FABCO Holdings Ltd

Desk Study Report

August 2023

Plot E – Felindre Meadows, Pencoed

Report No. F230816

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Report for

FABCO Holdings Ltd

Desk Study Report **Report and Factual Report on Ground Investigation**

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1. INTRODUCTION

This report presents the results of a geological desk study, field investigations and in-situ testing undertaken both historically and for the purposes of this report.

The majority of the Felindre Meadows development area has been extensively investigated. A preliminary site investigation was carried out by Integral Geotechnique Ltd, under the supervision of Ove Arup and Partners in 1991 as part of the Sony Development.

A further extensive site investigation was carried in 2005 by Messrs Soil Mechanics Ltd, specifically for the development of Pencoed Technology Park. The Investigation covered the area now designated as Plot F, within which this proposed development will be undertaken. Information from this report has been utilised and referenced accordingly.

2. THE SITE

2.1 Location and Description

Plot E is located within the Felindre Meadows Development Area, otherwise known as Pencoed Technology Park. The overall development is situated to the North-East of Junction 35 of the M4 motorway, and East of Pencoed Town Centre.

Plot E is one of a number of development plots located within the Felindre Meadows development scheme.

The OS Grid Reference of the site is **SS97193 80900** and the site covers approximately 6.37 acres, with a developable plateau measuring approximately 1.1 acres. The topography is relatively flat, sloping very gently towards the North, with a level, pre-graded development plateau positioned generally against the southern boundary. The plot is bounded to the North, East and West by hedges, and to the south by stock fencing.

2.2 Archaeological History

An initial archaeological search has shown that the general region is historically rich.

An assessment of the potential for significant archaeological remains within the site, undertaken in 1991, is presented in the appendices.

2.3 Recent History

The recent history of the Felindre Meadows Development site has been studied on old Ordnance Survey Maps dating from 1877 and on aerial photographs since I946.

In 1877, the land was generally undeveloped, consisting of open fields. Felindre, Bryn-Cwtyn and Pant Ruthin Fawr Farms already existed, and the access tracks had also been constructed. A system of footpaths and footbridges traversed the site. In the north- east corner, the district boundary followed the centre of a linear hollow feature, and the Ewenny Fach River was unusually straight in this area. This suggests that the river had been straightened prior to 1877 and the hollow is probably the old river course. An artificially cut off meander can also be seen on the 1877 plan to the east of Bryn-Cwtyn on the Ewenny River. No further

development had occurred on the site by 1920, although the abandoned meander course was shown indistinctly and presumably was virtually obliterated.

By 1946, two very small buildings had been constructed near field boundaries on the eastern side of the site. These were probably small barns or sheds for agricultural use.

Jn 1954, earthworks were being carried out in the north of the site, marking the construction of Pencoed Cemetery.

By 1979, the new M4 motorway had been constructed in the south, the A473 has been built in the west; Felindre Road had been constructed in the north and realigned in the east. The two small barns/sheds had been dismantled. Bryn-Cwtyn Farm had been demolished by this time, but a small additional building had been constructed in the south-east.

In 1991 /1992 the existing Sony factory was developed across agricultural land to the west. The scheme included the construction of a surface car park in the western area of the site. As part of this development, ponds were formed to the south and south-west of the factory, and an access road, service station, hotel and fast food restaurant was built in the south-west corner of the area.

The construction of a new roundabout junction on Felindre Road to serve the new development of Pencoed Technology Park commenced in April 2006.

The proposal involved the construction of a new industrial access road into the new development and the provision of a new footway/cycleway from the Bridgend County Borough Council border to the development along the existing Felindre Road

Following completion of a series of development plateaus, subsequent development commenced with the construction of the Ortho Clinical Diagnostics research and development facility, currently occupied by the Johnson & Johnson Company.

Further development followed with the construction of a new Office building for South Wales Police Authority.

2.4 Published Geology

The published geological maps covering the site, BGS Sheet 261 and 262 Bridgend (1974) shows the solid geology to comprise Triassic mudstones overlain by superficial deposits comprising River Gravels.

2.5 Natural Cavities and Abandoned Mining

During the late 1980's, the Department of Environment commissioned geographical reviews on the influence of natural cavities and abandoned mine workings on ground surface stability (carried out by Applies Geology and Arup Geotechnics respectively).

Records of six natural cavities have been found within 2km of the site, although none are within the site boundary itself. The cavities were mostly "sink holes", recorded in areas where Carboniferous Limestone directly underlies the glacial sands. However, a sink hole in the Triassic Conglomerate was recorded at an opencast coal site east of Llanilid.

The abandoned mine workings database contains no records of workings beneath the site itself. The nearest recorded mine entrance was a small lead mine near to Ruthin, about 400m south of the site and within the Carboniferous Limestone. Furthermore, the geological

environment of the site is such that the likelihood of unrecorded mine workings is considered negligible.

3. PROPOSED DEVELOPMENT

The proposed development comprises of the construction of 16 light industrial units, built in 3 blocks in a courtyard type layout. The development will include an access road, car parking hard standings and associated drainage systems.

It is noted that the development will be similar in design and usage to that of an adjacent development on the area previously known as Plot F.

4. PREVIOUS SITE INVESTIGATIONS

4.1 1991 Investigations

A preliminary investigation was carried out for the Sony factory site and its surroundings between 22 January and 14 February 1991. The following investigation was carried out both within and adjacent to the site:

4.1.1 12 light cable percussive boreholes

4.1.2 6 boreholes extended by rotary coring.

4.1.3 27 machine excavated trial pits.

Piezometers were installed in two boreholes. In-situ and laboratory tests were undertaken on selected samples.

Borehole and trial pits logs, in-situ and laboratory test results are included in the appendices.

The location of boreholes and trial pits are shown in Figure 5.

4.2 2001 Investigations

A desk study report was produced by Ove Arup and Partners Ltd in November 2001. Existing historical data was used as part of a feasibility assessment for The Welsh Development Agency, who proposed the development of Pencoed Technology Park, encompassing Felindre Meadows.

4.3 2005 Investigations

A factual report on ground investigations was carried out by Soil Mechanics Ltd in November 2005, on behalf of Ove Arup and Partners.

The investigation was carried out as part of the wider technology park scheme, however a number of trial pits, in-situ testing and boreholes were carried out within Plot E and are presented in Appendix C.

5. GROUND CONDITIONS

5.1 Stratigraphy

The wider ground conditions encountered during the 2001 investigation may be summarised as follows:

Stratum	Thickness (m)
Topsoil	0.15-0.50
Transition Zone	Absent to 0.80
Alluvium	Absent to 2.00
Glacial Deposits	8.20 to over 17.70
Triassic	Not proved.
Carboniferous	Not proved.

5.2 Groundwater

Groundwater was generally encountered in the trial pits as slight and moderate seepages, between 2.3 and 3.6m below ground level.

Water level readings taken during the borehole drilling, did not encounter significant ground water inflows above 2.5m BGL.

5.3Topsoil and Transition Zone

The thickness of topsoil encountered was generally around 120mm, passing into a transition zone of up to 600mm thickness. This transition zone was a loose brown sandy, clayey silt with occasional fine to medium gravel and roots.

5.4 Alluvium

Alluvium was encountered in eleven trial pits and its extent corresponds to that shown on the published geology map. The maximum thickness encountered was 0.6m thick. The alluvium generally comprised loose to medium dense, light grey, orange brown and buff, slightly to very clayey, silty sand.

5.5 Glacial Deposits

5.5.1 General

Glacial deposits were present beneath the whole site, underlying the topsoil, transition zone and alluvium. They varied in thickness from 8.2m to over 17.7m. The glacial deposits were predominantly granular beneath most of the site with thin bands of cohesive material.

The cohesive deposits are interpreted to be boulder clay, deposited directly by glacial action. However, the granular deposits were probably of fluvioglacial origin, i.e. laid down by rivers flowing away from or marginal to the glacier.

5.5.2 Granular Glacial Deposits

The granular glacial deposits were predominantly a medium dense becoming dense, brown, very sandy fine to coarse sub-rounded to rounded gravel with some cobbles and occasional broken boulders.

5.5.3 Cohesive Glacial Deposits

The cohesive deposits were predominantly a firm to stiff, becoming very stiff, brown, maroon and yellow silty clay with some fine to coarse gravel. In BI-l's 3, 5, 7, 8 and 11, bands of soft yellow brown very silty clay were observed. These bands were between 1.1 and 3.5m thick and were found at depths of between 6.8 and 12m below ground level.

5.6 Bedrock Geology

5.6.1 Introduction

The bedrock was found at depths of between 9.1 and 14.4m across the site. However, the bedrock was not encountered in the extreme northern area, where at least 15 to 20m of drift cover was present.

5.6.2 Triassic Strata

Triassic rocks were encountered in five rotary cored boreholes, but probably underlie most of the site. These rocks were also encountered in previous boreholes along the motorway. In BH's 6, 11 and 13 Triassic Conglomerates were encountered whilst in BH's 3 and 5 Triassic Sandstones were found.

The conglomerate was a strong, in places moderately strong, thinly bedded medium grey and red-brown conglomerate, consisting of Carboniferous Limestones in a matrix of red-brown silty mudstones, generally clast supported. This stratum was formed in shoreline conditions by erosion of the adjacent Carboniferous Limestone and redeposition of the resultant cobbles in a marly matrix.

6. PRELIMINARY GEOTECHNICAL ADVICE

6.1 General

The preliminary site investigation was carried out some ten years ago.

6.2 Potential for Ground Surface Instability

There is some evidence from the desk study and site investigation that rising groundwater due to sub-artesian conditions is present at some locations near the centre of the site, however evidence of this was not encountered during trial excavations within the boundaries of Plot E development area.

