insufficint fines
3	3.00	B	MADE GROUND:Brown silty sandy gravel with cobbles									pH = 11.2 SO3 Total = 0.30% Particle Size Analysis
3	5.75	B	Brown silty sandy GRAVEL with cobbles									Particle Size Analysis
3	6.60	W	GROUNDWATER									pH = 8.1 SO3 Total = 0.03%
5	4.00 - 4.45	U	Brown very silty slightly sandy CLAY	95% 6	WASHED 23	17	16					Consolidation
6	8.50	B	Grey silty gravelly SAND									Particle Size Analysis

Remarks

Form 10/2

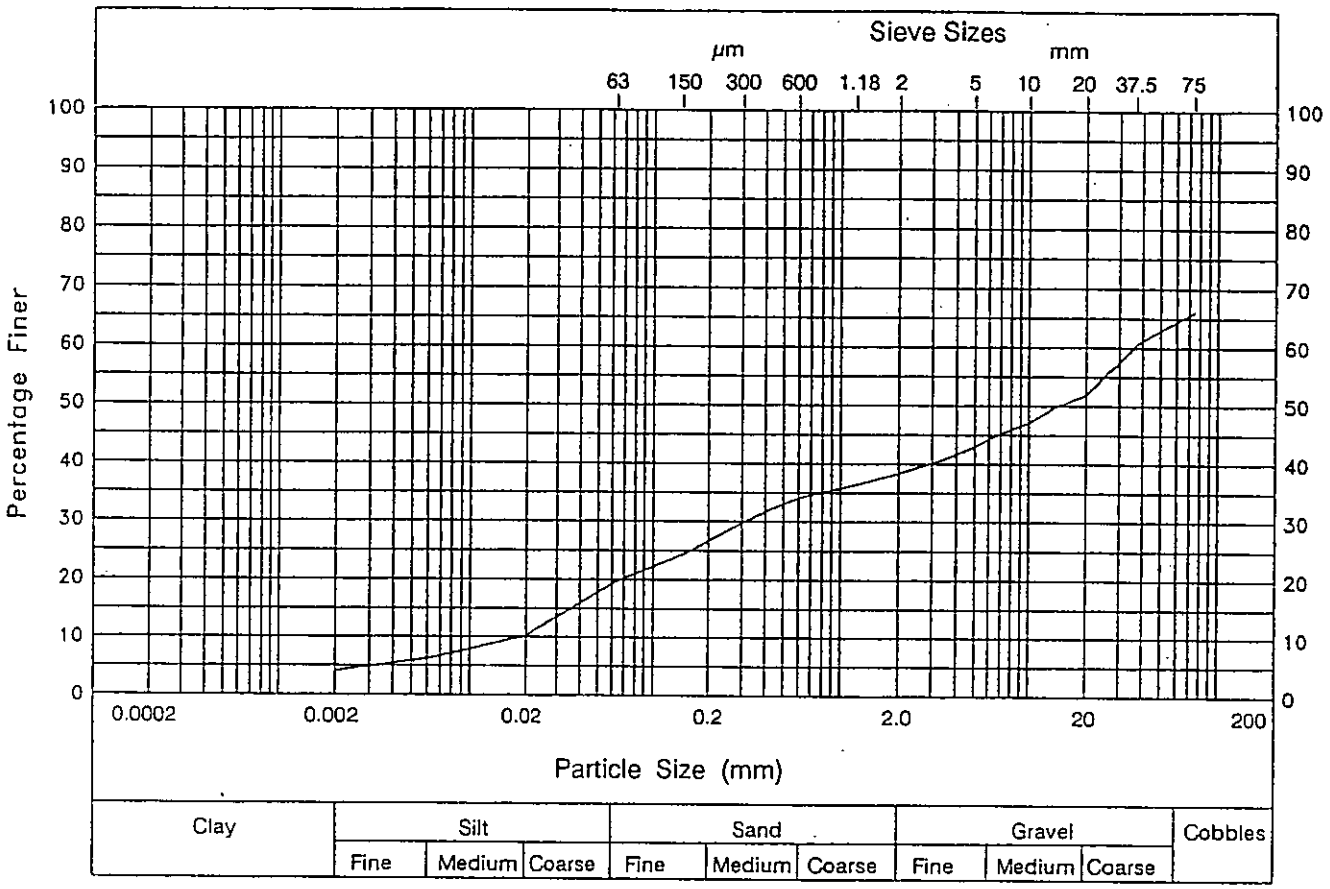
Laboratory - Results Summary

Exploration Associates

Project
17 Acre Site, Hirwaun
Welsh Devolopment Agency

Contract 155102

Sheet L1/2

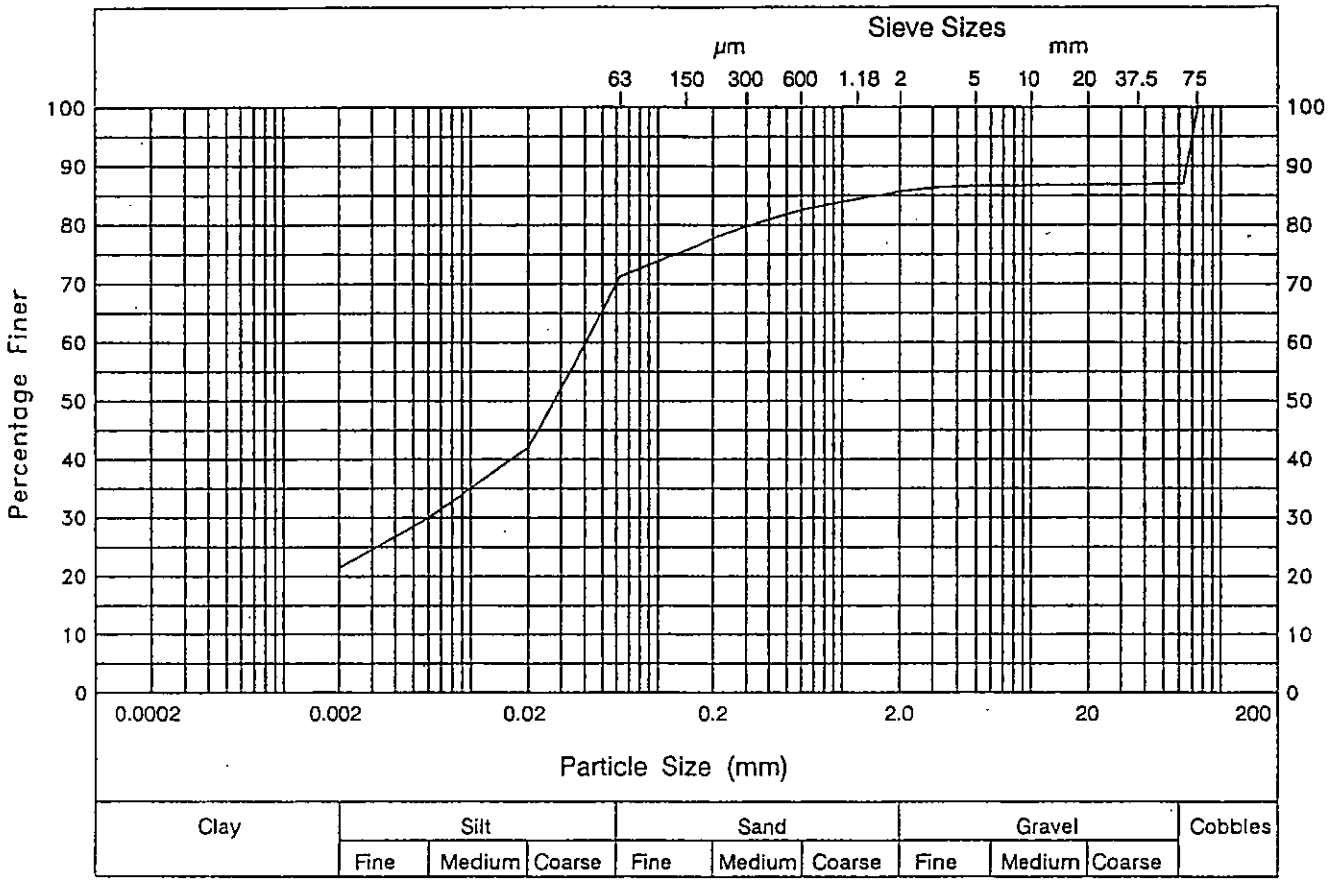


Particle Size	% Passing	Particle Size	% Passing
75 mm	66	1.18 mm	36
37.5 mm	61	600 µm	34
28 mm	57	425 µm	32
20 mm	52	300 µm	30
14 mm	50	212 µm	27
10 mm	47	150 µm	25
6.3 mm	45	63 µm	20
5 mm	43	20 µm	10
3.35 mm	41	6 µm	6
2 mm	38	2 µm	4

Hole 7A	**Sample Description** MADE GROUND:Brown silty sandy gravel with cobbles
Depth 0.25	
Type B	

Form 25/2

Laboratory - Particle Size Plot	**Project** 17 Acre Site,Hirwaun Welsh Devolopment Agency	**Contract** 155102
Exploration Associates		**Sheet** L2/1

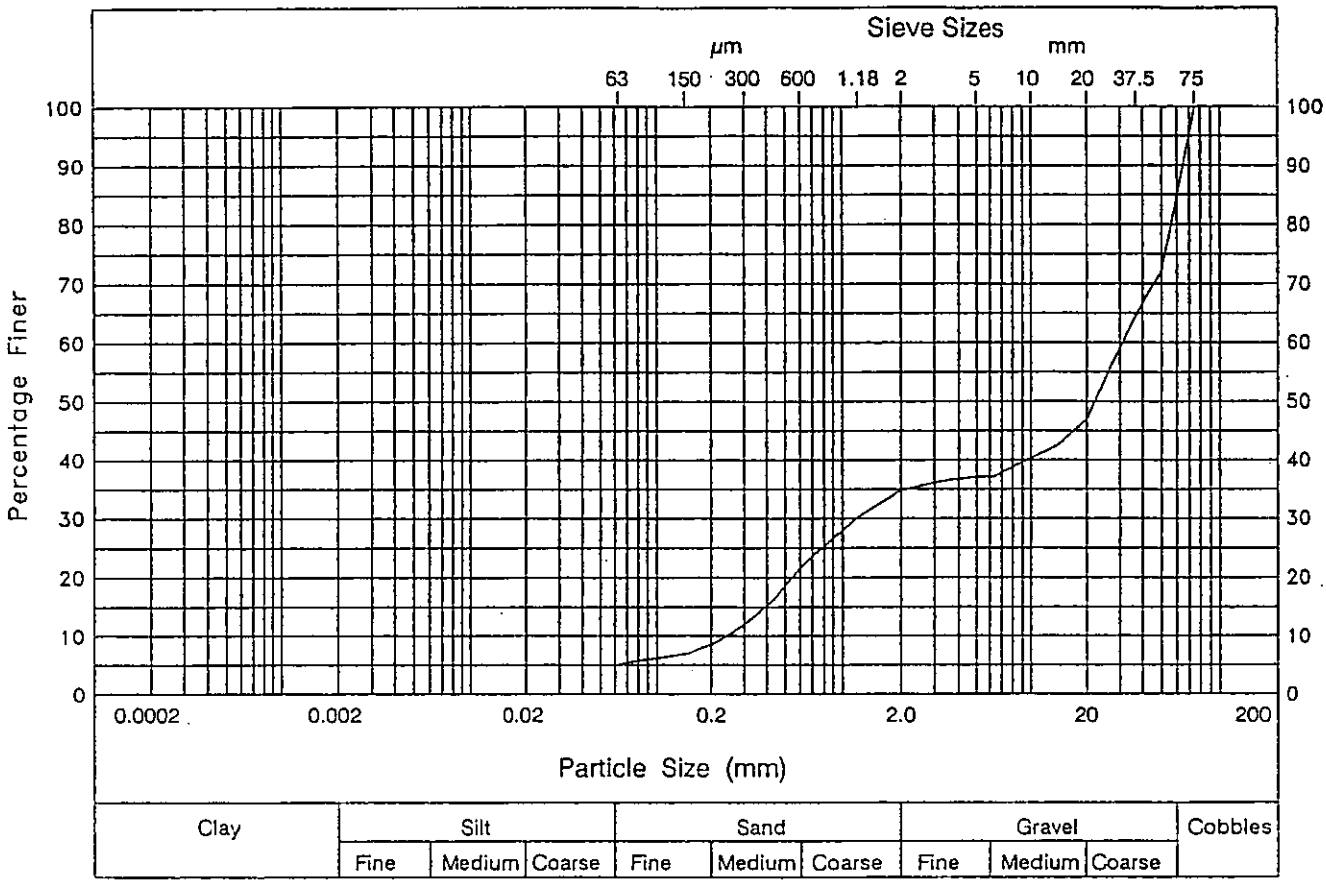


Particle Size	% Passing	Particle Size	% Passing
75 mm	100	425 µm	81
63 mm	87	300 µm	80
14 mm	87	212 µm	78
6.3 mm	87	150 µm	76
5 mm	87	63 µm	71
3.35 mm	86	20 µm	42
2 mm	86	6 µm	30
1.18 mm	84	2 µm	21
600 µm	83		

Hole 1	**Sample Description** Brown very silty sandy CLAY
Depth 2.00	
Type B	

Form 25/2

Laboratory - Particle Size Plot	**Project** 17 Acre Site, Hirwaun Welsh Devolopment Agency	**Contract** 155102
Exploration Associates		**Sheet** L2/2

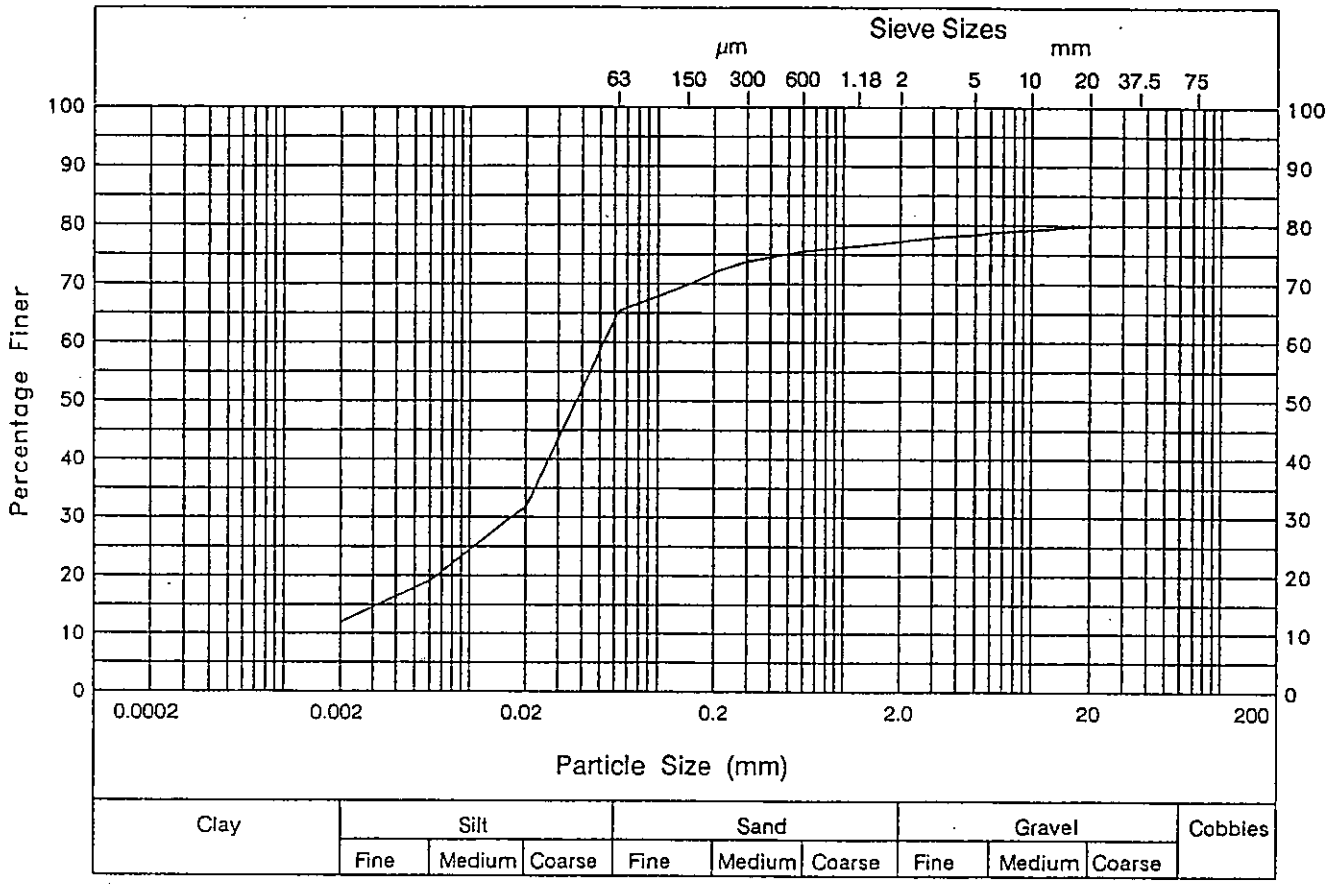


Particle Size	% Passing	Particle Size	% Passing
75 mm	100	3.35 mm	36
63 mm	88	2 mm	35
50 mm	72	1.18 mm	30
37.5 mm	65	600 µm	22
28 mm	57	425 µm	16
20 mm	47	300 µm	12
14 mm	43	212 µm	9
10 mm	40	150 µm	7
6.3 mm	37	63 µm	5
5 mm	37		