Earthworks

Most excavations for formations, foundations and services will be in alluvium and glacial deposits and will be easily carried out using conventional earth moving equipment.

Groundwater was generally encountered between 3.0m and 4.5m below ground level and excavation in these areas may encounter some light seepages, depending on design depths.

Cut and fill earthworks to create the building platform has been completed. Existing topsoil should be removed and any obvious loose or soft areas excavated and replaced with suitable material, placed and compacted in accordance with an appropriate earthworks specification. Areas of fill should be constructed using suitable material placed and compacted in accordance with an approved earthworks specification.

Site-won excavated material from glacial sands and gravels generally will be suitable as fill for engineering purposes. Consolidation settlement beneath areas of fill is likely to be small and should be complete soon after the fill has been placed. In cut areas, the exposed formation should be proof rolled and any soft areas replaced with well-compacted granular material, typically to 300mm depth.

6.4 Foundations and Floor Slabs

Conventional pad and strip foundations are recommended for structures, taken into the glacial deposits of at least firm to stiff/medium dense consistency. Allowable bearing pressures will be typically in the range of 190kN/m2 to 250kN/m2

Although slab loads are not known, floor slabs will typically be ground bearing.

6.5 Car Parks, Access Roads and Hard Standings

In-situ California Bearing Ratio (CBR) tests were carried out along the new Felindre Meadows access road. Test results ranged from values of 4% to 7% in the alluvial and transition zone material close to the surface. It can be assumed that a CBR of 6% or better can be achieved for the suitable recompacted, site-won or imported fill.

In areas of access roads and car parks, a value of 5% should be provisionally assumed for formations in glacial deposits, although this may fall to 2% in wet weather where cohesive deposits are present at formation.

6.6 Protection of Buried Concrete

Sulphate content test results in the glacial deposits and groundwater indicated that buried concrete shall conform, as a minimum, to Class I of BRE Digest 363.

REFERENCES

Applied Geology (1990)- Natural Cavity Database Search for Pencoed, Bridgend; Report No. 10512.EJS for Ove Arup & Partners, December 1990.

Ove Arup & Partners (1990)- Review of Mining Instability in Great Britain; Volume I/iii Regional Report for Wales for the Department of Environment, July 1990.

GKN Foundations Ltd (1971) - Site Investigation for London - South Wales M4 Motorway, Capel Llanilterne - Pencoed Section; Report No. S2070, Volume II Part IA for Glamorgan County Council, June 1971.

Building Research Establishment (1998) - Sulphate and Acid Resistance of Concrete in the Ground, BRE Digest 363

Welsh Development Agency

Land at Pencoed, Bridgend

Desk Study Report

Welsh Development Agency

Land at Pencoed, Bridgend

Desk Study Report

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1. INTRODUCTION

The Welsh Development Agency are considering developing a site to the east and south of the existing Sony Factory at Pencoed near Bridgend. Arup have been commissioned to carry out a desk study of the site.

The majority of the site was previously examined in 1991 as part of the Sony Development. A preliminary site investigation was carried out at this stage by Integral Geotechnique Ltd. under the supervision of Ove Arup and Partners.

This desk study report presents the results of a historical and geological desk study and summarises the results of the previous site investigation. It gives preliminary geotechnical comments and recommends a minor additional investigation in the north-east corner at preliminary stage. Further detailed investigation will be required across the whole site once full proposals are known.

2. THE SITE

2.1 Location and Description

The site is located north-east of Junction 35 of the M4 motorway and east of the existing Sony factory to the east of Penrhos, Mid Glamorgan. The National Grid Reference of the centre of the site is SS970809, see Figure 1. It is bounded to the south by the M4, to the west by the A473 and the existing Sony Factory and to the north and east by Pelindre Road, see Figure 2.

The site covers approximately 65ha. The topography is relatively flat, sloping very gently towards the south-west. Shallow undulations occur locally across the site. The ground to the south of the motorway rises steeply onto a hillside sloping at about 1 on 6. A local shallow depression is present in the south east and a wet vegetated area is also located nearby, see Figure 2

The Ewenny Fach River flows through the site, entering in the north east corner and leaving in the south-west. Small ponds formed as part of the Sony Factory is situated in the south-west.

The majority of the land is currently undeveloped fields which are in agricultural use. A car park, access road and small building associated with the Sony Factory is situated along the western boundary. A farm called Pantruthin-Fawr is situates adjacent to the M4 motorway in the south-west, see Figure 2. A small road runs from this farm to Pelindre Road in the east. An earth bund is present between the factory and cemetery in the north-west.

2.2 Archaeological History

An initial archaeological search has shown that the general region is historically rich. In particular, the existing ground is very hummocky in a small area in the north west, the Ordnance Survey Map indicates an ancient "Moat" site.

An assessment of the potential for significant archaeological remains within the site, undertaken in 1991, is presented in Appendix A.

2.3 Recent History

The recent history of the site has been studied on old Ordnance Survey Maps dating from 1877 and on aerial photographs since 1946.

In 1877, the land was generally undeveloped, consisting of open fields; see Figure 3a. Pelindre, Bryn-Cwtyn and Pantruthin Fawr Farms already existed and the access tracks had also been constructed. A system of footpaths and footbridges traversed the site. In the north-east corner, the district boundary followed the centre of a linear hollow feature and the Ewenny Fach River was unusually straight in this area. This suggests that the river had been straightened prior to 1877 and the hollow is probably the old river course. An artificially cut off meander can also be seen on the 1877 plan to the east of Bryn-Cwtyn on the Ewenny River. No further development had occurred on the site by 1920, see Figure 3b, although the abandoned meander course was shown indistinctly and presumably was virtually obliterated.

By 1946, two very small buildings had been constructed near field boundaries on the eastern side of the site. These were probably small barns or sheds for agricultural use.

In 1954, earthworks were being carried out in the north of the site, marking the construction of Penrhos Cemetery.

By 1979, the new M4 motorway had been constructed in the south, the A473 has been built in the west; Pelindre Road had been constructed in the north and realigned in the east. The two

small barns/sheds had been dismantled. Bryn-Owtyn Farm had been demolished by this time but a small additional building has been constructed in the south east, see Figure 2.

All aerial photographs show depressions and surface features on the site, see Figure 2. A circular depression (A) is present in the north-east, marked on all air photographs since 1946. A local farmer indicated that this depression appeared suddenly, sometime in the late 1940s, as a "blister" on the ground surface. On piercing the "blister" with pickaxes, a release of groundwater occurred and the ground subsided to form the present depression feature. It is probable that the depression formed as a result of ground loss due to washing out of fines in the outburst of water. Two other small circular depressions were also observed on some aerial photographs but were absent on others; B and C, on Figure 2. The farmer has stated that the most recent depressions (B) was the result of a similar mechanism as discussed above, but on a smaller scale. This depression was quickly infilled, which explains its absence on later photographs. No details have been discovered about the nature of depression C.

Two small channel features are visible on all aerial photographs, south east of depression A and trending parallel with the River Ewenny; see Figure 2. These were dry and may indicate the positions of former issues. However, there are no indications of former springs in this area on the old ordnance survey maps.

In 1991/1992 the existing Sony factory was developed across agricultural land to the west. The scheme included the construction of a surface car park in the western area of the site together with a smaller structure, see Figure 2. As part of this development, ponds were formed to the south and south-west of the factory, and an access road, service station, hotel and fast food restaurant was built in the south-west corner of the site.

2.4 Published Geology

The geology of the site has been studies on British Geological Survey maps, Sheet SS 98 SE (1970 and 1984).

The 1970 map shows the site to be underlain by the littoral facies of the Mercia Mudstone. This unit was formerly known as the "Dolomite Conglomerate" and is a Triassic shoreline deposit. Carboniferous Limestone is shown outcropping on the hillside approximately 30m south of the site and these beds dip towards the north. The map shows the Undivided Millstone Grit Series outcropping some 100m north of the site and the base of the Coal Measures are conjectured to outcrop some 500m to the north.

However, the revised 1984 map shows that the majority of the site is underlain by Oxwich Head Limestone of the Carboniferous Limestone sequence with Undivided Namurian (Millstone Grit) present in the north, see Figure 4. The conjectural line of a fault is located in the north west, trending north-east to south-west.

Superficial deposits overlie the bedrock across all of the site. Alluvium is shown overlying the south-western and central areas, with river terrace deposits in the north-west and glacial boulder clay in the south-east. The boulder clay is probably present beneath the alluvium and river terrace deposits across the site. Head Deposits are shown in the extreme south, along the flanks of the Carboniferous Limestone hills, see Figure 4.

2.5 Natural Cavities and Abandoned Mining

During the late 1980's, the Department of Environment commissioned geographical reviews on the influence of natural cavities and abandoned mineworkings on ground surface stability (carried out by Applied Geology and Arup Geotechnics respectively). The databases from these studies have been consulted.

Records of six natural cavities have been found within 2km of the site, although none are within the site boundary itself. The cavities were mostly "sink holes", recorded in areas where Carboniferous Limestone directly underlies the glacial sands. However, a sink hole in the Triassic Conglomerate was recorded at an opencast coal site east of Llanfaethlu.

The abandoned mineworkings database contains no records of workings beneath the site itself. The nearest recorded mine entrance was a small lead mine near to Ruthen, about 460m south of the site and within the Carboniferous Limestone. Furthermore, the geological environment of the site is such that the likelihood of unrecorded mineworkings is considered negligible.

3. PROPOSED DEVELOPMENT

At the time of writing this report, the type and layout of the development is not known.

It is thought that industrial units are planned together with access roads, car parks and hardstandings. Depending on detailed proposals, the Ewenny Fach River could require diversion and culverts will be needed where access roads cross the river.

Earthworks will be necessary to create level building platforms. At this stage, these are not expected to exceed 2m of cut or fill and generally will be less.

4. PREVIOUS SITE INVESTIGATIONS

4.1 1971 Investigations

A site investigation was carried out along the southern and western boundaries of the site, drilled as part of the M4/A48 construction in the 1970s (see Reference 3).

The initial investigation was carried out by GKN Foundation Limited, five boreholes were located in the immediate vicinity of the site. Their locations are shown on Figure 5. Borehole logs and laboratory test results are presented in Appendix B and C.

During the construction of the M4, it is reported that ground surface subsidence occurred in the south and west and a further investigation was carried out to search for solution cavities within the Mercia Mudstone and Carboniferous Limestone bedrock. At least one solution cavity was encountered in a borehole in this investigation.

4.2 1991 Investigation

A preliminary investigation was carried out for the Sony factory site and its surroundings between 22 January and 04 February 1991. The following investigation was carried out on the site currently being considered.

- 12 light cable percussive boreholes
- 6 boreholes extended by rotary coring
- 27 mechine excavated trial pits

Piezometers were installed in two boreholes. In-situ and laboratory tests were undertaken on selected samples.

Borehole and trial pits logs, in-situ and laboratory test results are included in the Appendix B and C.

The locations of boreholes and trial pits are shown in Figure 5.

5. GROUND CONDITIONS

5.1 Stratigraphy

The ground conditions encountered during the investigation are illustrated on the cross-sections in Figures 6a and 6b. The stratigraphy may be summarised as follows:

Stratum	Thickness (m)
Topsoil	0.15-0.50
Transition Zone	Absent to 0.80
Alluvium	Absent to 2.00
Glacial Deposits	8.20 to over 17.70
Triassic	Not proved
Carboniferous	Not proved

5.2 Groundwater

Groundwater was generally encountered in the trial pits as slight and moderate seepages, between 2.0 and 3.6m below ground level. Trial pits 19, 22, 35 and 36 were close to the Twenty Fach River or its tributaries, and these encountered seepages at shallower depths. TP 23, located in a low area, also encountered shallow seepages.

TP34 was excavated in a particularly wet field and was located near the depression A observed on aerial photographs and discussed in Section 2.3. Here, the groundwater ingress was very rapid from a depth of 1.0m causing large scale instability of the pit and it proved impractical to excavate below 1.5m.

Water level readings taken during the borehole drilling, together with limited piezometric levels are presented in Table 1. These levels are also shown on the sections in Figures 6a and 6b. The levels indicate that the phreatic surface varies between 31.4mAOD in the north-east and 25.5m AOD in the south-west.

During the light cable percussive boring of BH3, the water level was observed to be at 28.2mAOD. However, when the borehole was subsequently extended by rotary coring into the rock, the water level rose quickly to 30.7mAOD, indicating the sub artesian water pressure within the bedrock at this location. This is also located quite close to depression A.

5.3 Topsoil and Transition Zone

The thickness of topsoil encountered was generally around 300mm, passing into a transition zone of up to 800mm thickness. This transition zone was a loose brown sandy, clayey silt with occasional fine to medium gravel and roots.

5.4 Alluvium

Alluvium was encountered in eleven trial pits and its extent corresponds to that shown on the published geology map; see Figure 5. The maximum thickness encountered was 2.0m in TP32, but generally it was around 0.6m to 0.7m thick. The alluvium generally comprised loose to medium dense, light grey, orange brown and buff, slightly to very clayey, silty sand.

BOREHOLE NO	WATER DEPTH DURING DRILLING (m)	WATER LEVEL DURING DRILLING (mAOD)	PIEZOMETER WATER LEVEL (mAOD)	
			6.2.91	19.2.91
3	1.4	28.19		
4	3.1-3.8	26.52-27.22		
5	3.1-3.1	25.25-25.55		
6	2.2	26.71		
7	4.6-4.7	26.35-26.45	26.85	26.55
8	2.1-4.6	27.75-30.25		
9	2.8-7.3	26.83-31.30		
10	2.6-3.2	29.88-30.48		
11	1.1-1.6	30.9-31.4		
12	2.5	30.8		
13	1.1	29.91		30.71
14	2.15-2.7	27.88-28.43		
BH	0.9	30.69		

TABLE 1 GROUNDWATER OBSERVATIONS

5.5 Glacial Deposits

5.5.1 General

Glacial deposits were present beneath the whole site, underlying the topsoil, transition zone and alluvium. They varied in thickness from 8.2m to over 17.7m. The glacial deposits were predominantly granular beneath most of the site with thin bands of cohesive material. However, in the centre of the site, they were predominantly cohesive; e.g. Boreholes 3, 13 and 14.

The cohesive deposits are interpreted to be boulder clay, deposited directly by glacial action. However, the granular deposits were probably of fluvioglacial origin, i.e. laid down by rivers flowing away from or marginal to the glacier.

The sections in Figure 6a and 6b show conjecturally that the cohesive and granular deposits interdigitate, as a result of minor advances and retreats of the glaciers during deposition of the sequence. Consequently, some of the gravels probably have been overriden and reworked by glacial action.

In the extreme south west (BH5), medium dense/loose sands were encountered beneath the fluvioglacial gravels. These represent deposition in quieter conditions, possibly a temporary glacial lake.

5.5.2 Granular Glacial Deposits

The granular glacial deposits were predominantly a medium dense becoming dense , brown, very sandy fine to coarse sub-rounded to rounded gravel with some cobbles and occasional broken boulders.

5.5.3 Cohesive Glacial Deposits

The cohesive deposits were predominantly a firm to stiff, becoming very stiff, brown , maroon and yellow silty clay with some fine to coarse gravel. In BH's 2, 5, 7, 8 and 11, bands of soft yellow brown very silty clay were observed. These bands were between 1.1 and 3.5m thick and were found at depths of between 6.8 and 12m below ground level. However, the consistency of this material has probably been affected by a differential hydraulic head causing uplift to the soil at the bottom of the casing during drilling. In cases where this differential hydraulic head was prevented from occurring by maintaining a head of water in the borehole, the material was observed to have a firm consistency.

5.6 Bedrock Geology

5.6.1 Introduction

The bedrock was found at depths of between 9.1 and 14.4m across the site. However, the bedrock was not encountered in the extreme northern area, where at least 15 to 20m of drift cover was present. Triassic rocks generally underlie the site at most borehole locations, but Carboniferous rocks were present directly beneath the drift in Boreholes 9 and 14. This suggests that the upper surface of the underlying Carboniferous is irregular and the Triassic has to some extent infilled the irregularities.

5.6.2 Triassic Strata

Triassic rocks were encountered in five rotary cored boreholes, but probably underlie most of the site. These rocks were also encountered in previous boreholes along the motorway. In BH's 6, 11 and 13 Triassic Conglomerates were encountered whilst in BH's 3 and 5 Triassic Sandstones were found.

The conglomerate was a strong, in places moderately strong, thinly bedded medium grey and red brown conglomerate, consisting of Carboniferous Limestones in a matrix of red-brown silty mudstones, generally clast supported. This stratum was formed in shoreline conditions by erosion of the adjacent Carboniferous Limestone and redeposition of the resultant cobbles in a marly matrix.

Small solution cavities (5mm to 30mm diameter) were found in the cores, probably due to solutional weathering of calcite crystals originally deposited in the matrix. Also, small falls were recorded during drilling indicating clay infilled solution cavities, varying from 10mm to 1100mm high and probably following the bedding planes.

The sandstone was a moderately strong to strong, light grey thinly bedded calcareous fine sandstone, dipping at approximately 9°. Small inter-connected and unconnected solution cavities were present in the cores. In BH3 the sandstone was underlain by bands of siltstone and mudstone. This borehole also showed a 0,9m core loss and rapid penetration was recorded by the driller at about 1.6m below the bedrock surface. This could indicate a solutionally widened fissure or cavity, infilled with soft clay.

5.6.3 Carboniferous Strata

Carboniferous rocks were encountered in BH 9 and 14, where alternating mudstones and sandstones, probably of the Millstone Grit Series were found. In BH3, Carboniferous Limestone may have been encountered at the base.

The mudstones were weak, occasionally very weak, grey, very finely bedded fissured silty mudstone with the bedding nearly horizontal. This material was weathered in parts to a stiff brown silty clay. Lamellibranch fossils were observed at some locations in the cores.

The sandstones were moderately strong light yellow-grey thinly to medium bedded sandstone. The sandstones graded upwards into mudstone strata via a thin transition zone consisting of a dark grey and brown laminated siltstone and sandstone.

The Carboniferous Limestone may have been encountered at the base of BH3, proven for some 0.4m. It was a strong, medium grey re-crystallised limestone.

6. PRELIMINARY GEOTECHNICAL ADVICE

6.1 General

The preliminary site investigation was carried out some ten years ago. In the absence of details of the proposed development, particularly structure locations and details of loadings, the comments below are for guidance only, and will need to be confirmed by detailed investigation when firm development proposals are known, see Section 6.7.

6.2 Potential for Ground Surface Instability

There is some evidence from the desk study and site investigation that rising groundwater due to sub-artesian conditions is present at some locations near the centre of the site. In BH3, a high water level was encountered whilst rotary coring the rock, suggesting that a sub-artesian water pressure was present at this location. Also, the accounts of the two surface "blisters" and resulting depressions discussed in Section 2.3, one of which was located some 100m from BH3, suggests that artesian water pressures have occurred from time to time. High water pressures were not present in BH5 and 11 nearby, and hence the limits of this phenomenon are unknown. The extent will need to be confirmed by a detailed investigation and sub-artesian conditions will need to be accommodated for in the design.