Hole 1	**Sample Description** Brown clayey sandy GRAVEL with cobbles
Depth 4.00	
Type B	

Form 25/2

Laboratory - Particle Size Plot	**Project** 17 Acre Site, Hirwaun Welsh Devolopment Agency	**Contract** 155102
Exploration Associates		**Sheet** L2/3

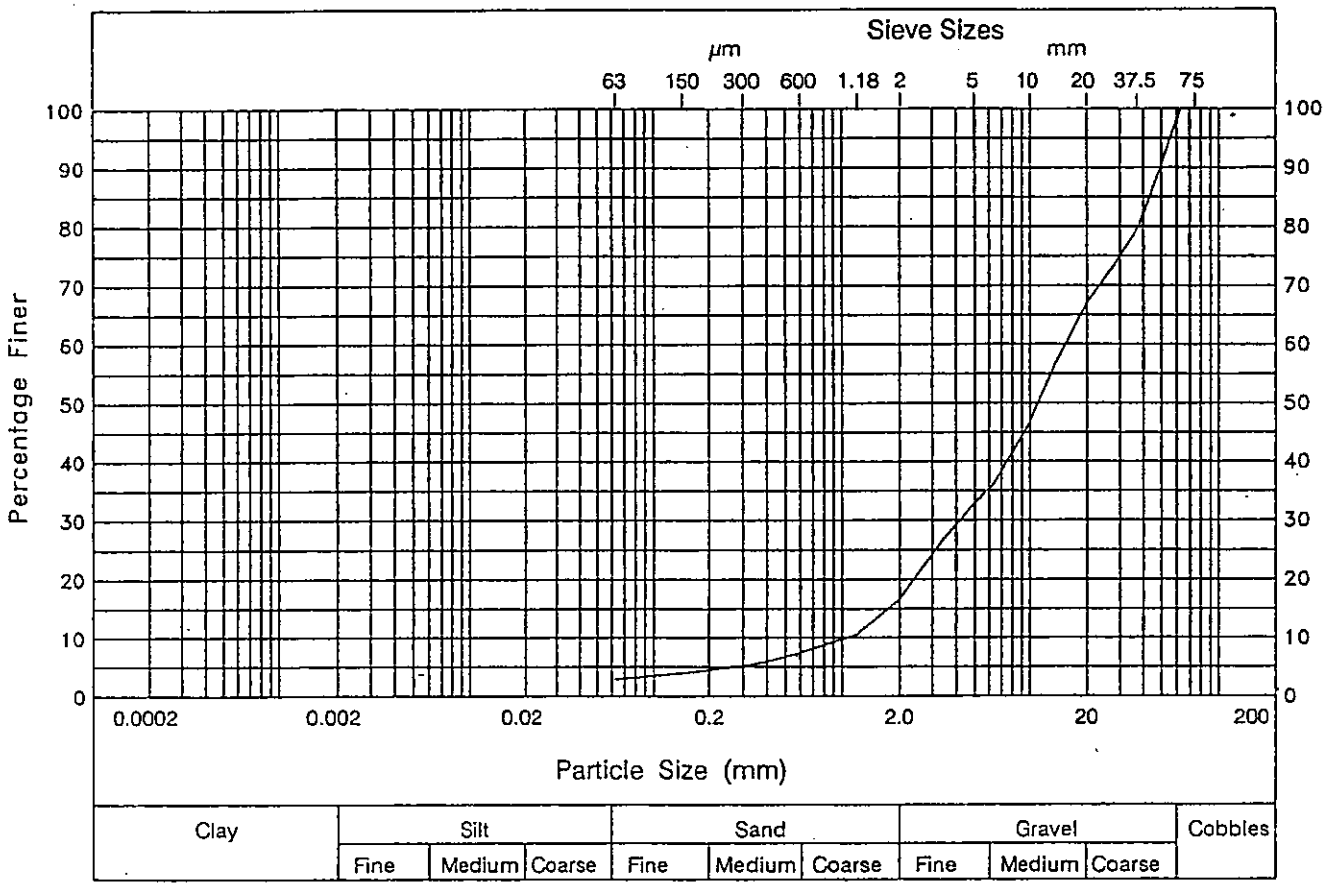


Particle Size	% Passing	Particle Size	% Passing
75 mm	80	425 µm	75
20 mm	80	300 µm	74
10 mm	79	212 µm	72
6.3 mm	79	150 µm	70
5 mm	78	63 µm	65
3.35 mm	78	20 µm	32
2 mm	77	6 µm	19
1.18 mm	76	2 µm	12
600 µm	75		

Hole 2	Sample Description
Depth 1.00	MADE GROUND:Stiff brown silty sandy clay with cobbles
Type B	

Form 25/2

Laboratory - Particle Size Plot	**Project** 17 Acre Site,Hirwaun Welsh Devolopment Agency	**Contract** 155102
Exploration Associates		**Sheet** L2/4

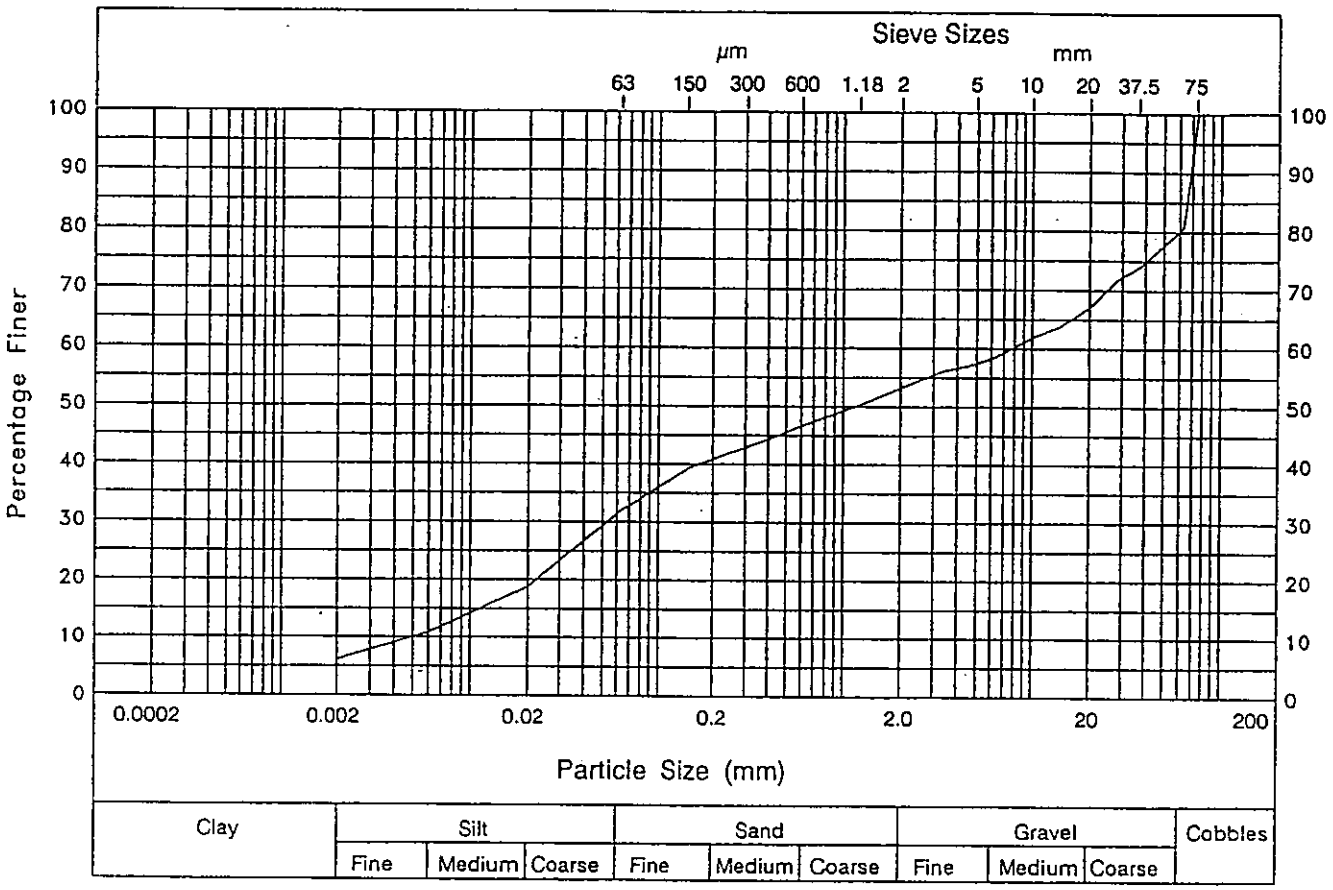


Particle Size	% Passing	Particle Size	% Passing
63 mm	100	3.35 mm	26
50 mm	91	2 mm	17
37.5 mm	80	1.18 mm	11
28 mm	73	600 µm	8
20 mm	67	425 µm	6
14 mm	57	300 µm	5
10 mm	47	212 µm	5
6.3 mm	36	150 µm	4
5 mm	33	63 µm	3

Hole 3	**Sample Description** MADE GROUND:Brown silty sandy gravel with cobbles
Depth 3.00	
Type B	

Form 25/2

Laboratory - Particle Size Plot	**Project** 17 Acre Site,Hirwaun Welsh Devolopment Agency	**Contract** 155102
Exploration Associates		**Sheet** L2/5

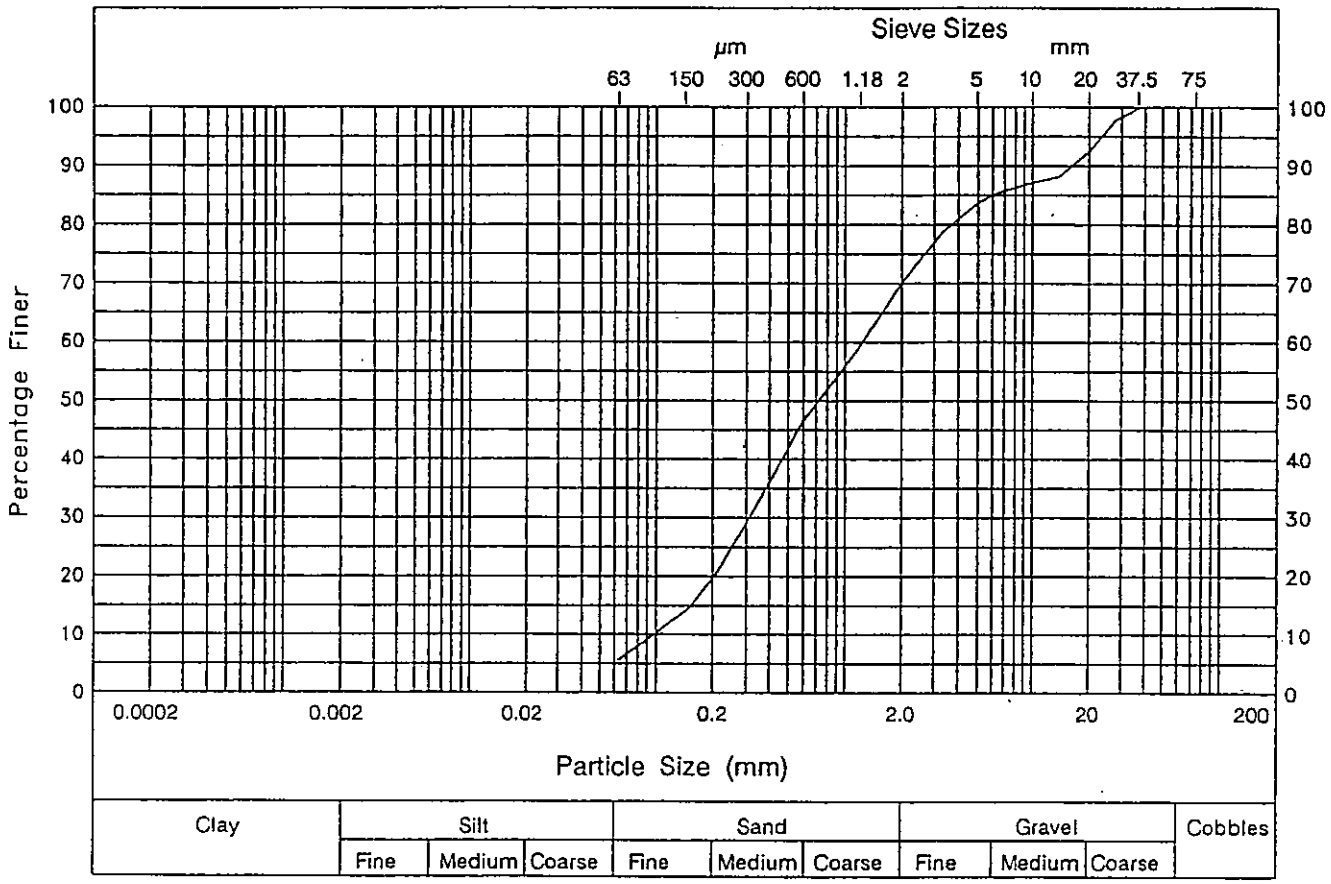


Particle Size	% Passing	Particle Size	% Passing
75 mm	100	1.18 mm	50
63 mm	81	600 µm	47
37.5 mm	74	425 µm	45
28 mm	72	300 µm	43
20 mm	67	212 µm	41
14 mm	64	150 µm	39
10 mm	62	63 µm	32
6.3 mm	58	20 µm	19
5 mm	57	6 µm	11
3.35 mm	56	2 µm	6
2 mm	53		

Hole 3	**Sample Description** Brown silty sandy GRAVEL with cobbles
Depth 5.75	
Type B	

Form 25/2

Laboratory - Particle Size Plot	**Project** 17 Acre Site, Hirwaun Welsh Devolopment Agency	**Contract** 155102
Exploration Associates		**Sheet** L2/6