Small solution features and interconnected channels have been observed in the rock cores and during drilling. There is a potential that ground loss could occur into these solution features, resulting in subsidence of the overlying ground. It is reported that ground surface subsidence occurred during the construction of the M4 motorway in the south, see Section 4.1. However, the solution cavities encountered during this investigation were generally small and in addition, some 9 to 15m of drift cover was present across the site. This indicates that the likelihood of cavities migrating to the surface is very small and the potential for ground surface instability occurring due to this process is therefore considered to be very low.

6.3 Earthworks

Most excavations for formations, foundations and services will be in alluvium and glacial deposits and will be easily carried out using conventional earth moving equipment.

Groundwater was generally encountered between 2.6m and 4.5m below ground level, although in local areas, the water level was slightly higher. Excavation in these areas may encounter some seepages, depending on design depths and locations. These may be dealt with by pumping from sumps within the excavations. However, high ground water levels were met in BH13 and TP34 and it may become difficult to dewater excavations in this area without sheet pile cut-offs and possibly a wellpoint dewatering system. Permanent drainage will probably be necessary in this area, see below.

Minor cut and fill earthworks will be required to create building platforms. In fill areas, existing topsoil should be removed and any obvious loose or soft areas excavated and replaced with suitable material, placed and compacted in accordance with an appropriate earthworks specification. The areas of fill should be constructed using suitable material placed and compacted in accordance with an approved earthworks specification.

Site won excavated material from glacial sands and gravels generally will be suitable as fill for engineering purposes. Consolidation settlement beneath areas of fill are likely to be small and should be complete soon after the fill has been placed. In cut areas, the exposed formation should be proof rolled and any soft areas replaced with well-compacted granular material, typically to 300mm depth.

A careful watch should be maintained in cut and fill areas for zones of sub-artesian groundwater conditions, where provisions for permanent drainage to relieve water pressures may be necessary. This should be confirmed by the findings of a detailed investigation, see Section 6.7

6.4 Foundations and Floor Slabs

Conventional pad and strip foundations are provisionally recommended for structures, taken into the glacial deposits of at least firm to stiff/medium dense consistency. Allowable bearing pressures will vary with depth and position on site, typically in the range of 150kN/m² to 300kN/m².

Although slab loads are not known, floor slabs are likely to be ground bearing.

Sub-artesian groundwater and the potential for ground surface instability should be accommodated for in the design where necessary.

6.5 Car Parks, Access Roads and Hardstandings

In-situ California Bearing Ratio (CBR) tests were carried out in the area of the proposed demolition of the A473. Test results ranged from values of 2% to 5% in the alluvial and transition zone material close to the surface. The location and elevation of the road is not known, however, if the road is to be built on a 1 to 2m high embankment, it can be assumed that a CBR of 6% or better can be achieved for the suitable recompacted, site-won or imported fill.

In areas of access roads and car parks, a value of 5% should be provisionally assumed for formations in glacial deposits, although this may fall to 2% in wet weather where cohesive deposits are present at formation. In-situ and recompacted CBR values in the transition zone and alluvium were low and will be susceptible to deterioration due to trafficking and wet weather. Where these materials are exposed at formation level, it is recommended that a CBR value of 1 shall be assumed at this stage.

6.6 Protection of Buried Concrete

Sulphate content test results in the glacial deposits and groundwater indicated that buried concrete shall conform, as a minimum, to Class 1 of BRE Digest 363 (see Reference 4). However, individual tests in the alluvium and weathered conglomerate gave values of 0.25% and 0.3% indicating Class 2 conditions. These values should be confirmed by further tests at detailed investigation stage.

6.7 Further Site Investigation

No site investigation has been undertaken in the north east corner of the site, since this was not part of the site area examined in 1991. It is considered likely that similar ground conditions are present in this area as observed along the River Ewenny to the south west. To confirm or otherwise this interpolation, it is recommended that 4-5 trial pits are excavated in this area at the preliminary stage.

A detailed site investigation should be carried out once development details are known including layouts and loadings. The investigation should be designed to provide sufficient information to confirm design parameters for foundations, floor slabs, car parks, roads and earthworks. In particular, however, the investigation must take account of the need to assess, in detail, the implication of the following on design:

- Sub-artesian groundwater within the bedrock, possibly resulting in surface up welling and ground surface instability, and where it is confined
- Potential for ground loss and surface subsidence into solution cavities within the underlying bedrock.

Typically, the investigation would consist of additional soft ground boreholes across building footprints, together with rotary coring and open hole boring to identify the bedrock geology and investigate solution cavities and groundwater levels. Allowance should be made for installing piezometers to measure groundwater pressures. Additional trial pitting is also recommended to investigate the near surface deposits in detail, particularly where car parks and access roads are planned.

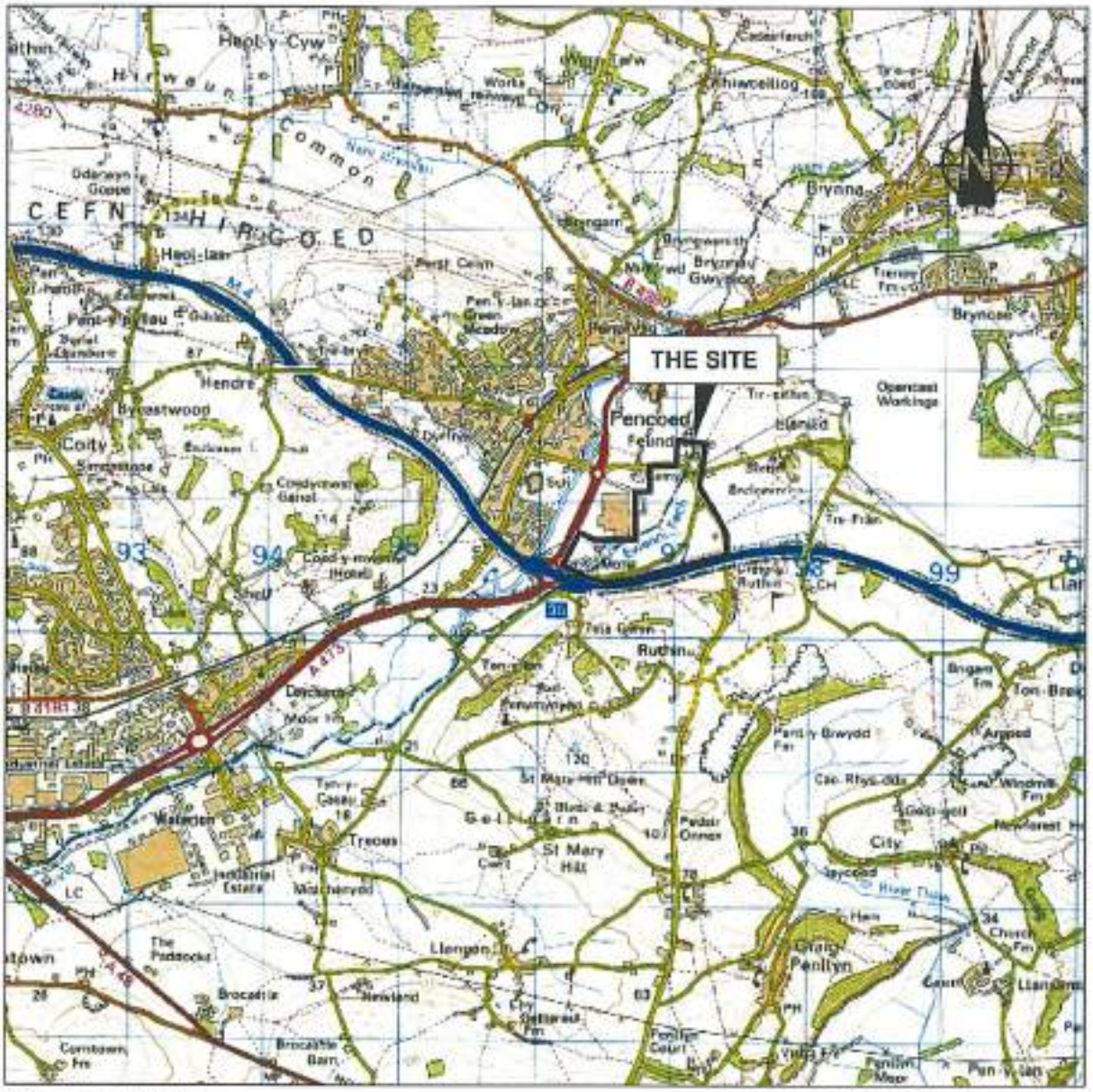
REFERENCES

1. Applied Geology (1990) – Natural Cavity Database Search for Pencoed, Bridgend, Report No. 39512.1/15 for Ove Arup & Partners, December 1990.

2. Ove Arup & Partners (1990) – Review of Mining Instability in Great Britain. Volume 16(i) Regional Report for Wales for the Department of Environment. July 1990

3. GKN Foundations Ltd (1971) – Site Investigation for London – South Wales M4 Motorway. Capel Llanilterne – Pencoed Section; Report No. S2070. Volume II Part 1A for Glamorgan County Council, June 1971.

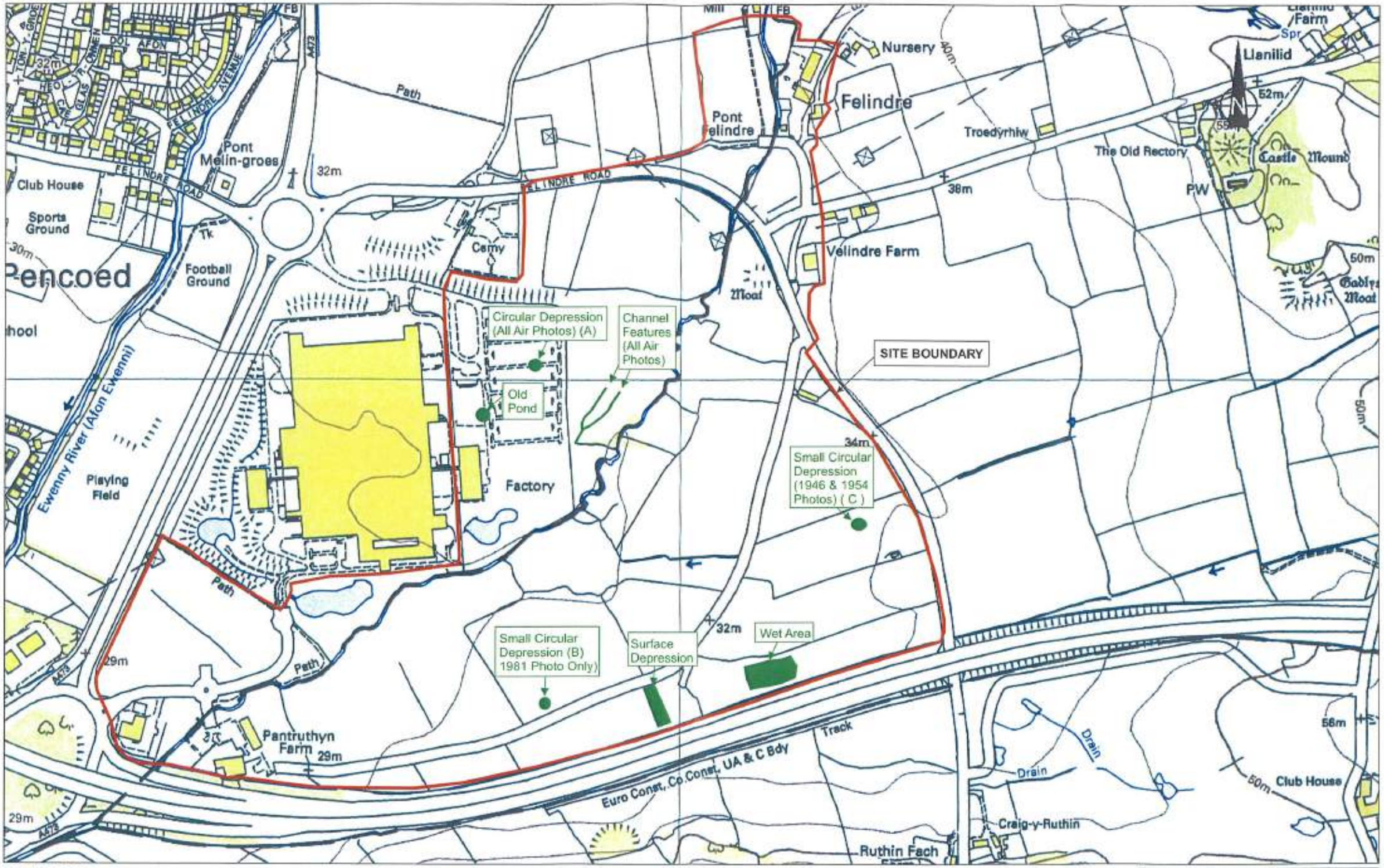
4. Building Research Establishment (1998) – Sulphate and Acid Resistance of Concrete in the Ground, BRE Digest 363.



SCALE - 1: 50000

SITE LOCATION

67975 FIGURE **1**



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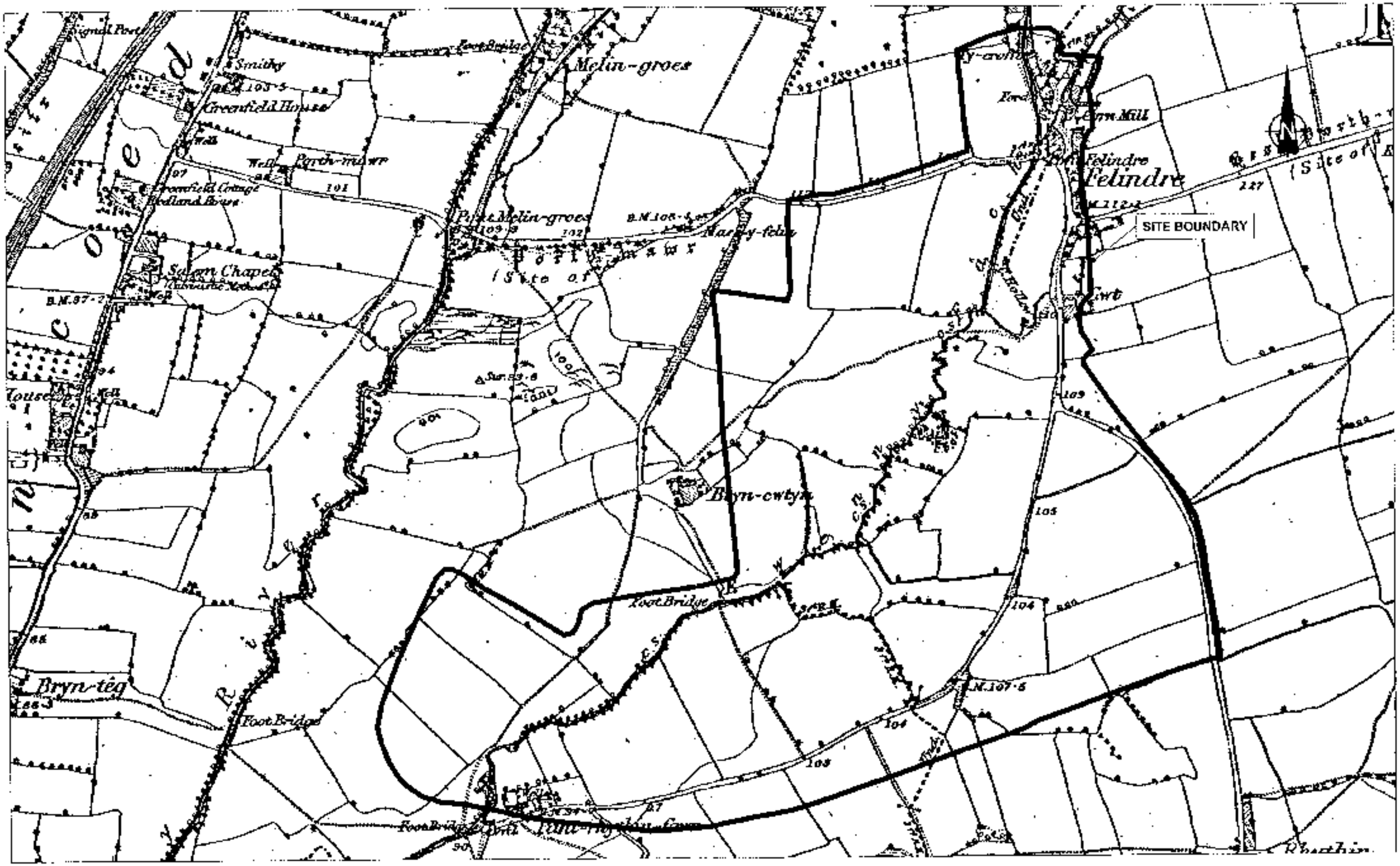
SITE LAYOUT AND SURFACE FEATURES

67975 FIGURE **2**



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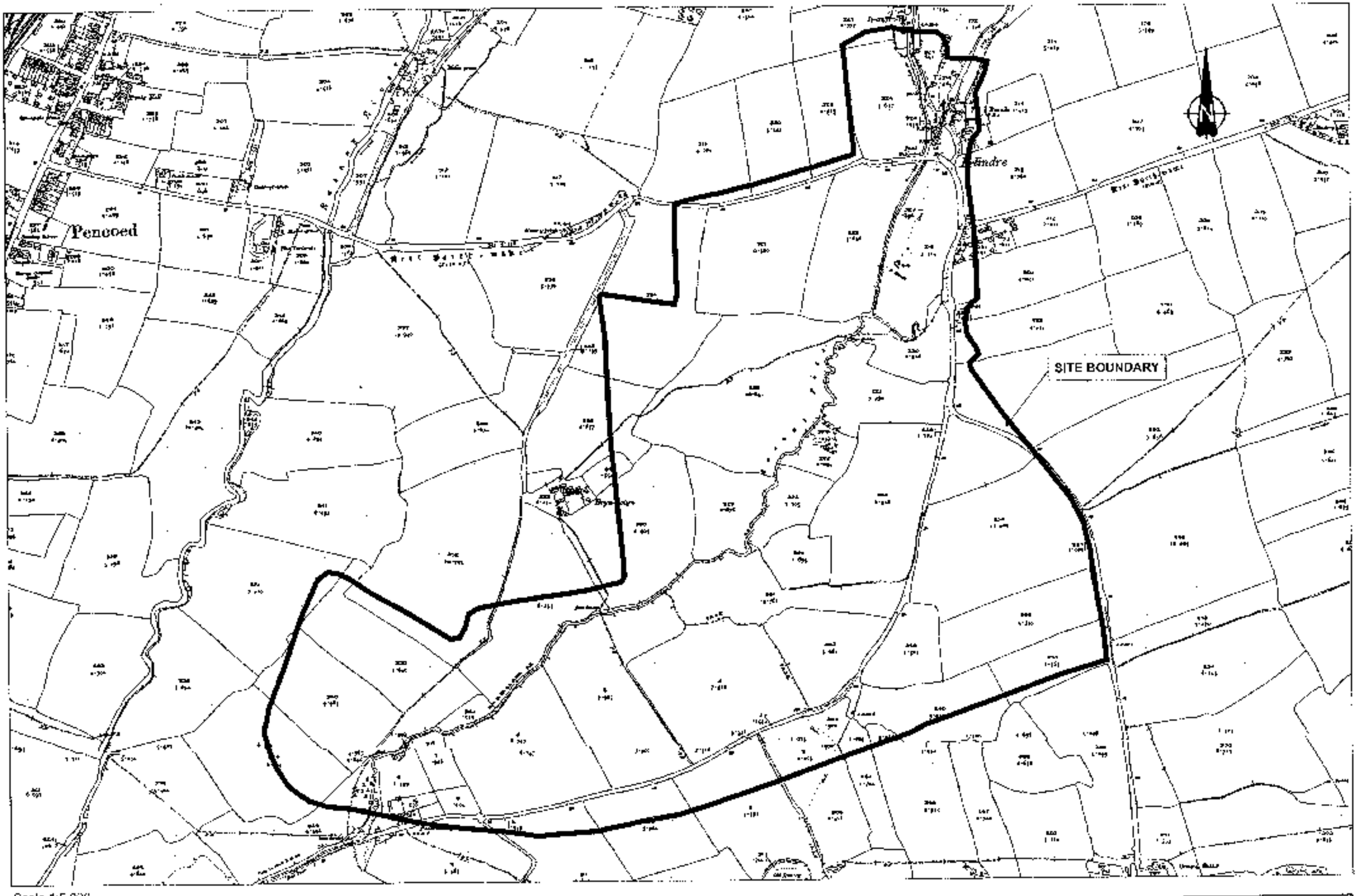
HISTORY 1875