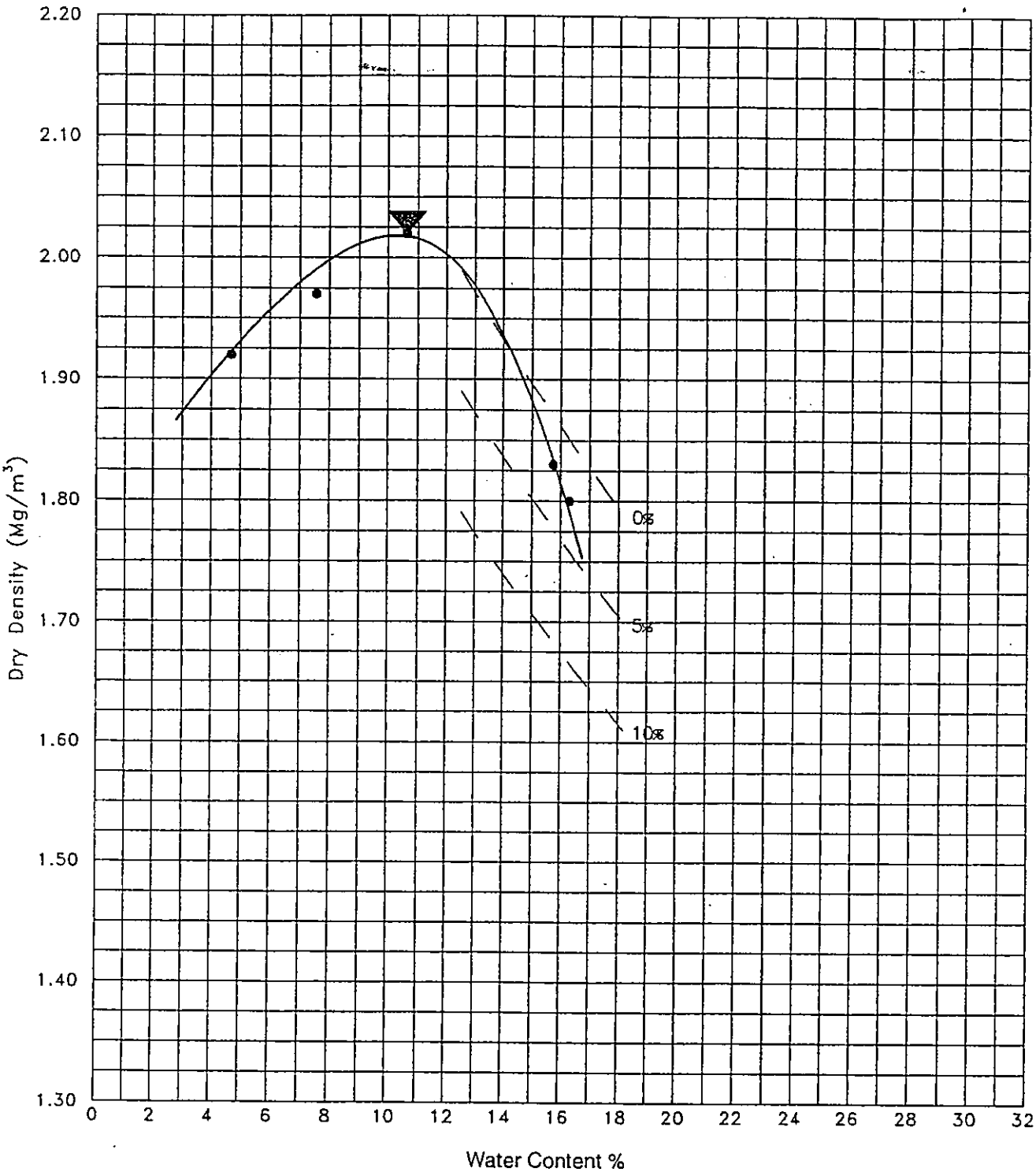


Particle Size	% Passing	Particle Size	% Passing
37.5 mm	100	2 mm	70
28 mm	98	1.18 mm	59
20 mm	92	600 µm	47
14 mm	88	425 µm	38
10 mm	87	300 µm	29
6.3 mm	85	212 µm	21
5 mm	84	150 µm	15
3.35 mm	79	63 µm	6

Hole 6	Sample Description: Grey silty gravelly SAND
Depth 8.50	
Type B	

Form 25/2

Laboratory - Particle Size Plot	**Project** 17 Acre Site, Hirwaun, Welsh Devolopment Agency	**Contract** 155102
Exploration Associates		**Sheet** L2/7



- ● Moisture Content/Dry Density
- o Compaction at Natural Water Content
- ▼ Maximum Dry Density/Optimum Water Content

Type of Test/Mould	2.5kg/CBR	
Particle Density Assumed	2.65	Mg/m^3
Maximum Dry Density	2.02	Mg/m^3
Optimum Water Content	11	%
% retained 37.5mm sieve	5.87	
% retained 20mm sieve	8.99	

Description

MADE GROUND:Brown silty gravelly sand

Hole TP5

Depth 1.00

Type B

Form 54/0

Remarks

Laboratory - Moisture Content/ Dry Density Relationship

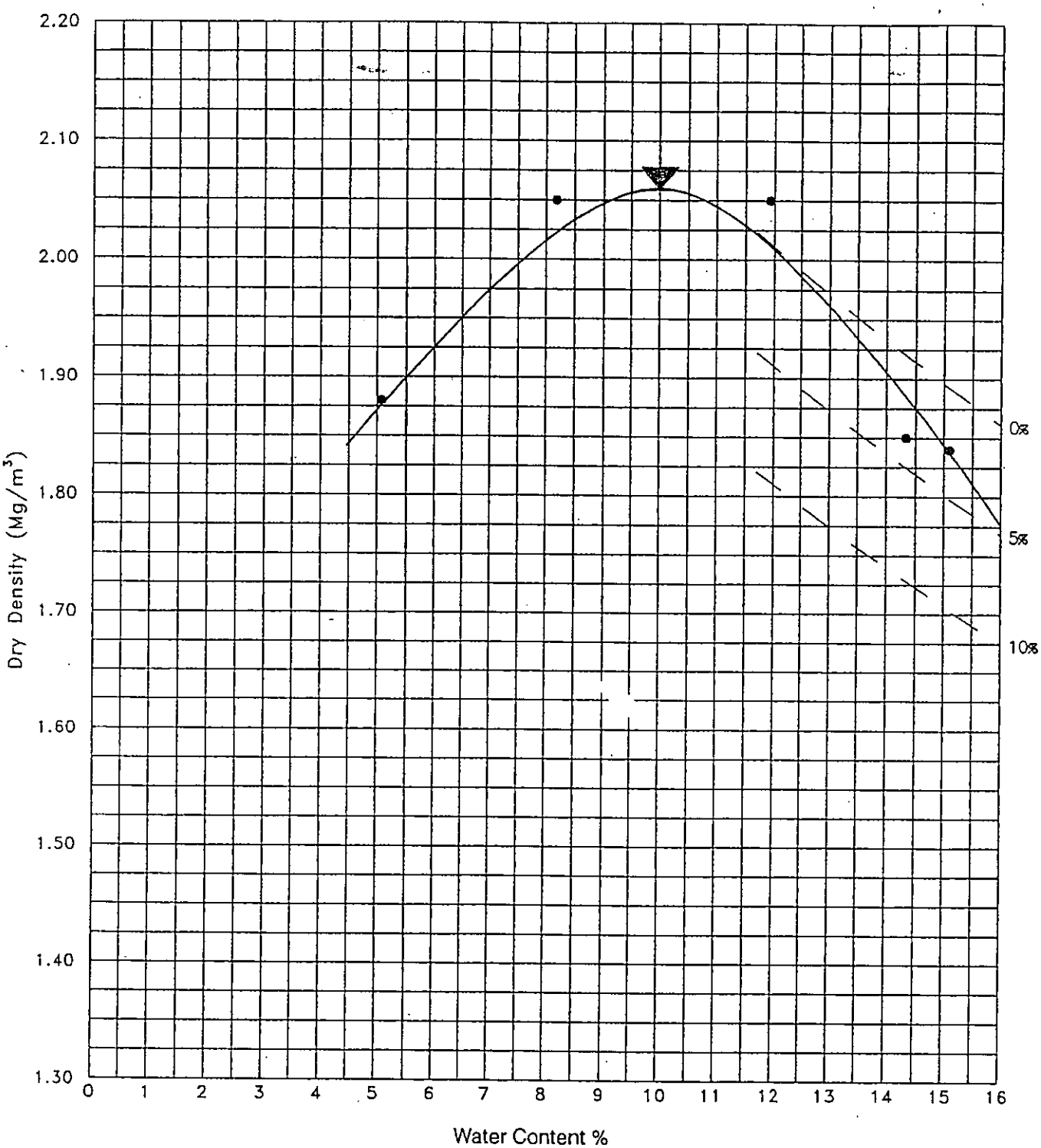
Exploration Associates

Project

17 Acre Site,Hirwaun
Welsh Devolopment Agency

Contract 155102

L3/1



- ● Moisture Content/Dry Density
- o Compaction at Natural Water Content
- ▼ Maximum Dry Density/Optimum Water Content

Type of Test/Mould	2.5kg/CBR		
Particle Density Assumed	2.65	Mg/m³	
Maximum Dry Density	2.06	Mg/m³	
Optimum Water Content	10	%	
% retained 37.5mm sieve	14.54		
% retained 20mm sieve	6.29		

Description

MADE GROUND:Brown clayey gravel

Hole TPC

Depth 1.00

Type B

Form 54/0

Remarks

Laboratory - Moisture Content/ Dry Density Relationship

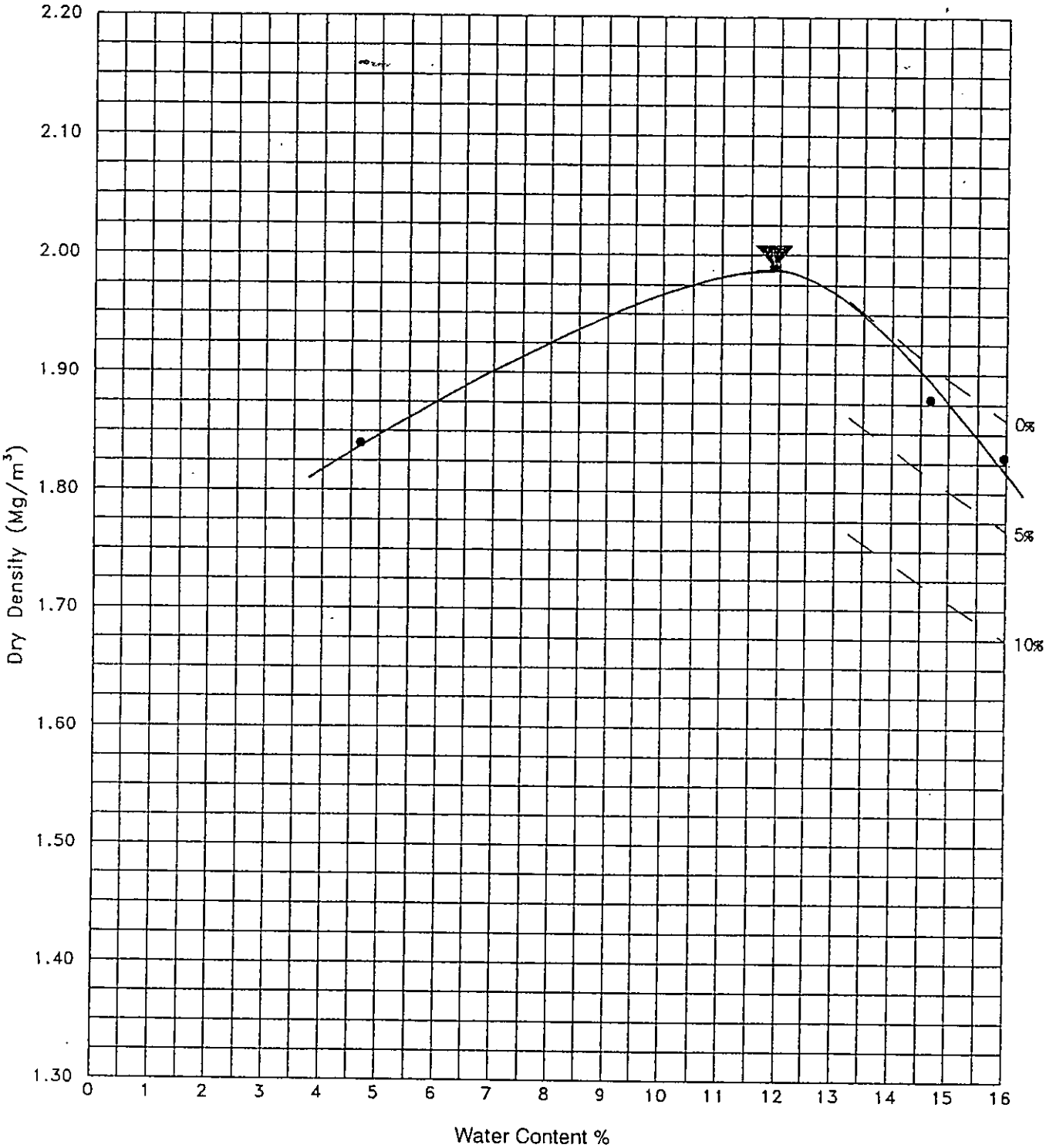
Exploration Associates

Project

17 Acre Site,Hirwaun
Welsh Devolopment Agency

Contract 155102

L3/2



- ● Moisture Content/Dry Density
- o Compaction at Natural Water Content
- ▼ Maximum Dry Density/Optimum Water Content

Type of Test/Mould	2.5kg/CBR	
Particle Density Assumed	2.65	Mg/m^3
Maximum Dry Density	1.99	Mg/m^3
Optimum Water Content	12	%
% retained 37.5mm sieve	8.33	
% retained 20mm sieve	8.23	