67975 FIGURE 3a



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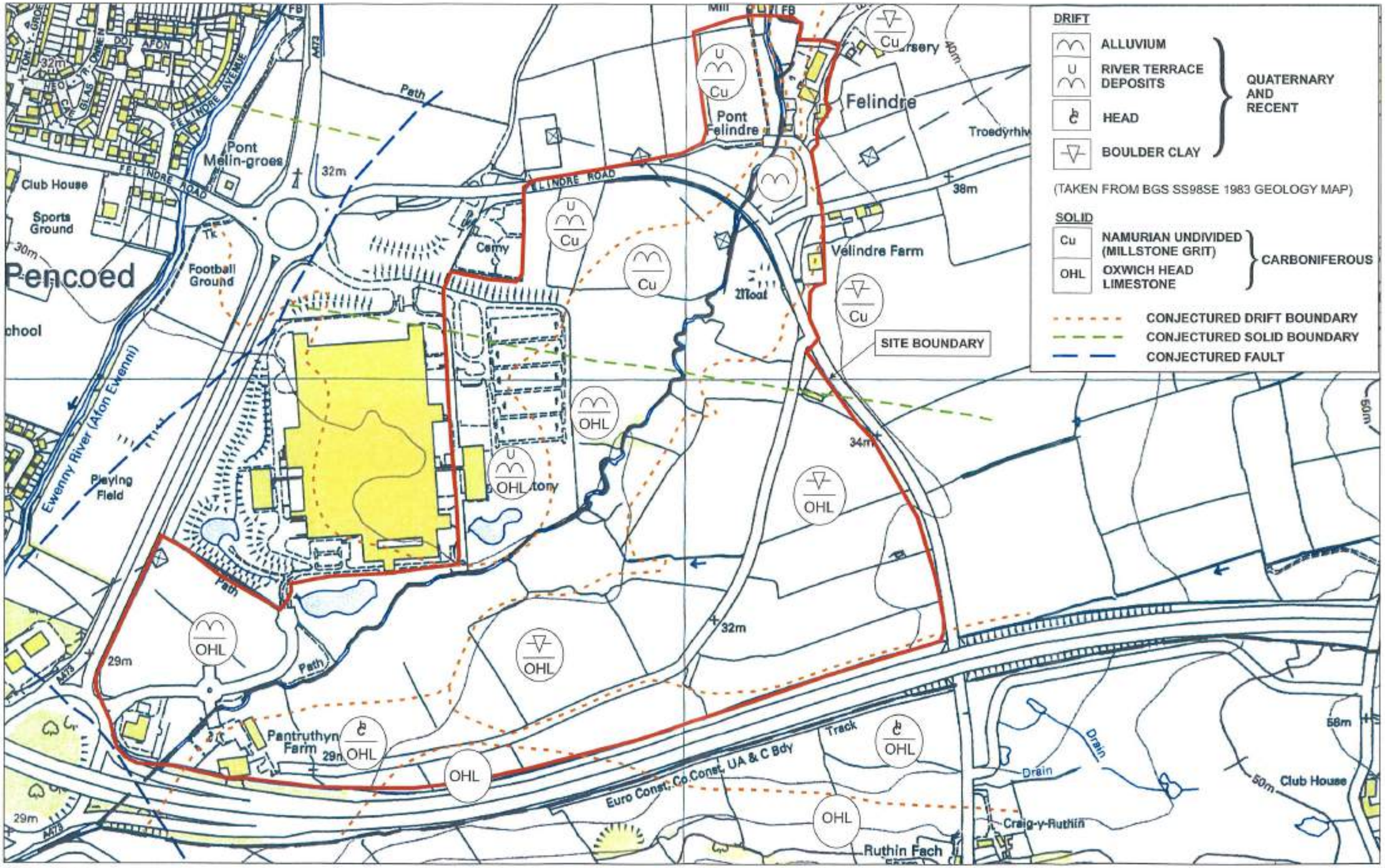
HISTORY 1920

67975 FIGURE **3b**



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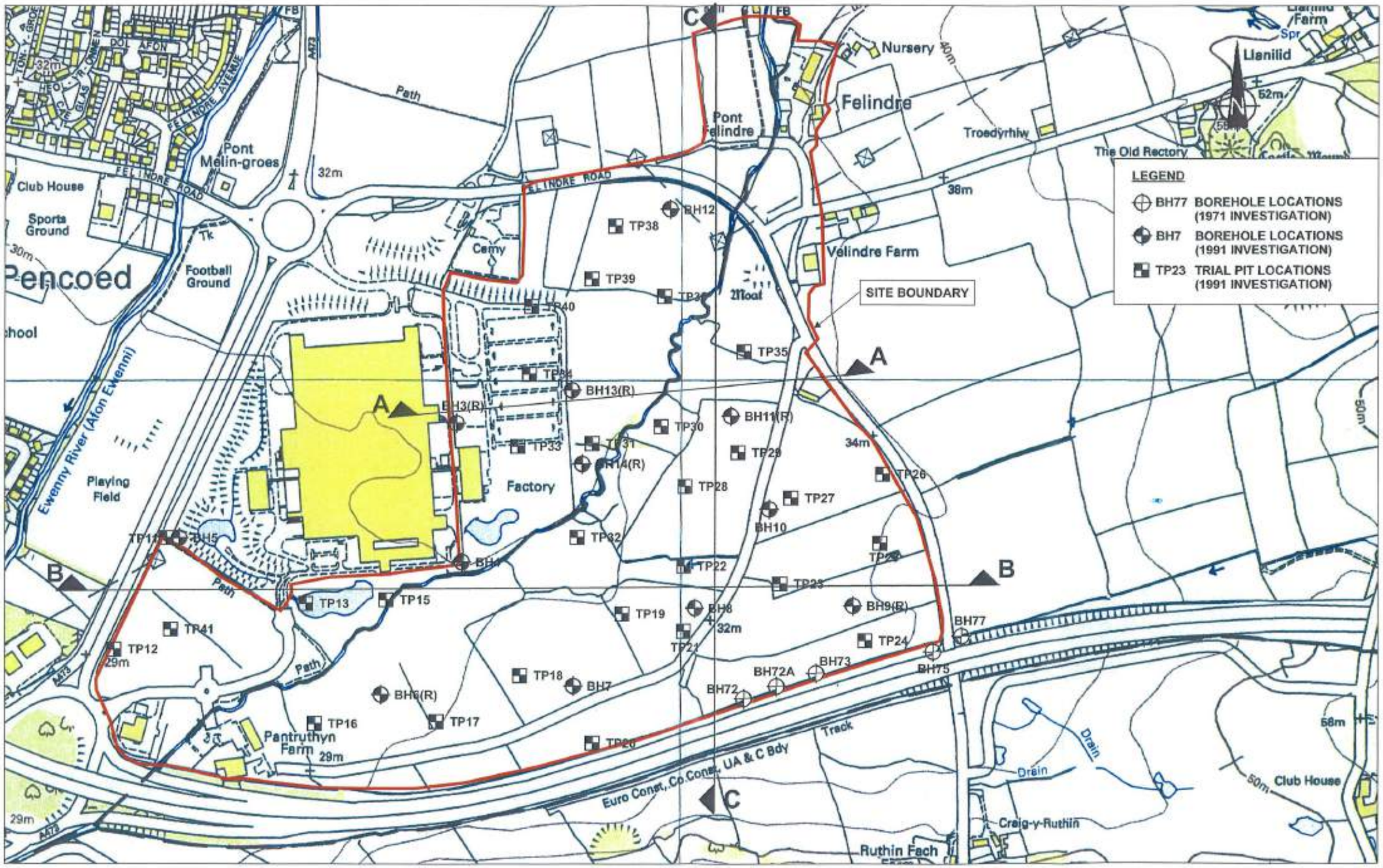
PUBLISHED GEOLOGY

67975 FIGURE **4**



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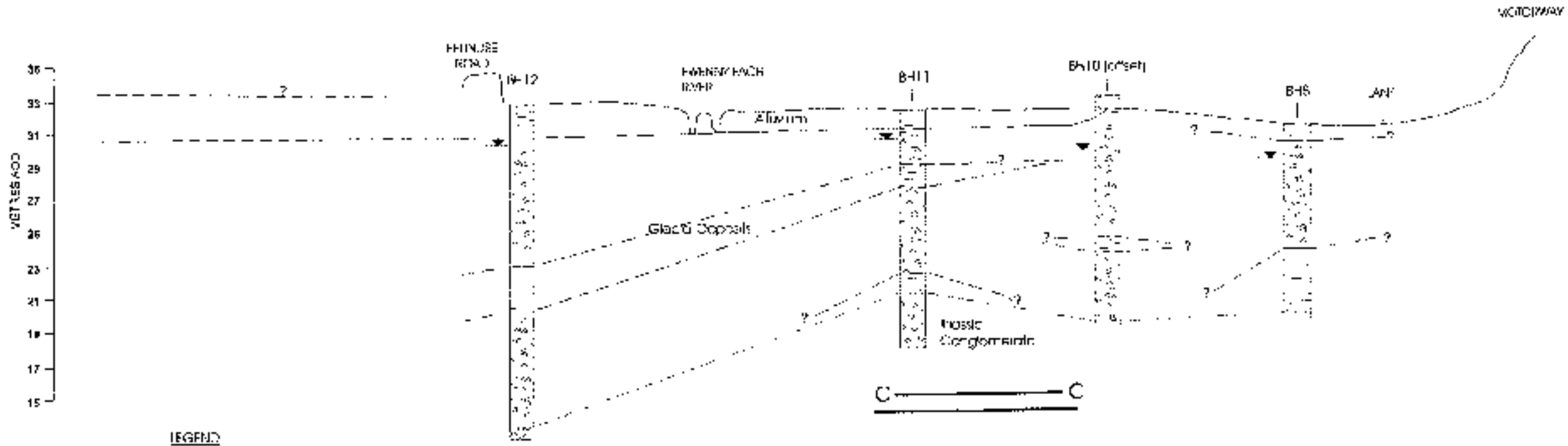
EXPLORATION HOLE POSITIONS - PREVIOUS SI

67975 FIGURE **5**



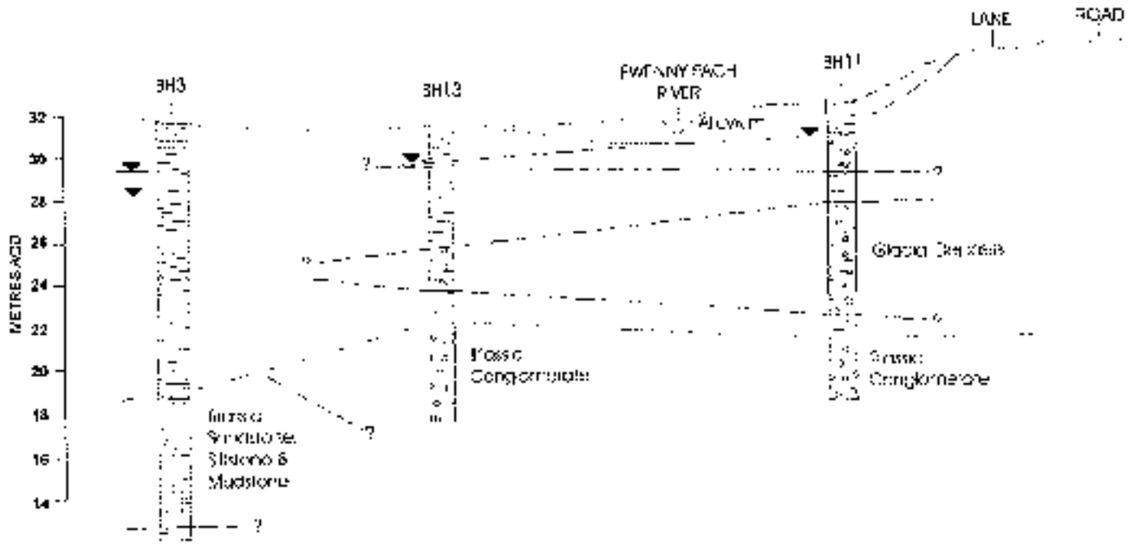
LEGEND

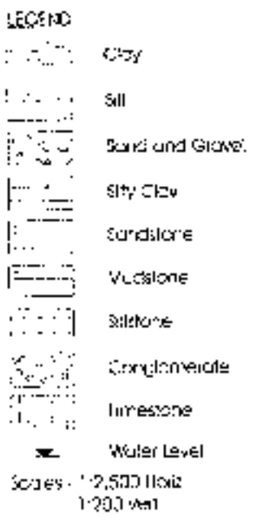
- Clay
- Silt
- Sand and Gravel
- Sandstone
- Mudstone
- Siltstone
- Conglomerate
- Water Level

Scales - 1:2,500 Horiz
1:200 Vert

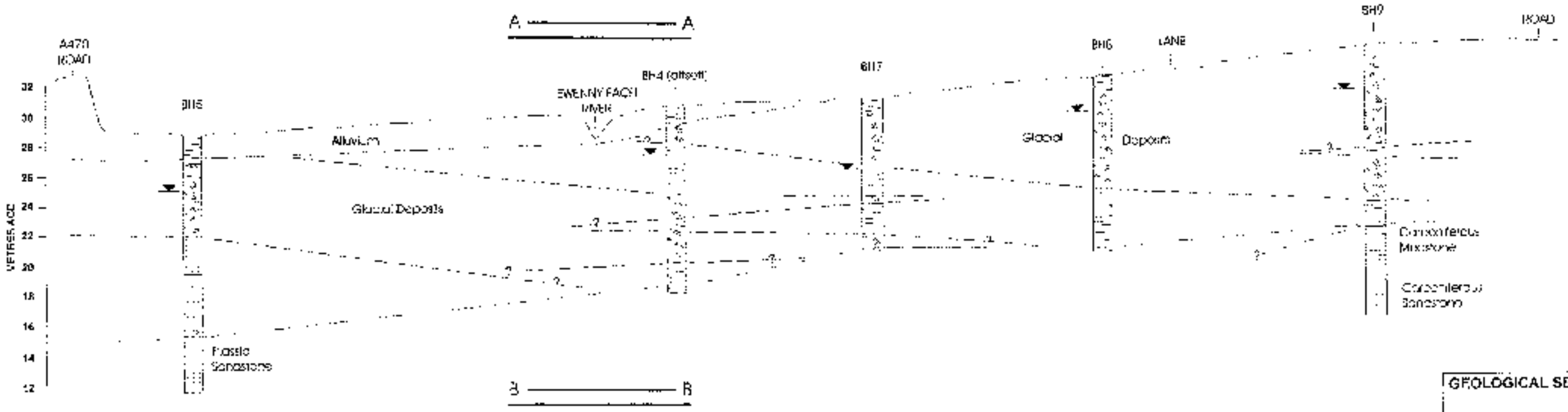
GEOLOGICAL SECTION

67975 FIGURE 6b





A ——— A



B ——— B

GEOLOGICAL SECTIONS

07975 FIGURE 6a

APPENDIX A

1991 ARCHAEOLOGICAL STATEMENT

ARCHAEOLOGICAL POTENTIAL OF SONY PENCOED SITE

1.0 INTRODUCTION

The potential for significant archaeological remains within the Pencoed site has been studied from the following sources:-

- old ordnance survey plans
- published historical and archaeological accounts
- the public record of Sites and Monuments.

The latter source is part of the official Welsh archaeological archive which is continually updated by the Glamorgan - Gwent Archaeological Trust on behalf of CADW.

2.0 GENERAL HISTORY

The site has a well established farming history and was associated with the Knights of St John of Jerusalem, whose main land holdings in Glamorgan were in this area from medieval times. There are also suggestions of links with the Arthurian Legends, although there is little supportive evidence for this.

Old editions of the Ordnance survey maps show that the traditional rural topography of the site has remained unaltered, certainly from the mid nineteenth century until the present day. The land appears to have been occupied by the farmsteads of Pantruthin Fawr, Bryn Cwtyn and Pelindre (see Figure 4) and apart from the demolition of Bryn Cwtyn sometime between 1960 and 1979, very little else has changed. Also, a small cottage or farm known as Gwt is shown ruined on the 1875 OS map and has now disappeared. Field boundaries, which mainly follow minor features such as drainage lines, also have remained little changed, with few cases of field amalgamation or division over the years.

There is no indication that industrial activities such as quarrying or landfilling, have occurred which could influence the engineering works at the site. Significant opencast coal mining and the abandoned Llanharry haematite mines lie to the east, whilst on the higher ground to the south there were small mines for non-ferrous metal ores.

3.0 ARCHAEOLOGICAL SITES

The known areas of archaeological interest in the vicinity of the site are shown on Figure 1. These are as follows:-

Heol Porth Mawr
Pelindre
Llanhilid (Moated Mound and Church of St Illid and St Curig)
Gadlys
Ffynnon Cere
Un named "Moat" Site.

Heol Porth Mawr is an ancient routeway on the northern site boundary, along which many of the archaeological sites are clustered, e.g. the old corn mill site of Pelindre.

Llanhilid is well to the east of the site. It was probably a small medieval hamlet and the moated church site may be the remains of a deserted medieval village.

The Gadlys enclosure is described as a Roman Marching Camp on old OS plans. However, published historical accounts suggest there is no evidence for this other than local nineteenth century speculation and that it is more likely to be a domestic enclosure of medieval date.

Ffynnon Geri is a natural spring. It was probably an important water supply for Llanhilid in medieval times, hence it is named.