Description

MADE GROUND:Brown silty sandy gravel

Hole TPD
Depth 1.50
Type B

Form 54/0

Remarks

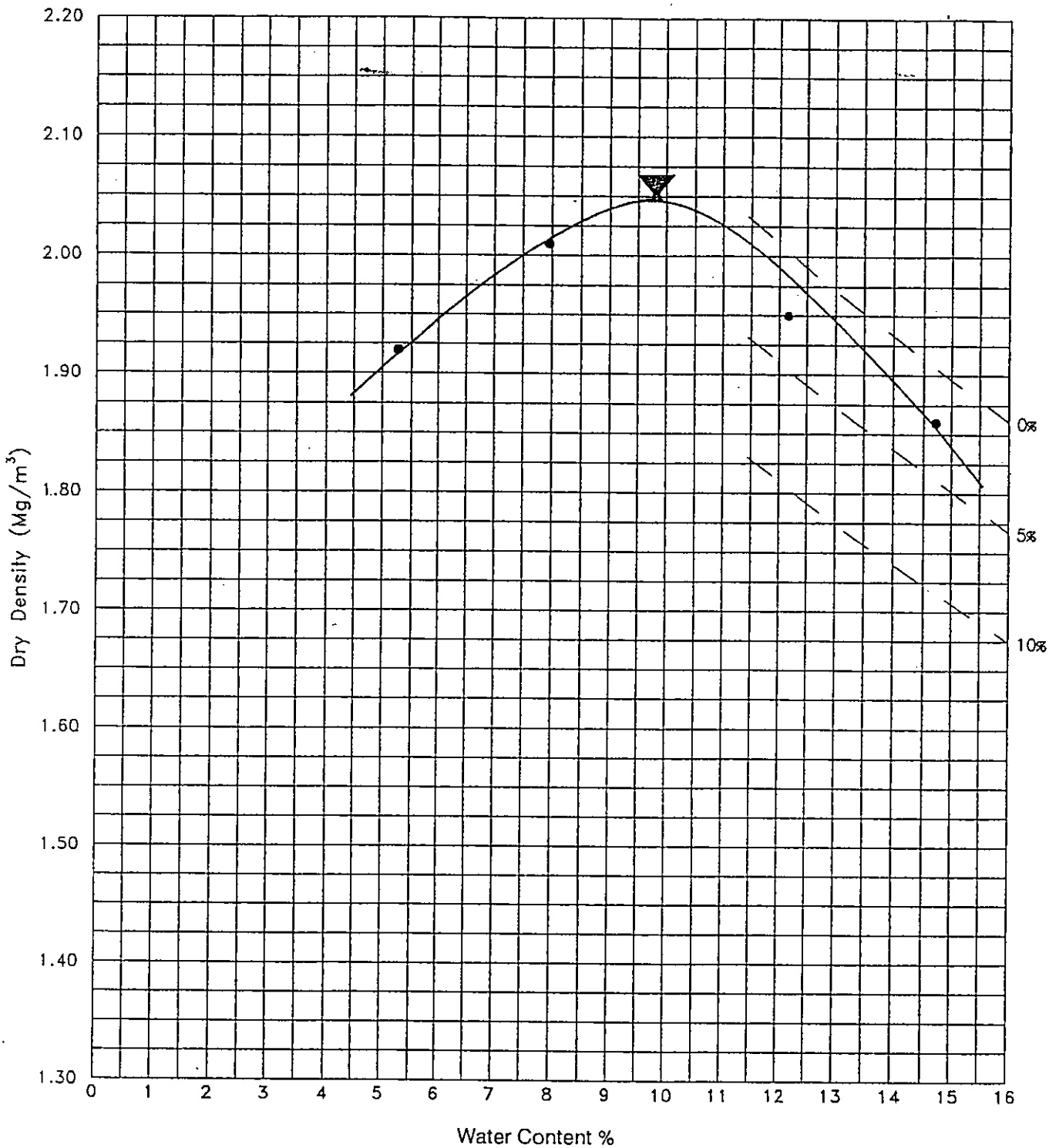
Laboratory - Moisture Content/ Dry Density Relationship

Exploration Associates

Project
17 Acre Site,Hirwaun
Welsh Devolopment Agency

Contract 155102

L3/3



- ● Moisture Content/Dry Density
- o Compaction at Natural Water Content
- ▼ Maximum Dry Density/Optimum Water Content

Type of Test/Mould	2.5kg/CBR	
Particle Density Assumed	2.65	Mg/m^3
Maximum Dry Density	2.05	Mg/m^3
Optimum Water Content	9.8	%
% retained 37.5mm sieve	9.49	
% retained 20mm sieve	4.54	

Description

MADE GROUND:Brown sandy gravelly clay

Hole 1

Depth 0.25

Type B

Form 54/0

Remarks

Laboratory - Moisture Content/ Dry Density Relationship

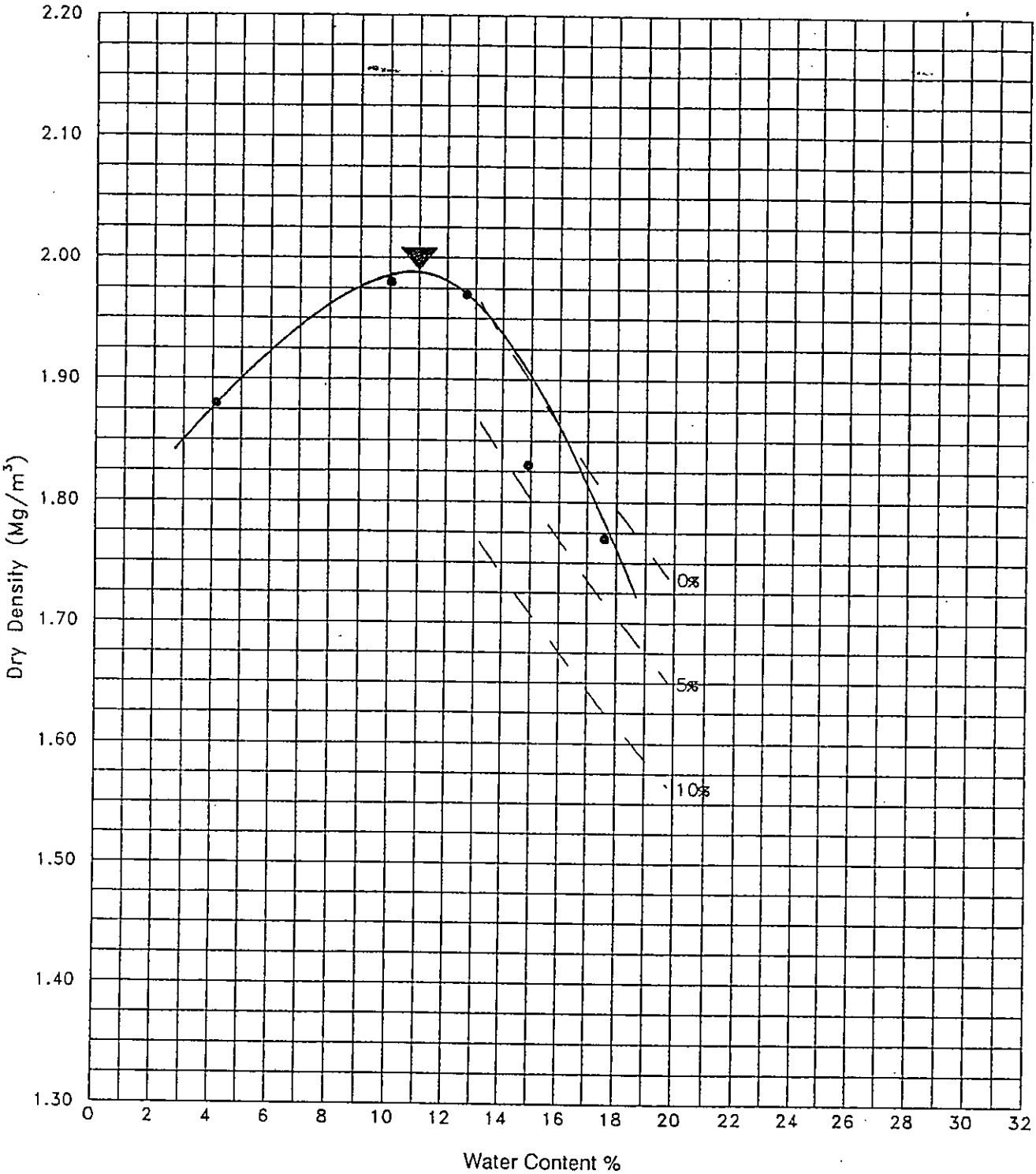
Exploration Associates

Project

17 Acre Site,Hirwaun
Welsh Devolopment Agency

Contract 155102

L3/4



- ● Moisture Content/Dry Density
- o Compaction at Natural Water Content
- ▼ Maximum Dry Density/Optimum Water Content

Type of Test/Mould	2.5kg/CBR	
Particle Density Assumed	2.65	Mg/m^3
Maximum Dry Density	1.99	Mg/m^3
Optimum Water Content	11	%
% retained 37.5mm sieve	4.70	
% retained 20mm sieve	7.12	

Description

MADE GROUND:Stiff brown silty sandy gravel with cobbles

Hole	2
Depth	0.25
Type	B

Form 54/0

Remarks

Laboratory - Moisture Content/ Dry Density Relationship

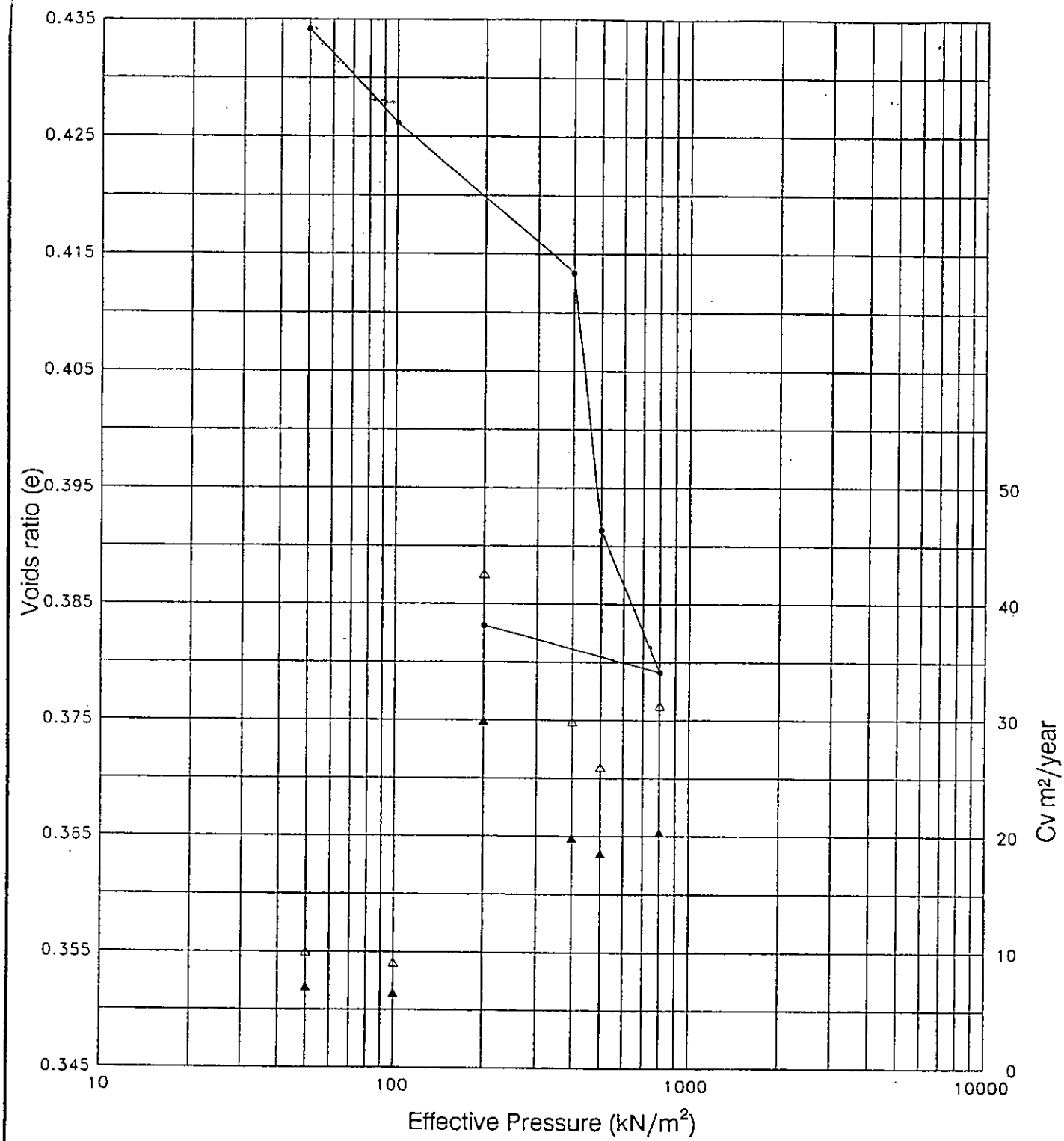
Exploration Associates

Project

17 Acre Site, Hirwaun
Welsh Devolopment Agency

Contract 155102

L3/5



Sample Dimensions	74.96	mm dia.
	18.940	mm high
Initial Voids Ratio	.465	
Final Voids Ratio	.383	
Swelling Pressure	-	kN/m²
Initial Water Content	19.94	%
Final Water Content	17.99	%
Initial Saturation	113.62	%
Bulk Density	2.17	Mg/m³
Dry Density	1.81	Mg/m³
Specific Gravity	2.65	ASSUMED
Sample Type	UNDISTURBED	

Pressure kN/m²	0	50	100	400	500	800
	50	100	400	500	800	200
Mv m²/MN	.423	.111	.030	.156	.029	.005
Cv Log t_{50} ▲ m²/yr	6.95	6.47	19.86	18.51	20.32	29.93
Cv Root t_{90} △ m²/yr	10.00	9.09	29.88	25.96	31.26	42.59
Final Voids Ratio	.434	.426	.413	.391	.379	.383

Description
Brown very silty slightly sandy CLAY

Hole 5
Depth 4.00 - 4.45 m
Sample Type U

Laboratory - Consolidation Test

Project
17 Acre Site, Hirwaun
Welsh Development Agency

Contract 155102

Sheet

Exploration Associates

Form 45/0

ENVIRONMENTAL ANALYSIS LTD

Unit 9, Brunel Road, Churchfields Industrial Estate, St Leonards on Sea, East Sussex. TN38 9RT
Fax: 01424 852245 Tel: 01424 852252/855030

ANALYTICAL REPORT No. R20774

Your Contract No. 155102

CLIENT: Exploration Associates

Location: 17 Acre Site, Hirwaun

Date 01/08/95

F.A.O.–Mr Rob Griffiths

Soils

TP/BH	Depth (m)	Our ref	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Zinc (mg/kg)
TP1	2.50	95745	8.0	2.0	5	20	53	<0.5	25	1.9	94
TP2	1.00	95746	1.8	1.7	5	5	5	<0.5	7	<0.5	25
TP4	1.55	95747	27.4	3.8	17	19	86	<0.5	16	0.7	147
TP8	2.00	95748	2.2	0.8	9	3	15	0.6	9	<0.5	36

TP/BH	Depth (m)	Our ref	Water sol. Boron (mg/kg)	pH Value	Total Sulphate (% as SO4)	Phenols (mg/kg)	Total Cyanide (mg/kg)	Sulphide (mg/kg)	Elemental Sulphur (mg/kg)	PAH (mg/kg)	Thiocyanate (mg/kg)
TP1	2.50	95745	<0.5	6.5	0.14	<1	<1	<1	570	<0.5	##
TP2	1.00	95746	<0.5	6.3	0.07	<1	<1	<1	146	<0.5	<2
TP4	1.55	95747	0.6	5.5	0.11	<1	<1	<1	1880	<0.5	##
TP8	2.00	95748	<0.5	6.1	0.14	<1	<1	<1	2620	0.9	##

No result due to chemical interference

Methods of Analysis: Version 4: 27
Version 5: 3,7,9,20,22,23,25,26,27,28,29,31,32

C.P.V. Knight

ENCLOSURE C

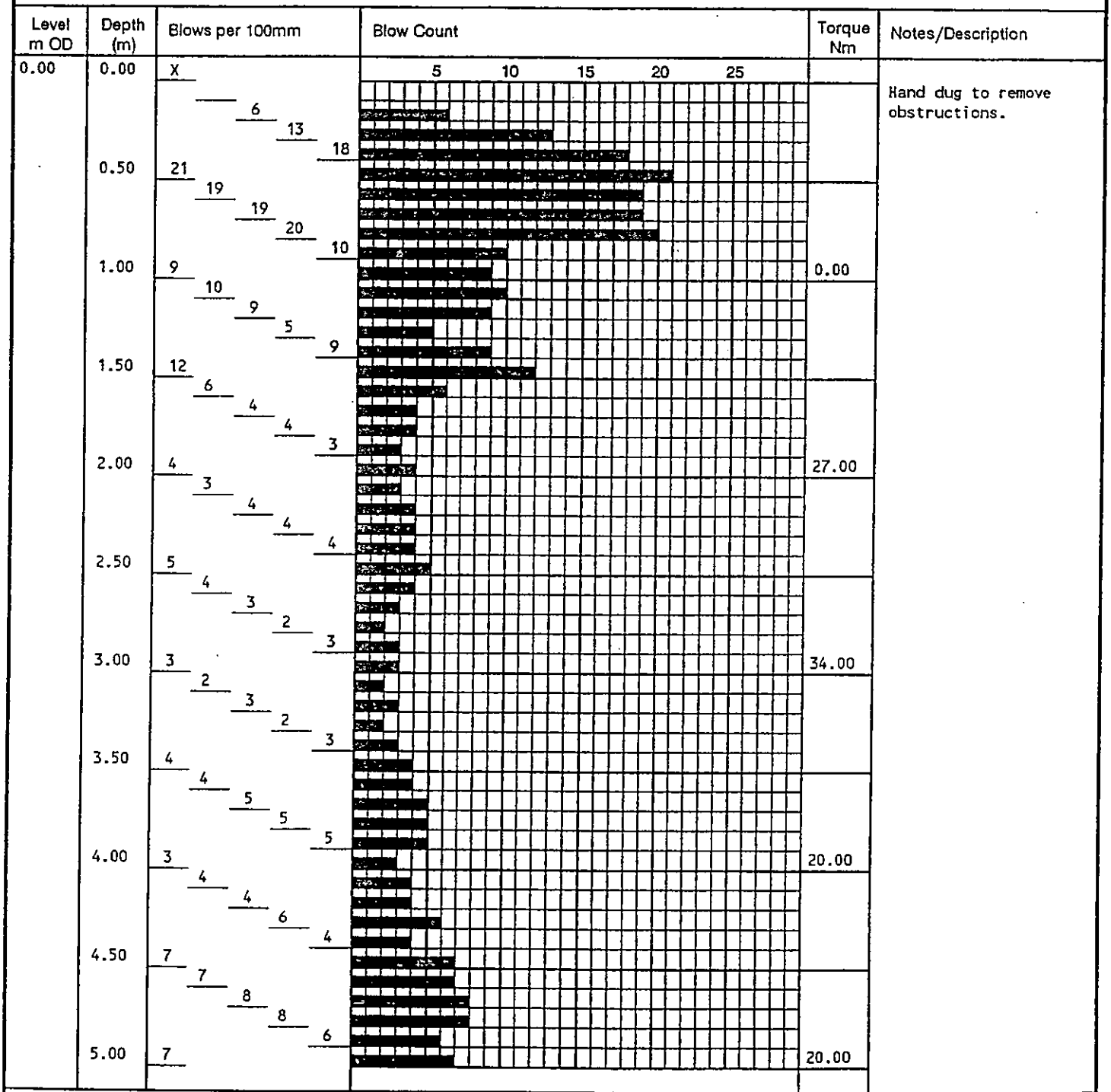
Dynamic Cone Penetration Tests

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 1
Test No: 1
Date: 20/06/95
Sheet 1 of 2

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 6.90 m



Remarks Test in accordance with BS 1377: Part 9: 1990

Form 57/1

Operator GD
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Continuous Dynamic Probing

Exploration Associates

Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

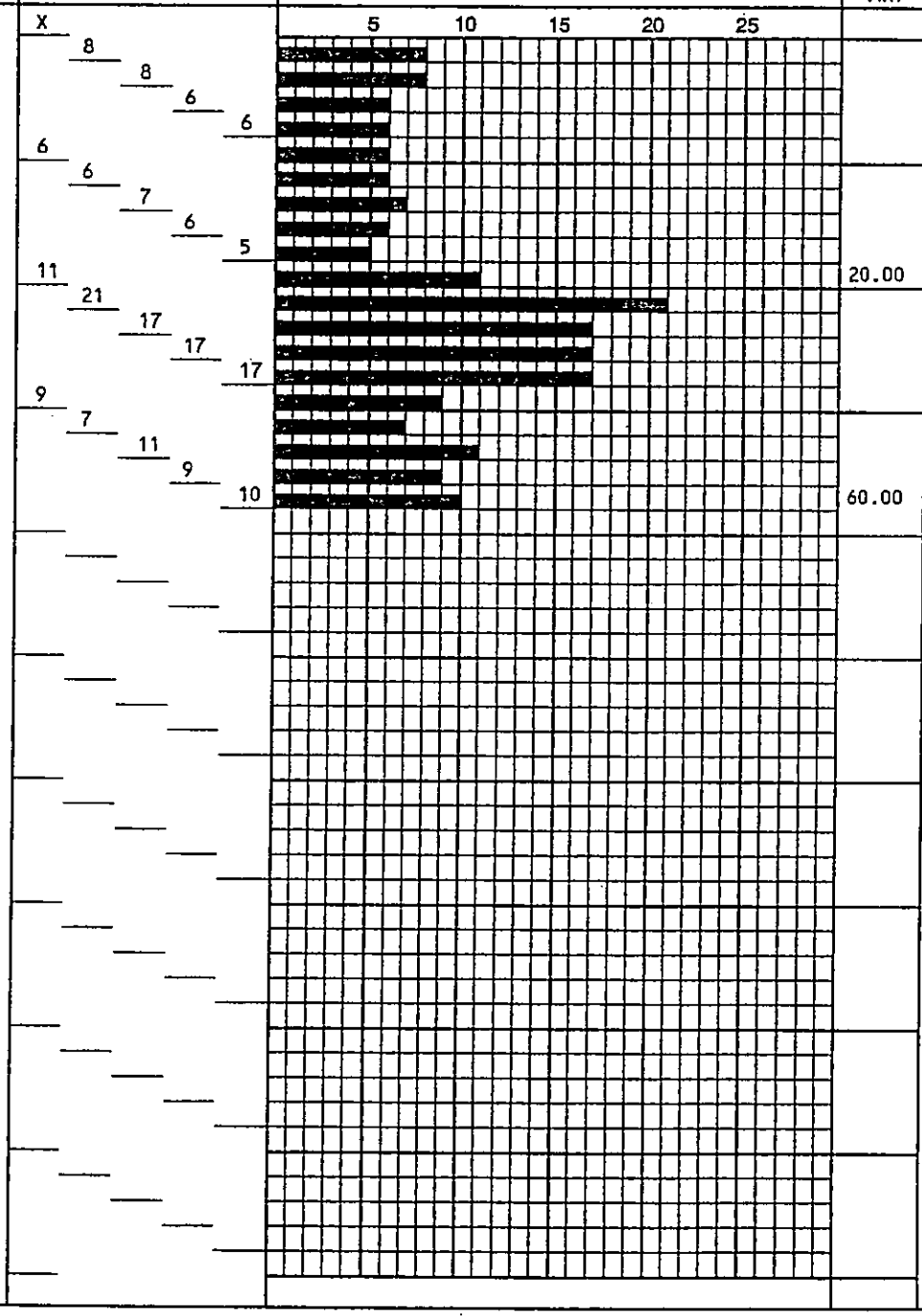
Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 1
Test No: 1
Date: 20/06/95
Sheet 2 of 2

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 6.90 m



Remarks Test in accordance with BS 1377: Part 9: 1990

Form 57/1

Operator GD
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Continuous Dynamic Probing

Exploration Associates

Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

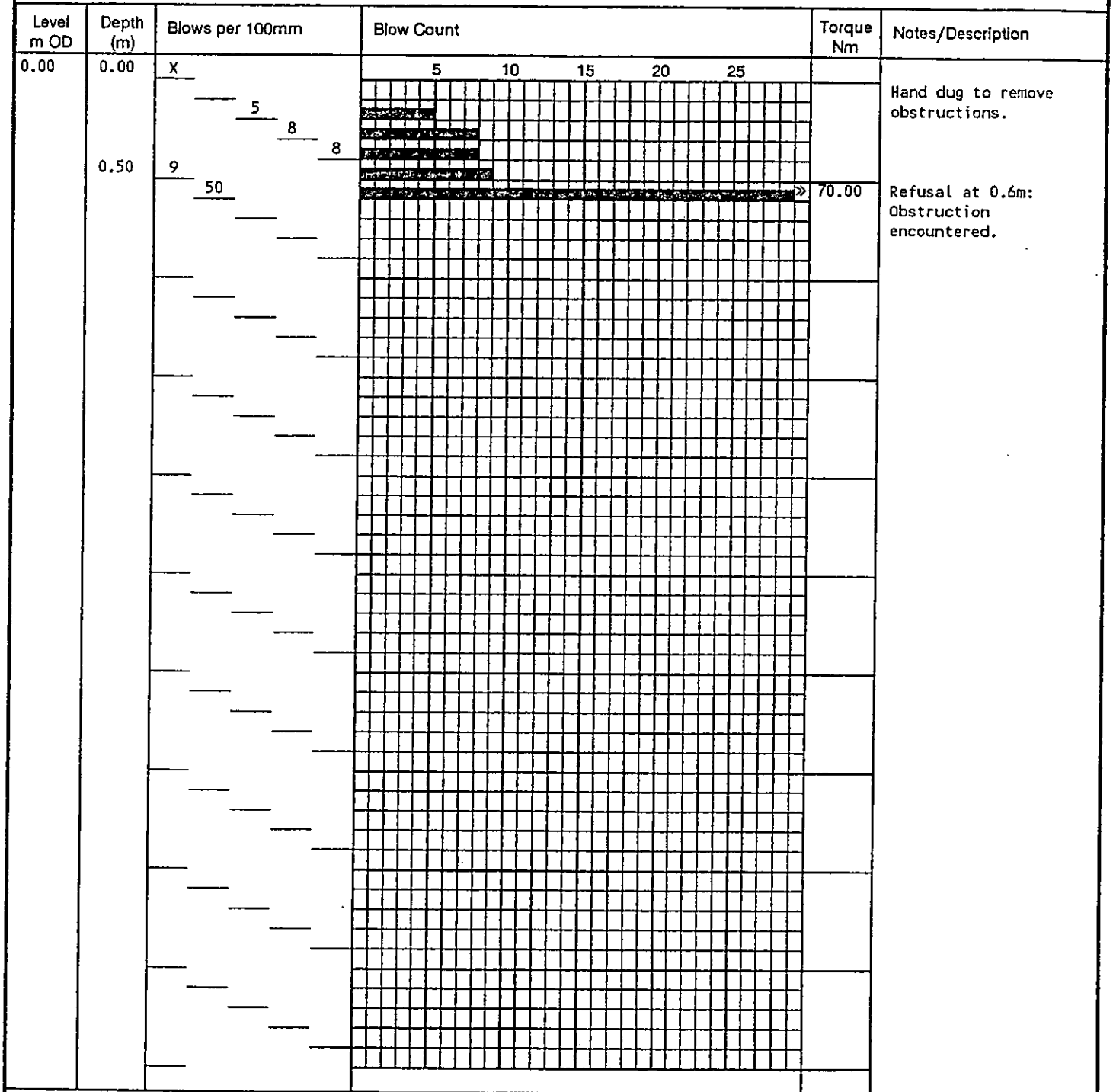
Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 2
Test No: 1
Date: 20/06/95
Sheet 1 of 1

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 0.60 m



Remarks Test in accordance with BS 1377: Part 9: 1990
Obstruction encountered at 0.6m: Probe hole terminated.

Form 57/1

Operator GD
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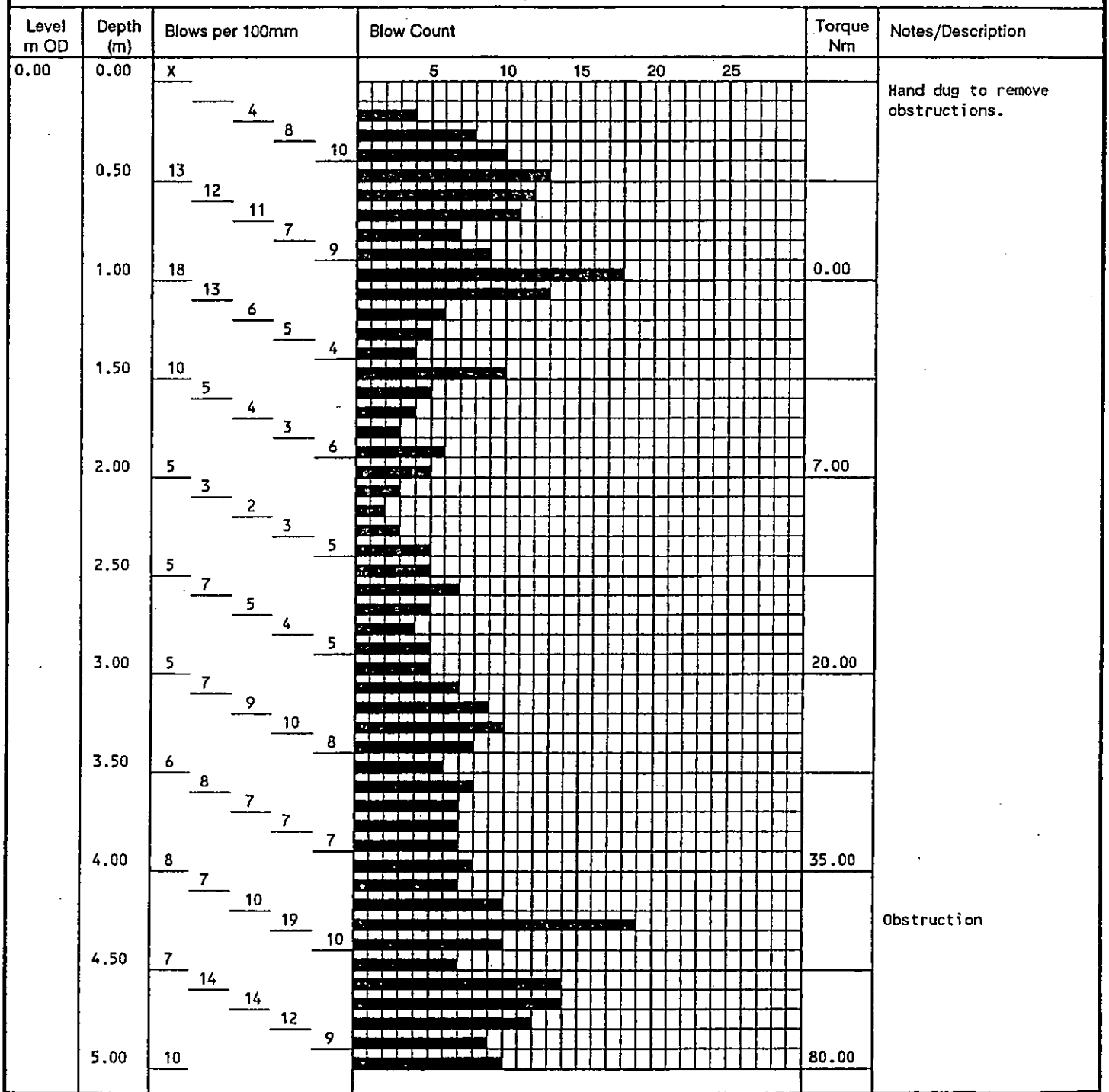
Continuous Dynamic Probing	Project: 17 Acre Site - Hirwaun	Contract: 155102
Exploration Associates		Figure

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 2A
Test No: 1
Date: 20/06/95
Sheet 1 of 2

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 6.90 m



Remarks Test in accordance with BS 1377: Part 9: 1990

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Continuous Dynamic Probing

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Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 2A
Test No: 1
Date: 20/06/95
Sheet 2 of 2

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 6.90 m

Level m OD	Depth (m)	Blows per 100mm	Blow Count	Torque Nm	Notes/Description
		X	5 10 15 20 25		
		10			
		10			
		9			
		12			
	5.50	21			
		16			
		14			
		11			
		16		80.00	Terminated at 5.9m.

Remarks Test in accordance with BS 1377: Part 9: 1990

Form 57/1

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Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 3
Test No: 1
Date: 20/06/95
Sheet 1 of 1

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 0.90 m

Level m OD	Depth (m)	Blows per 100mm	Blow Count	Torque Nm	Notes/Description
0.00	0.00	X 0 1 8 14	5 10 15 20 25		
	0.50	15 13 13 9 7			Terminated at 0.9m:Deviation of rods from vertical

Remarks Test in accordance with BS 1377: Part 9: 1990
Probe hole terminated at 0.9m:Deviation of rods from vertical in excess of 5 degrees

Form 57/1

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Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

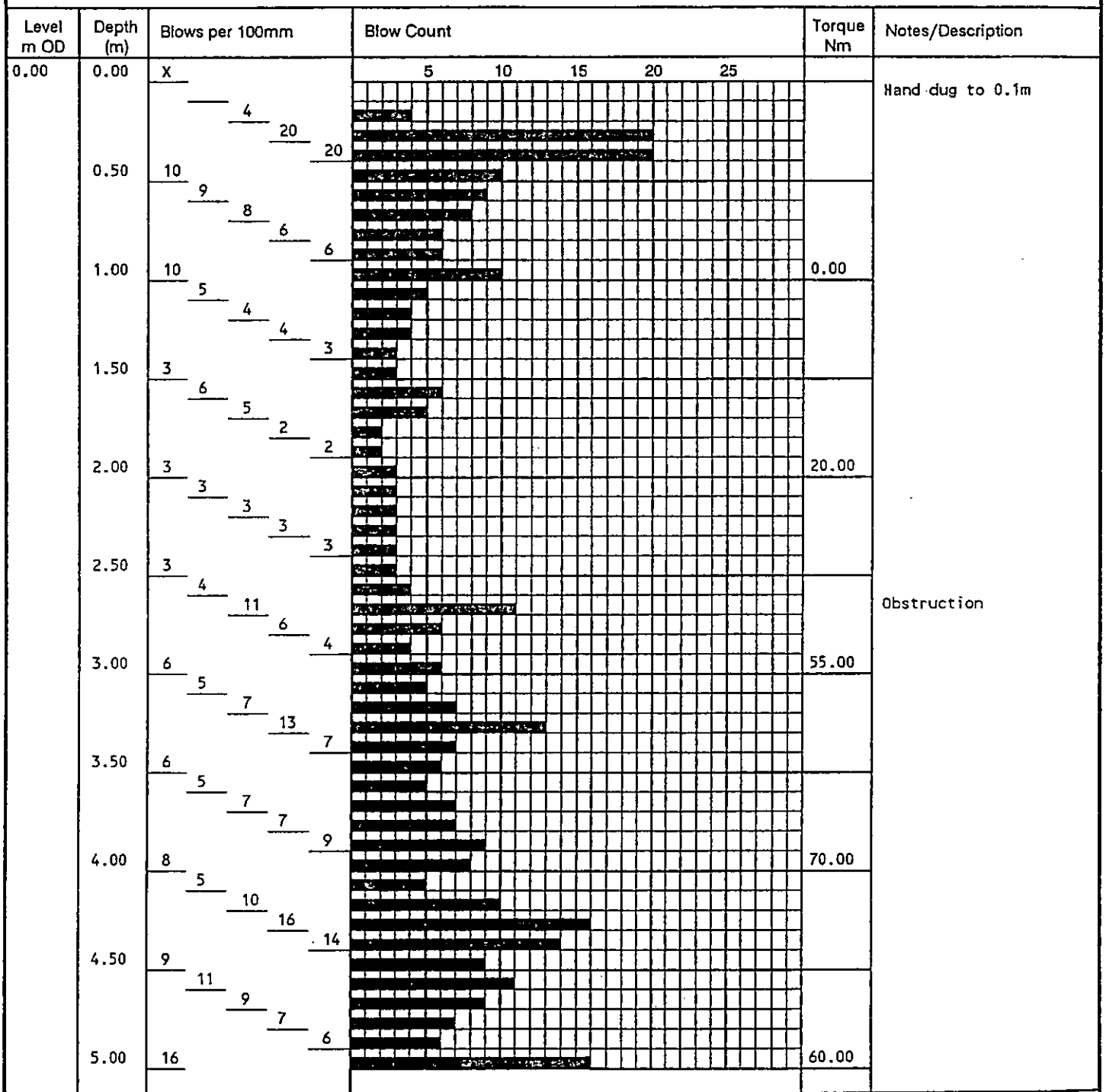
Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 3A
Test No: 1
Date: 20/06/95
Sheet 1 of 2

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 5.90 m



Remarks Test in accordance with BS 1377: Part 9: 1990

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Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 3A
Test No: 1
Date: 20/06/95
Sheet 2 of 2

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 5.90 m

Level m OD	Depth (m)	Blows per 100mm	Blow Count	Torque Nm	Notes/Description
	5.50	X 9 7 7 9 / 8 6 5 5 18	5 10 15 20 25	70.00	Terminated at 5.9m

Remarks Test in accordance with BS 1377: Part 9: 1990

Form 57/1

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Continuous Dynamic Probing

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Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 4
Test No: 1
Date: 20/06/95
Sheet 1 of 1

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 0.90 m

Level m OD	Depth (m)	Blows per 100mm	Blow Count	Torque Nm	Notes/Description
0.00	0.00	X	5 10 15 20 25		Hand dug to 0.1m
		5			
		13			
		16			
	0.50	15			
		18			
		12			
		15			
		50		65.00	Refusal at 0.9m:70mm penetration with 50 blows

Remarks Test in accordance with BS 1377: Part 9: 1990
Obstruction encountered at 0.9m:Probe hole terminated

Form 57/1

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Continuous Dynamic Probing

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Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

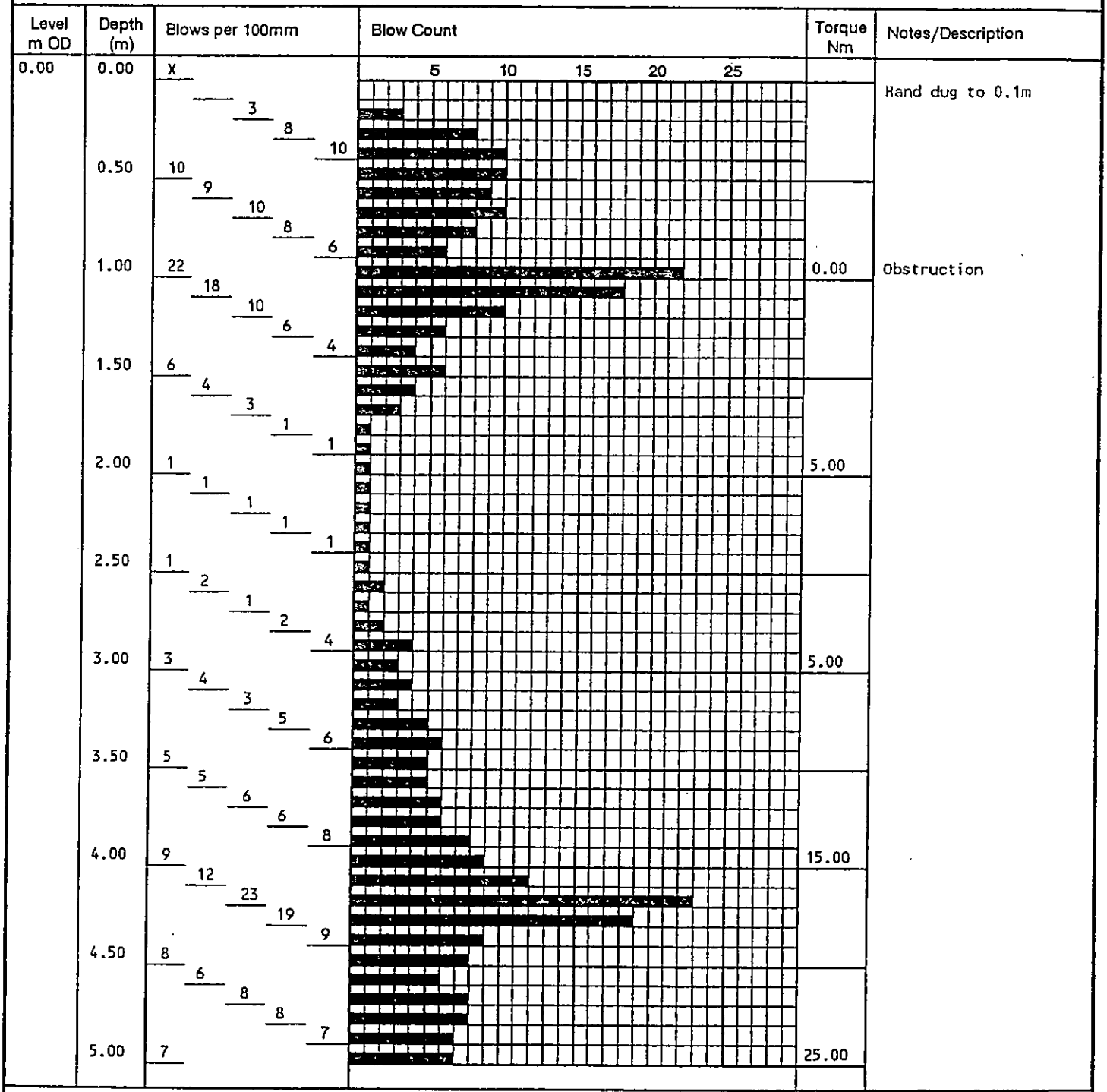
Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 4A
Test No: 1
Date: 20/06/95
Sheet 1 of 2

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 7.00 m



Remarks Test in accordance with BS 1377: Part 9: 1990

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Continuous Dynamic Probing

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Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 4A
Test No: 1
Date: 20/06/95
Sheet 2 of 2

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 7.00 m

Level m OD	Depth (m)	Blows per 100mm	Blow Count	Torque Nm	Notes/Description
		X 7 8 7 8	5 10 15 20 25		
	5.50	12 10 11 11 10			
	6.00	10 10 8 9 9		40.00	
	6.50	9 9 9 11 11			
	7.00	11		45.00	Terminated at 7.00m

Remarks Test in accordance with BS 1377: Part 9: 1990

Form 57/1

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Continuous Dynamic Probing

Exploration Associates

Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

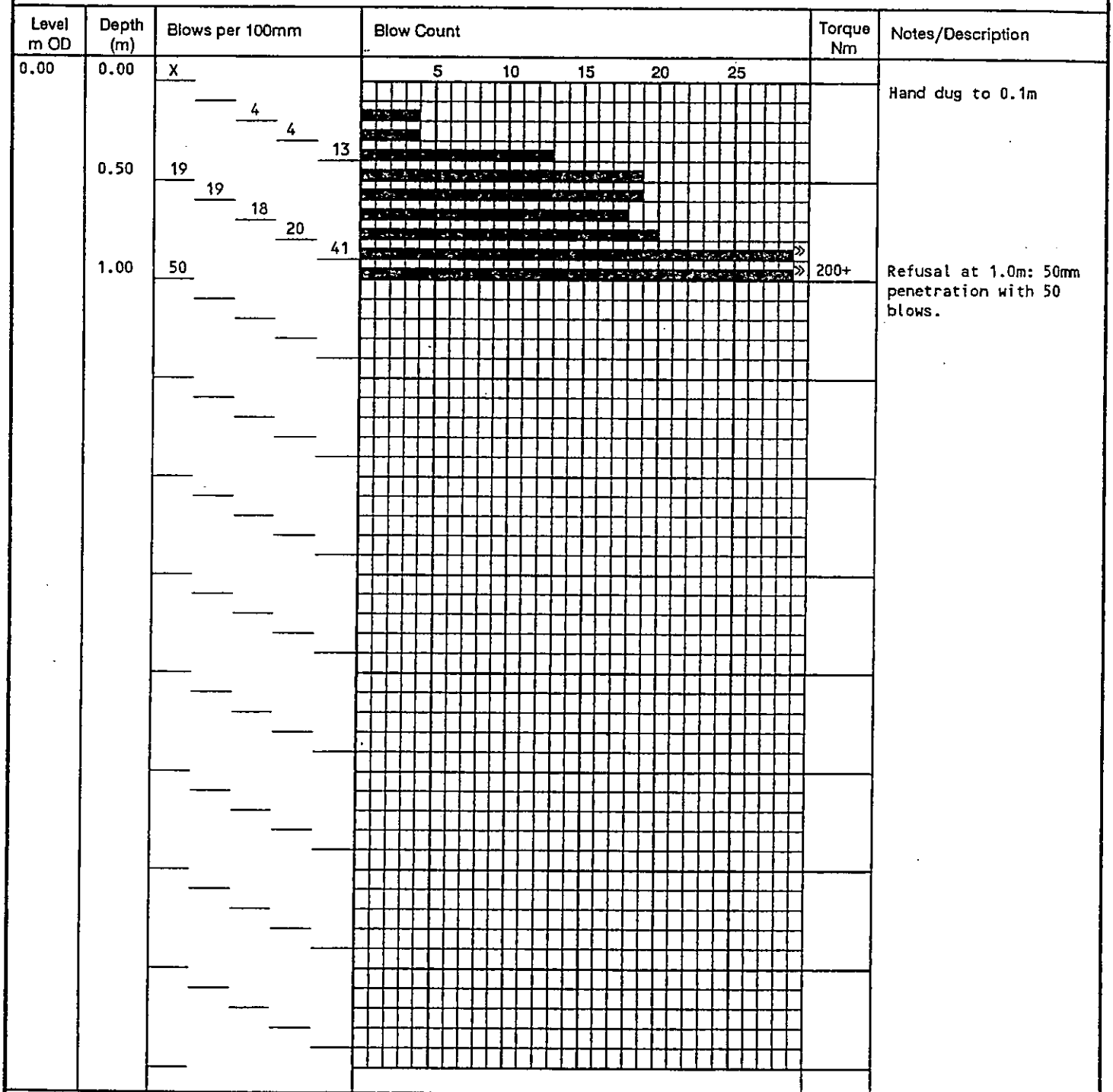
Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 5
Test No: 1
Date: 21/06/95
Sheet 1 of 1

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 1.00 m



Remarks Test in accordance with BS 1377: Part 9: 1990
Obstruction encountered at 1.0m: Probe hole terminated.

Form 57/1

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Continuous Dynamic Probing

Exploration Associates

Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

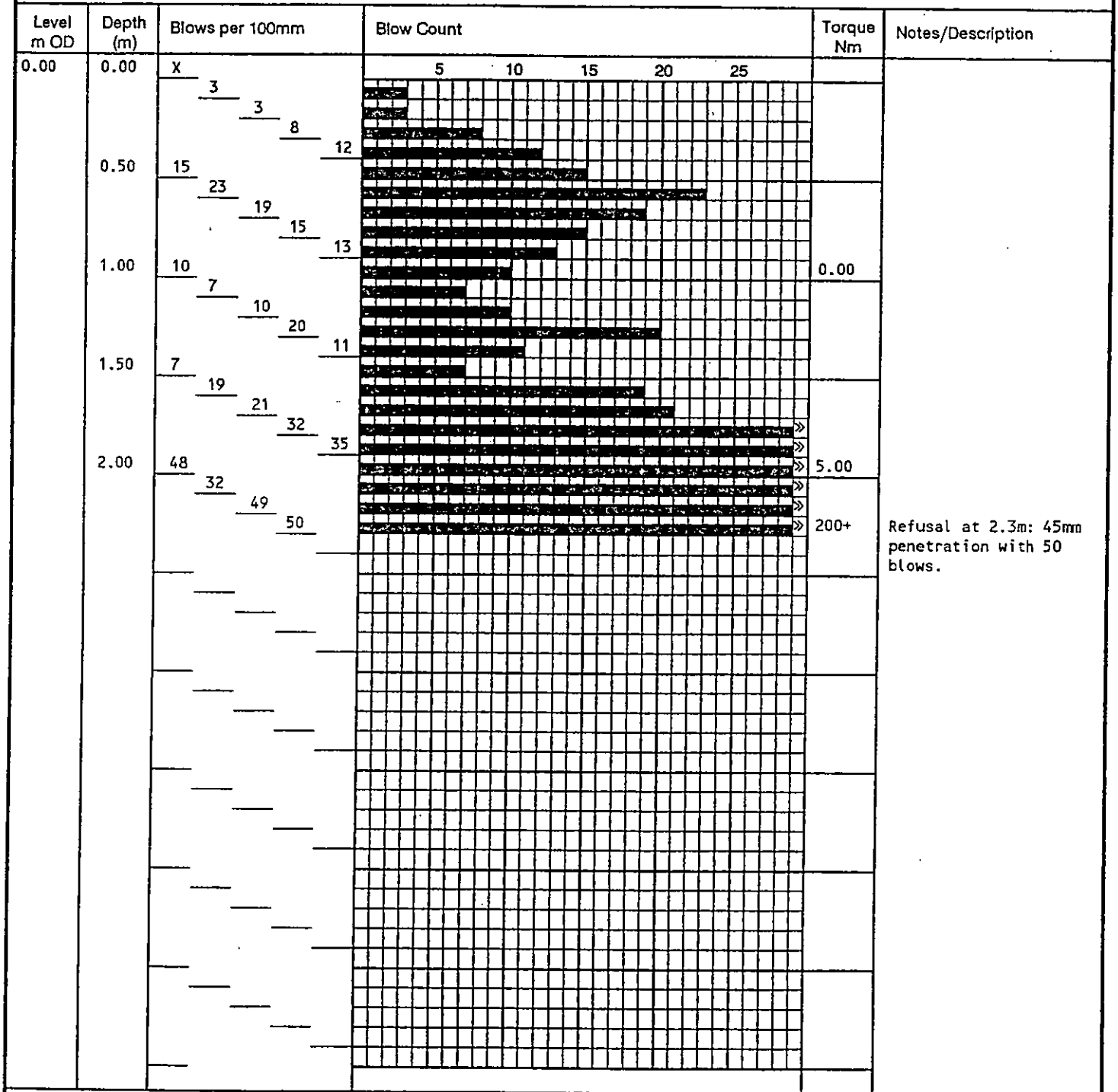
Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 5A
Test No: 1
Date: 21/06/95
Sheet 1 of 1

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 2.30 m



Remarks Test in accordance with BS 1377: Part 9: 1990
Obstruction encountered at 2.3m:probe hole terminated.

Form 57/1

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Continuous Dynamic Probing

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Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

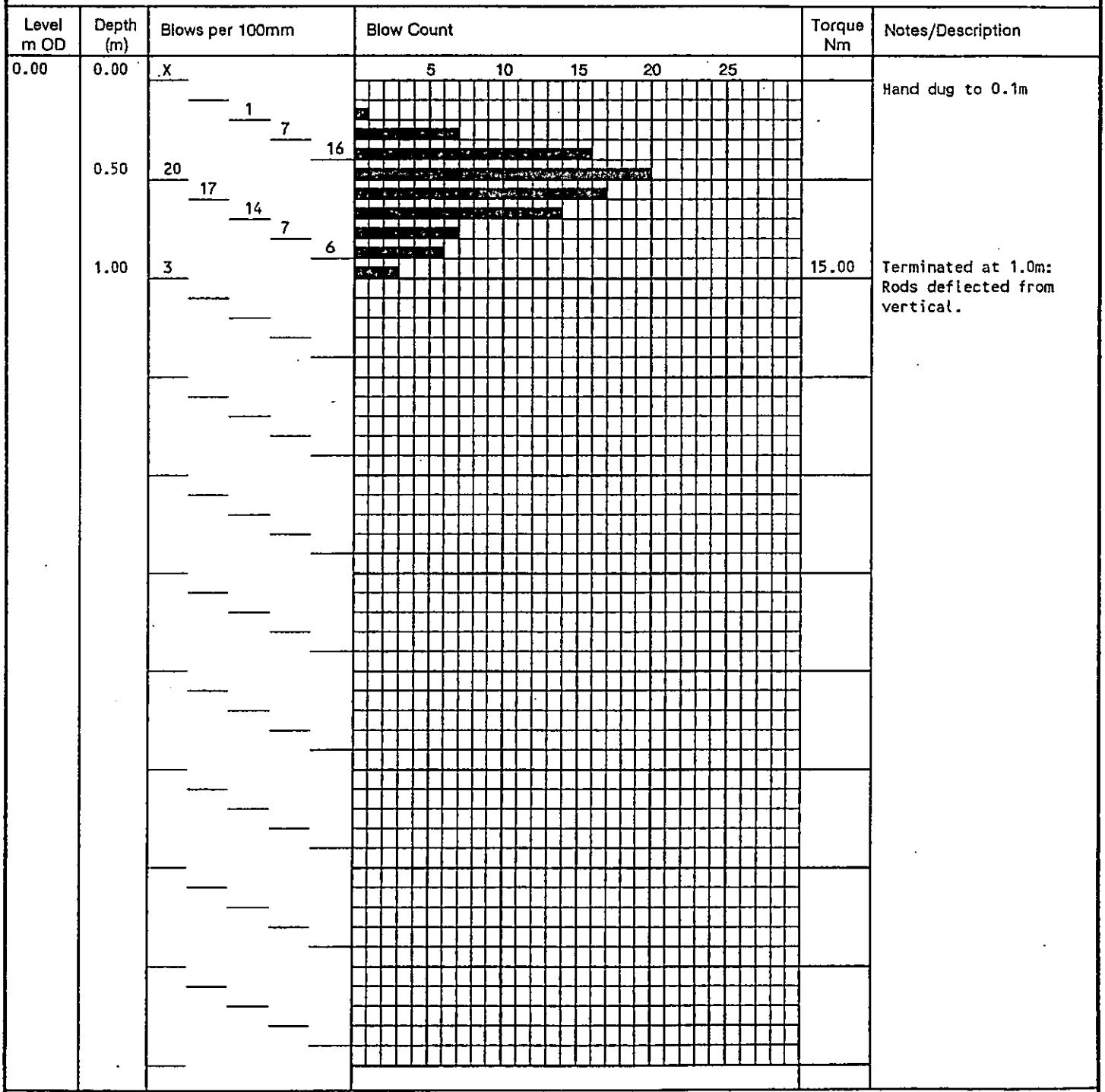
Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 6
Test No: 1
Date: 21/06/95
Sheet 1 of 1

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 1.00 m



Remarks Test in accordance with BS 1377: Part 9: 1990
Probe hole terminated at 1.0m: Deviation of rods from vertical in excess of 5 degrees.

Operator GD
Checked by GD

Form 57/1

Continuous Dynamic Probing	**Project** 17 Acre Site - Hirwaun, Welsh Development Agency	**Contract** 155102
Exploration Associates		**Figure** N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 6A
Test No: 1
Date: 21/06/95
Sheet 1 of 1

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 0.50 m

Level m OD	Depth (m)	Blows per 100mm	Blow Count	Torque Nm	Notes/Description
0.00	0.00	X	5 10 15 20 25		Hand dug to 0.1m
		4			
		11			
		12			
	0.50	13		5.00	Terminated at 0.5m: Rods deflected from vertical.

Remarks Test in accordance with BS 1377: Part 9: 1990
Probe hole terminated at 0.5m:Deflection of rods from vertical in excess of 5 degrees.

Form 57/1

Operator GD
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Continuous Dynamic Probing

Exploration Associates

Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

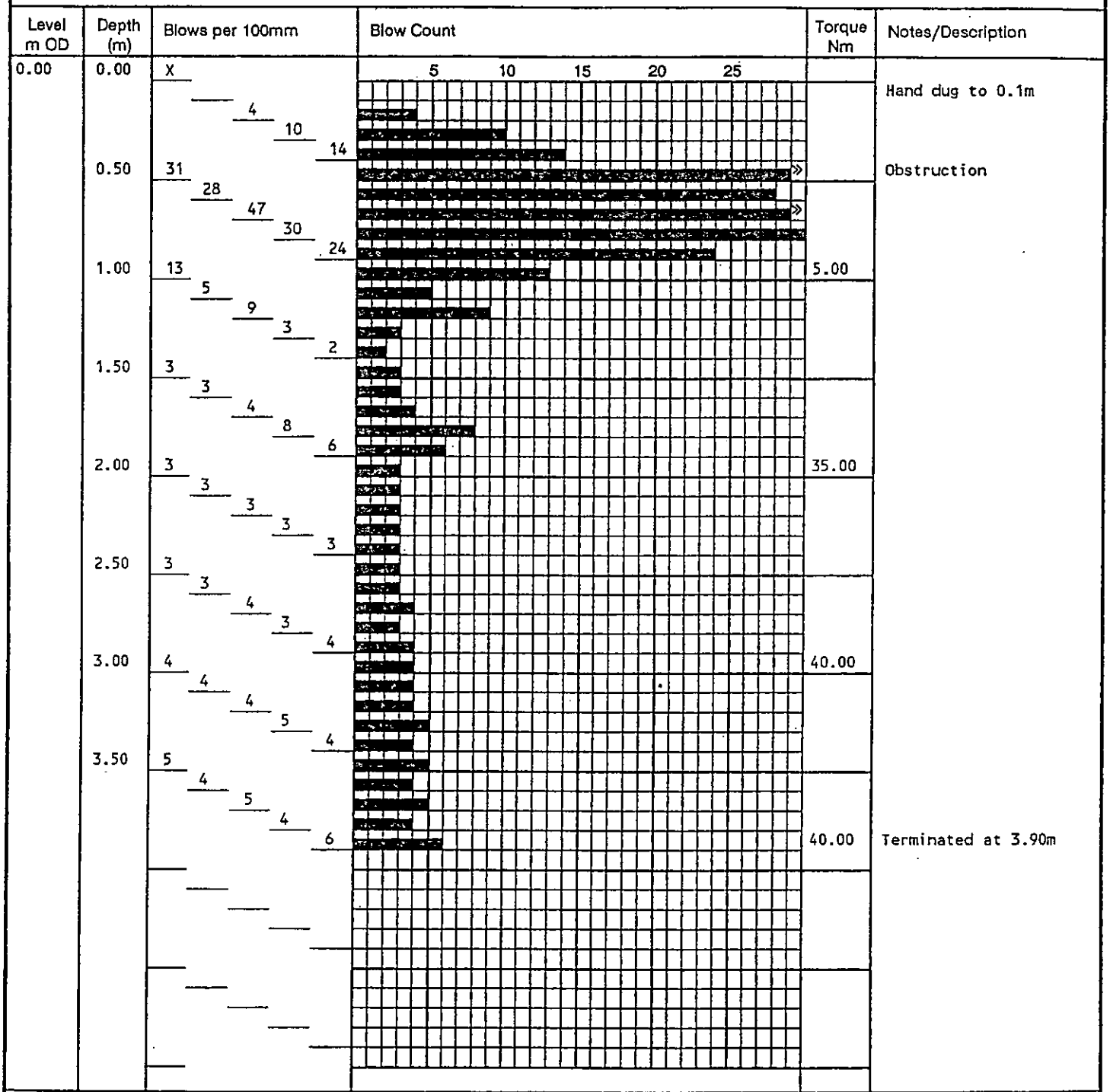
Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 6B
Test No: 1
Date: 21/06/95
Sheet 1 of 1

Backfilled: YES
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 3.90 m



Remarks Test in accordance with BS 1377: Part 9: 1990
Probe hole terminated at 3.90m in agreement with Engineer.

Form 57/1

Operator GD
Checked by GD

Continuous Dynamic Probing

Exploration Associates

Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

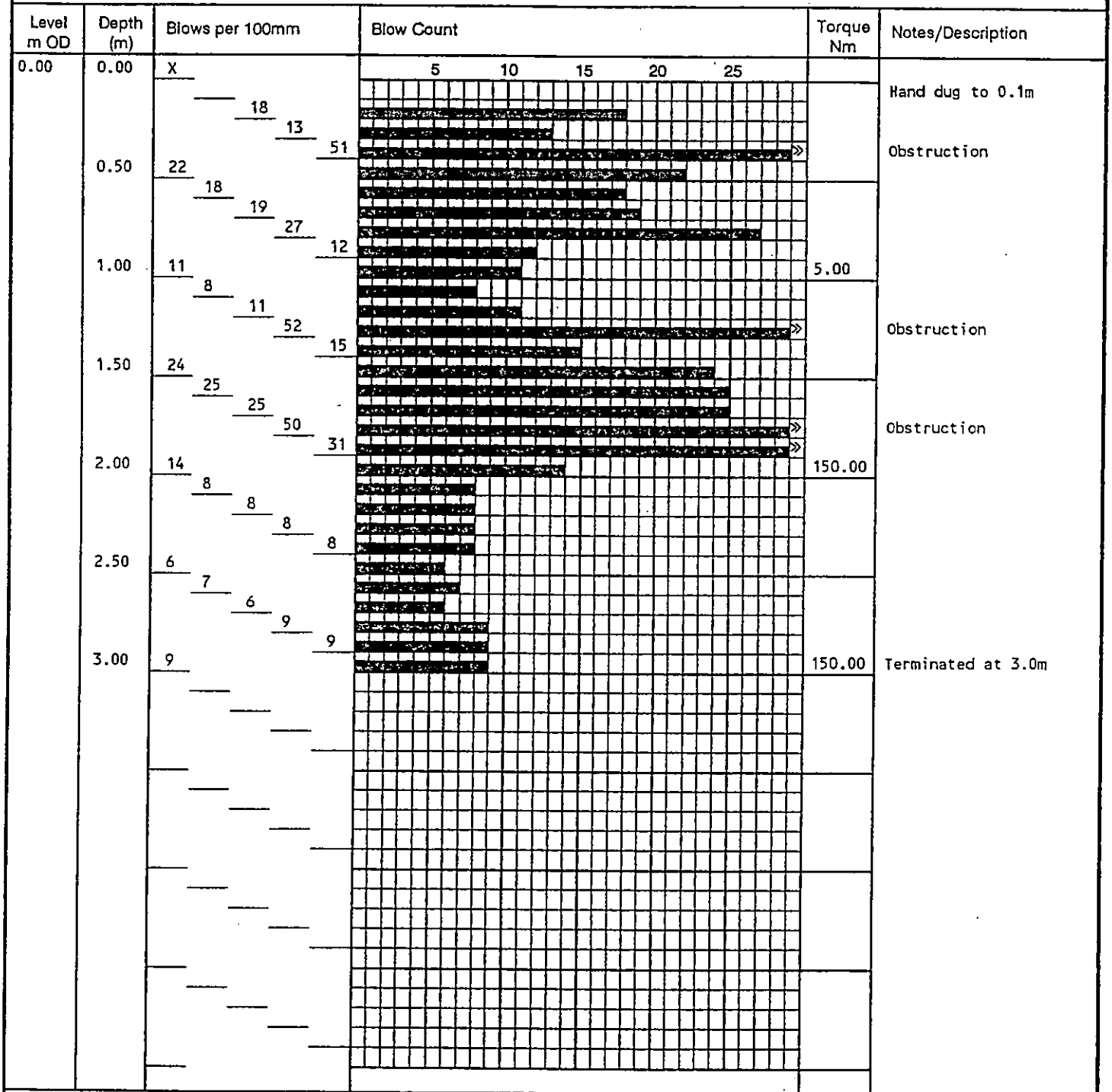
Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 7
Test No: 1
Date: 21/06/95
Sheet 1 of 1

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 3.00 m



Remarks Test in accordance with BS 1377: Part 9: 1990
Probe hole terminated at 3.0m in agreement with Engineer.

Form 57/1

Operator GD
Checked by GD

Continuous Dynamic Probing

Exploration Associates

Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 8
Test No: 1
Date: 22/01/06
Sheet 1 of 1

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 1.10 m

Level m OD	Depth (m)	Blows per 100mm	Blow Count	Torque Nm	Notes/Description
0.00	0.00	X	5 10 15 20 25		Hand dug to 0.3m
	0.50	14 15 14 15 20			
	1.00	39 50		0.00	Refusal at 1.1m: 10mm penetration with 50 blows.

Remarks Test in accordance with BS 1377: Part 9: 1990
Obstruction encountered at 1.1m:probe hole terminated.

Form 57/1

Operator GD
Checked by GD

Continuous Dynamic Probing

Exploration Associates

Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

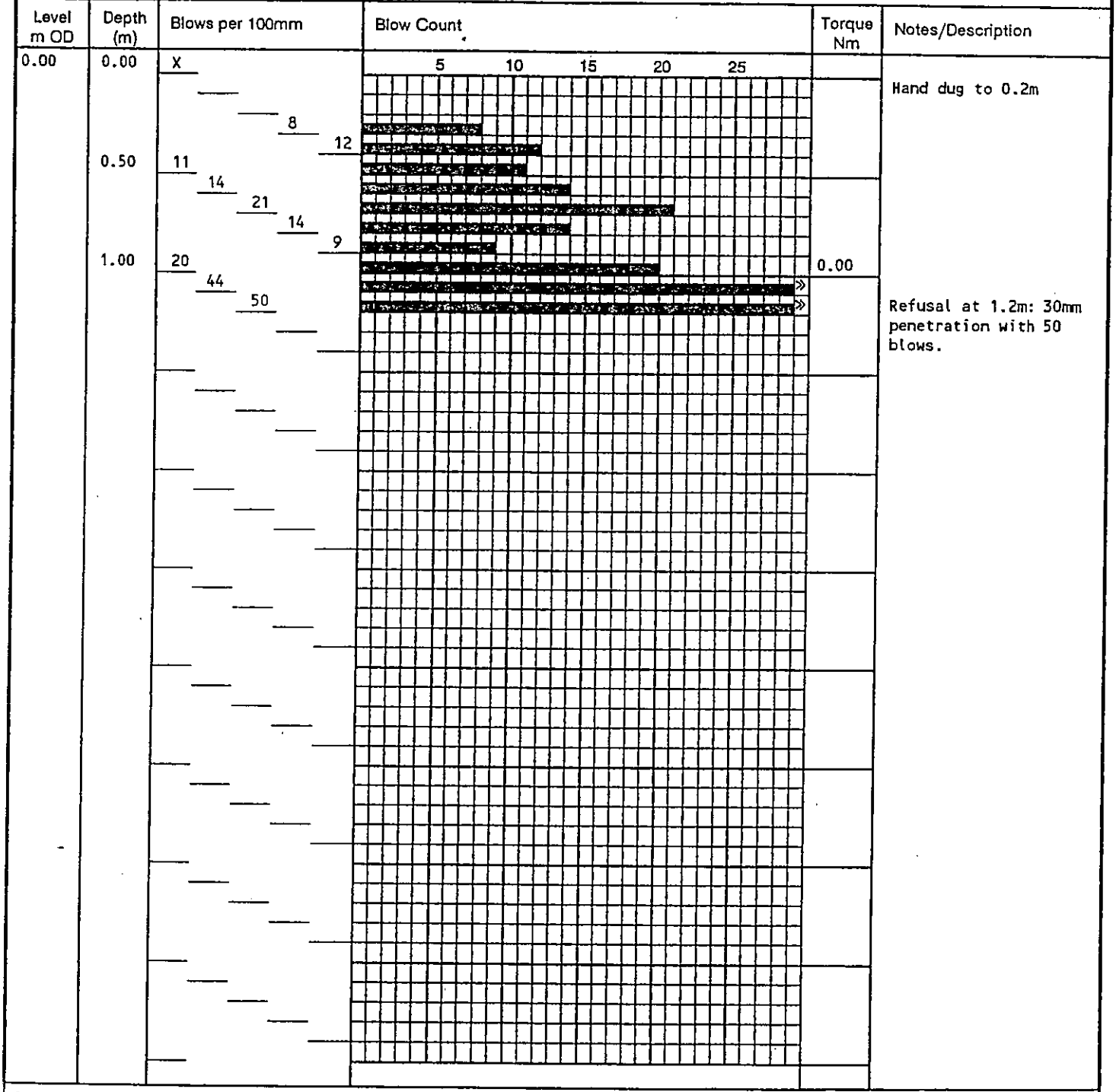
Figure N

Continuous Dynamic Probing Test Data Sheet

Borehole No: DP 8A
Test No: 1
Date: 21/06/95
Sheet 1 of 1

Backfilled: NO
Ground Level: m OD
Coordinates E N

Equipment: DPH
DPL (LRS10), DPH (SRS15), DPSH
Rod Type: 6 KA/M
Rod Diameter: 32 mm
Cone Type: 90 Degrees
Cone Diameter: 44 mm
Damper: NO Type:
Cone Tip Abandoned: YES at 1.20 m



Remarks Test in accordance with BS 1377: Part 9: 1990
Obstruction encountered at 1.2m: Probe hole terminated.

Form 57/1

Operator GD
Checked by GD

Continuous Dynamic Probing

Exploration Associates

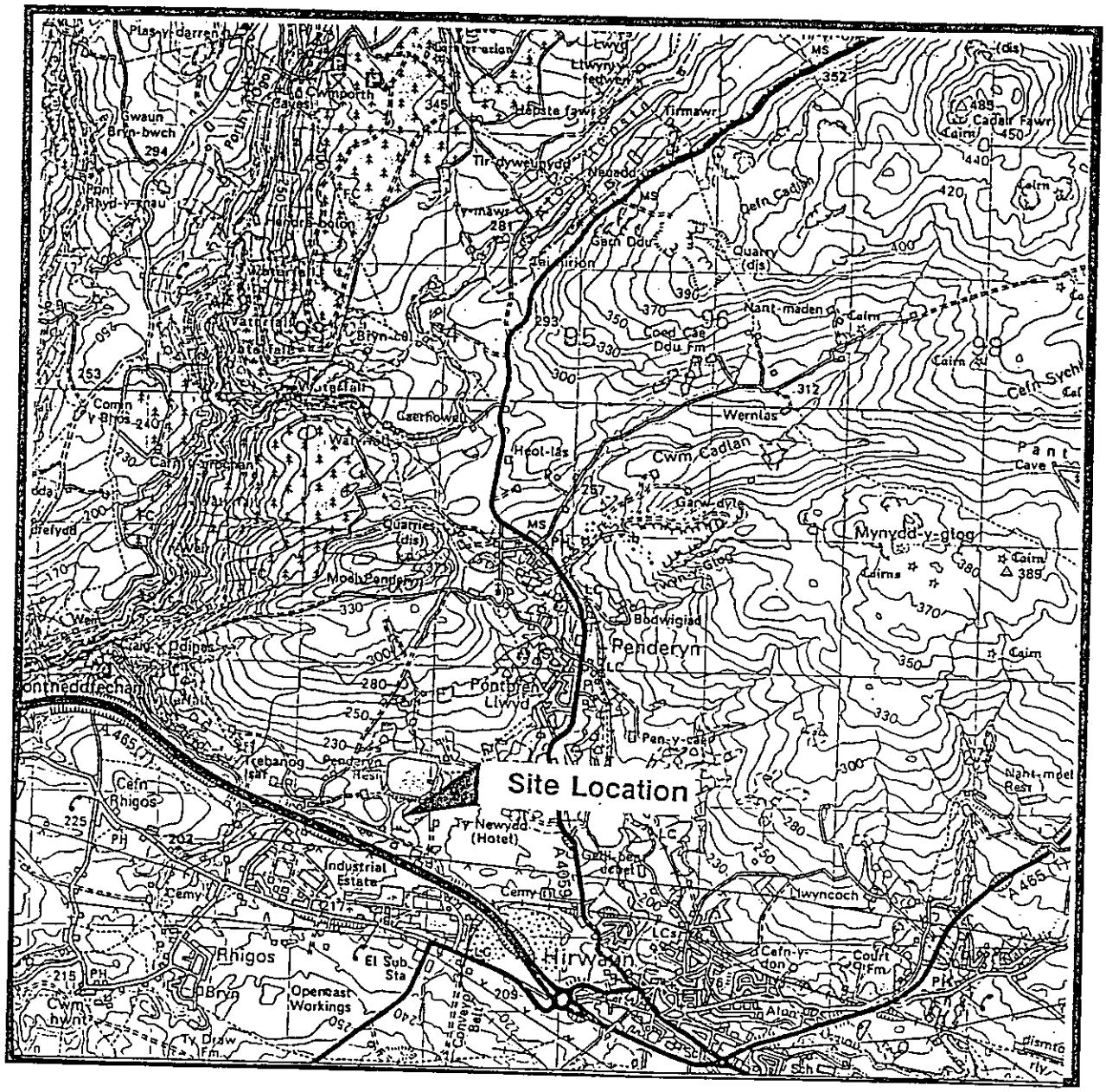
Project
17 Acre Site - Hirwaun
Welsh Development Agency

Contract 155102

Figure N

ENCLOSURE D

Drawings



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Scale 1:50,000

Site Location Plan	Project 17 Acre Site, Hirwaun Welsh Development Agency	Contract 155102	
Exploration Associates		Drawing	

APPENDIX

General Notes

- General Notes
- WDA Trial pit logs

General Notes

These notes, which accompany the ground investigation report, are intended to assist the user of the information contained in the report. They point out some inevitable shortcomings of any ground investigation and do not constitute a disclaimer of responsibility for the results obtained by Exploration Associates Limited.

1. The information in this report is based on the ground conditions encountered during the ground investigation work and the results of any field and laboratory testing. The exploratory records describe the ground conditions at their specific locations and should not be regarded as representative of the ground as a whole.

2. Ground investigations are performed by the company in general accordance with the recommendations in BS 5930 (1981) "Code of Practice for Site Investigations". The testing of soils, rocks and aggregates generally follow the recommendations of BS 1377 (1990) "Methods of test for soils for Civil Engineering Purposes", the International Society of Rock Mechanics (Brown, 1981) "Rock characterisation, testing and monitoring, ISRM suggested methods", and BS 812 (1975) "Methods of sampling and testing of mineral aggregates, sands and filters", respectively.

3. The primary purpose of ground investigation boreholes and trial pits is to probe the stratified sequences of soil and/or rock. From the results of these probings no conclusions should be drawn concerning the presence of size, lithological nature and numbers per unit volume of ground of cobbles and boulders in soil types such as glacial till (boulder clay).

4. When cable percussion boring techniques are used in superficial and drift deposits some mixing of thin-layered soils inevitably occurs. If strong randomly-occurring pieces of rock are encountered in soil material then the rock may be either pushed aside or penetrated and broken up in which case the arisings that are recovered may not be indicative of the nature of the material in situ.

5. Rotary drilling techniques may sometimes be used for drilling through superficial deposits and rocks in order to provide a very general indication of the nature of the ground. Where open-hole methods have been used for the ground investigation the description of the ground is based on the cuttings recovered from the flushing medium and the rate of progress in advancing the hole. Descriptions of strata and the depths of changes in strata may not be accurate under these conditions.

6. Groundwater conditions noted during boring may be subject to change through seasonal and/or other effects such as, for example, boring and constructional excavation. When a groundwater inflow is encountered during boring, work on the hole is suspended, typically for 20 minutes, and any change in level is recorded. The groundwater level recorded on resumption of boring may not be the natural pre-boring standing water level. When piezometers are installed in boreholes the reported groundwater levels may also be subject to variation due to seasonal and/or other effects.

7. The factual information contained within the ground investigation report should not be used for any purpose other than for the development project for which it was prepared unless a check has been carried out on its applicability. Where the ground investigation report contains an interpretation of the factual information that interpretation must be considered in the context of the stated development proposals and should not be used in any other context.

8. This report is for the use of the person or organisation that commissioned the work. Exploration Associates Limited accepts no responsibility if the information is used by any other party. The information is the property and copyright of the person or organisation that commissioned the investigation. It should not be reproduced or transmitted in any form without the owner's written permission.

March 1995

TRIAL PIT LOG

SITE Hinwaun Industrial Estate

TRIAL PIT N° 1

GROUND LEVEL

DATE 15th July 1985

SCALE 1.20

DESCRIPTION	LEVEL	LEGEND	DEPTH in metres	THICKNESS	DEPTH TO WATER
Subsoil	GL		0	75mm	
Light brown clay with angular stone			0.6	525mm	
dark brown clay with cobbles			1.1	500mm	No water encountered
dark brown clay with cobbles/stones			1.4	1100mm	

1

TRIAL PIT LOG

[redacted]

SITE Hirwaun Industrial Estate

TRIAL PIT N° 2

GROUND LEVEL

DATE 15th July 1988

SCALE 1:20

DESCRIPTION	LEVEL	LEGEND	DEPTH in metres	THICKNESS	DEPTH TO WATER
Subsoil	GL		0	75mm	
light brown clay with angular stone			1.0	925mm	
dark brown clay with cobbles			1.9	900mm	or water [illegible]
peat			2.4	500mm	
organic clay - stiff			3.0	600mm	

TRIAL PIT LOG

SITE Hirwaun Industrial Estate

TRIAL PIT N° 3

GROUND LEVEL

DATE 15th July 1988

SCALE 1:20

DESCRIPTION	LEVEL	LEGEND	DEPTH in metres	THICKNESS	DEPTH T. WATER
subsoil	G.L.		0	75 mm	
light brown clay with angular stone			0.6	725 mm	
dark brown clay with cobbles			1.9	1100 mm	no water encount.
peat / organic clay			2.9	1000 mm	

TRIAL PIT LOG

SITE Hirwaun Industrial Estate

TRIAL PIT N° 4

GROUND LEVEL

DATE 15th July 1988

SCALE 1:20

DESCRIPTION	LEVEL	LEGEND	DEPTH in metres	THICKNESS	DEPTH WATER
subsoil	G.L		0	75mm	
light brown clay with angular stone				525mm	
			0.6		
dark brown clay with cobbles				700mm	
			1.3		
mudstone / organic clay	water seepage			1700mm	
			2.0		

TRIAL PIT LOG

SITE Hirwain Industrial Estate

TRIAL PIT N° 5

GROUND LEVEL

DATE 15th July 1988

SCALE 1:20

DESCRIPTION	LEVEL	LEGEND	DEPTH in metres	THICKNESS	DEPTH TO WATER
	G.L.		0		
subsoil				100mm	
Light brown clay with angular stone			0.7	600mm	
dark brown clay with cobbles			1.6	900mm	
stiff boulder clay			2.8	1200mm	

TRIAL PIT LOG

SITE Hirwaun Industrial Estate

TRIAL PIT N° 6

GROUND LEVEL

DATE 15th July 1988

SCALE 1:20

DESCRIPTION	LEVEL	LEGEND	DEPTH in metres	THICKNESS	DEPTH WATER
subsoil	G.L.		0	75mm	
light brown clay with angular stone			0.8	725mm	
dark brown clay with cobbles				900mm	
Water seepage			1.7		
firm to stiff boulder clay			2.6	1100mm	

TRIAL PIT LOG

SITE Hirwaun Industrial Estate

TRIAL PIT N° 7

GROUND LEVEL

DATE 15th July 1988

SCALE 1:20

DESCRIPTION	LEVEL	LEGEND	DEPTH in metres	THICKNESS	DEPTH WATER
subsoil	G.L		0	75mm	
light brown clay with angular stone				725mm	
			0.8		
dark brown clay with cobbles				1900mm	
			2.7		