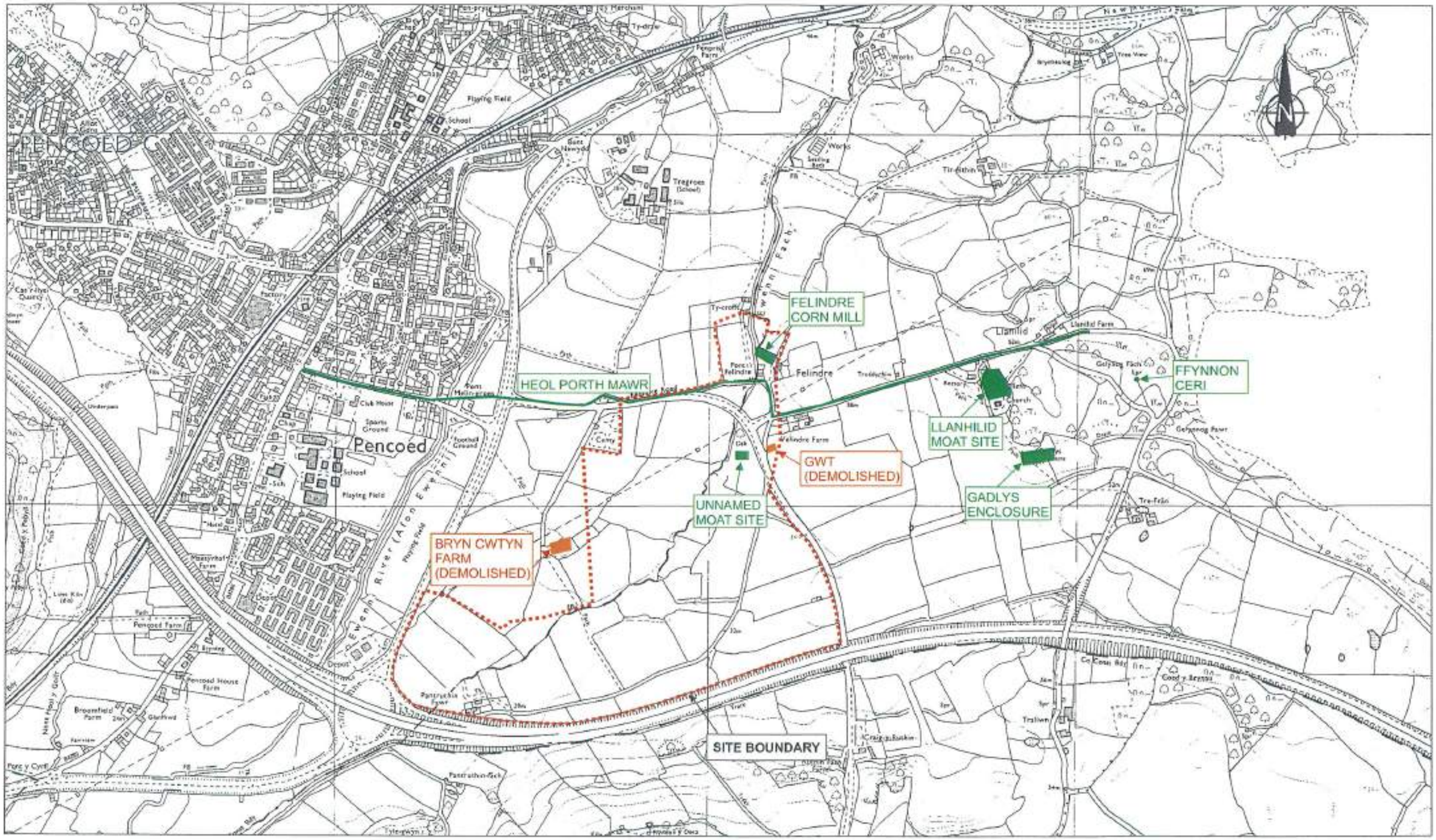
The only visible archaeological feature on the site itself is the un-named "moated" enclosure at the north-eastern corner, see Figure 1. This has been recognised relatively recently and is not shown on early maps. Little is known of its origin; it is a complex of ditches and banks and could be a medieval or post-medieval manor house, or it could be associated with farming at Gat. At the moment it should be regarded as a prime archaeological site. Hence, if any developments were to affect it, CADW would consider scheduling it so that its future survival would be assured.

4.0 POTENTIAL FOR ARCHAEOLOGICAL DISCOVERIES

The general lack of recognisable archaeological features on the site itself, and the paucity of recorded artefact discoveries, suggests that the site is unlikely to yield major archaeological discoveries. However, there has been little field work by archaeological groups based in Cardiff and Swansea in this area and the many medieval sites in the vicinity clearly suggest that further archaeological consideration is required, as part of the development process.

5.0 RECOMMENDATION

The area of archeological interest is remote from the Phase 1 works. The Glamorgan - Gwent Archeological Trust should be informed of the developent proposals and given an opportunity to investigate the area around the un-named "moat site", well ahead of any development in this area.



RECORDED ARCHEOLOGICAL FEATURES

67975 FIGURE **A1**

APPENDIX B

BOREHOLE/TRIAL PIT LOGS – PREVIOUS INVESTIGATIONS

BOREHOLE LOG

LOCATION S.7070 PENCOED.

BOREHOLE No. 72

F.G. 62

CLIENT Glamorgan County Council.

DRILLING METHOD Shell & Auger.

GROUND LEVEL 34·66m AOD.

DATE 10th March 1971.

SCALE 1" 100

DIAMETER 150 mm

SAMPLE HOLE

DESCRIPTION OF STRATA	SAMPLE	LOG-END	DEPTH	M/C	L.L.	P.I.	N	C/G
TOPSOIL.	1		0·35m					
SOFT brown and yellow/brown sandy silty CLAY.	2			21				
	3			22				
	4		2·5m	19	32	25		
SOFT brown sandy silty CLAY, some GRAVEL.	5		3·00	14				25/0°
STIFF brown sandy silty CLAY, some mixed GRAVEL.	6			12				
	7			13	30	23		140/8°
	8			12				
	9		6·00	13				

END OF BOREHOLE.

Note: No ground water was encountered during boring. On completion of hole and withdrawal of casing tubes, water entered hole and rose to 3·3m below ground level. Water level 24 hrs after completion of hole was 0·4m below ground level.

G.K.N. FOUNDATIONS LTD.,
SITE INVESTIGATION DEPARTMENT

● DISTURBED SAMPLE
| UNDISTURBED SAMPLE
◆ BULK DISTURBED SAMPLE

BOREHOLE LOG

LOCATION S. 2070 PENCOED.

BOREHOLE No. 72A

CLIENT Glamorgan County Council.

FIG. 6.3

DRILLING METHOD Hand Auger.

GROUND LEVEL 31·82m. AOD

DATE 25th March 1971.

SCALE 1 : 25

HAND AUGER.

DIAMETER 100mm.

DESCRIPTION OF STRATA	SAMPLE	LEGEND	DEPTH	M/C	L.L.	P.L.	N	C / φ
TOPSOIL.	1 ● W		0·2m					
SOFT black silty CLAY.	2 ●		1·0m	52	40	35		
SOFT light grey & yellow sandy silty CLAY	3 ●		2·3m	24	20	20		
	END OF BOREHOLE.							

NB. No further penetration could be achieved due to the presence of gravel.

Note; Ground waters was encountered at 0·2m below ground level.

G.K.N. FOUNDATIONS LTD.,
SITE INVESTIGATION DEPARTMENT

● DISTURBED SAMPLE
| UNDISTURBED SAMPLE
◆ BULK DISTURBED SAMPLE

BOREHOLE LOG

LOCATION S.2070 PENCOED. BOREHOLE No. 73

CLIENT Glamorgan County Council. FIG. 01

DRILLING METHOD Shell & Auger.

GROUND LEVEL 32·25m AOD.

DATE 11th March 1971.

SCALE 1 : 100

DIAMETER 150 mm

SAMPLE HOLE

DESCRIPTION OF STRATA	SAMPLE	LEGEND	DEPTH	M/C	L.L.	P.L.	N	C / φ
TOPSOIL.	1		0·35m					
STIFF FIRM mottled brown & grey silty CLAY, little mixed GRAVEL.	2 3 4		2·5m	25 18 22	24	19		170/6°
STIFF red slightly sandy silty CLAY some mixed GRAVEL.	5 6 7		6·0m	16 14 12	25	16	32	UNTESTABLE
END OF BOREHOLE.								

Note: No ground water was encountered during boring. On completion of hole water entered overnight and stood at 0·4m below ground level.

G.K.N. FOUNDATIONS LTD.,
SITE INVESTIGATION DEPARTMENT

● DISTURBED SAMPLE
▮ UNDISTURBED SAMPLE
◆ BULK DISTURBED SAMPLE

BOREHOLE LOG

LOCATION S.2070 PENCOED.

BOREHOLE No 75

FIG. 66

CLIENT Glamorgan County Council.

DRILLING METHOD Shell & Auger.

GROUND LEVEL 38·33m AOD.

DATE 4th-5th March 1971.

SCALE 1 : 10

DIAMETER 150 mm

SAMPLE HOLE

DESCRIPTION OF STRATA	SAMPLE	LEGEND	DEPTH	M/C	L.L.	P.L.	N	C/φ
TOPSOIL.			0					
SOFT brown very SANDY silty CLAY.	2			21				
	3		1·2m					UNTESTABLE
MODERATELY COMPACT mixed brown clayey SAND and mixed GRAVEL, very CLAYEY in places.	4							
	5						29	
	6						30	
							18	
	7						15	
	8						18	
			9·0m					
END OF BOREHOLE								

Note: No ground water was encountered during boring.

G.K.N. FOUNDATIONS LTD.,
SITE INVESTIGATION DEPARTMENT

● DISTURBED SAMPLE
| UNDISTURBED SAMPLE
◆ BULK DISTURBED SAMPLE

BOREHOLE LOG

LOCATION S.30/0 PENCOED.

BOREHOLE No 77

FIG. 68

CLIENT Glamorgan County Council.

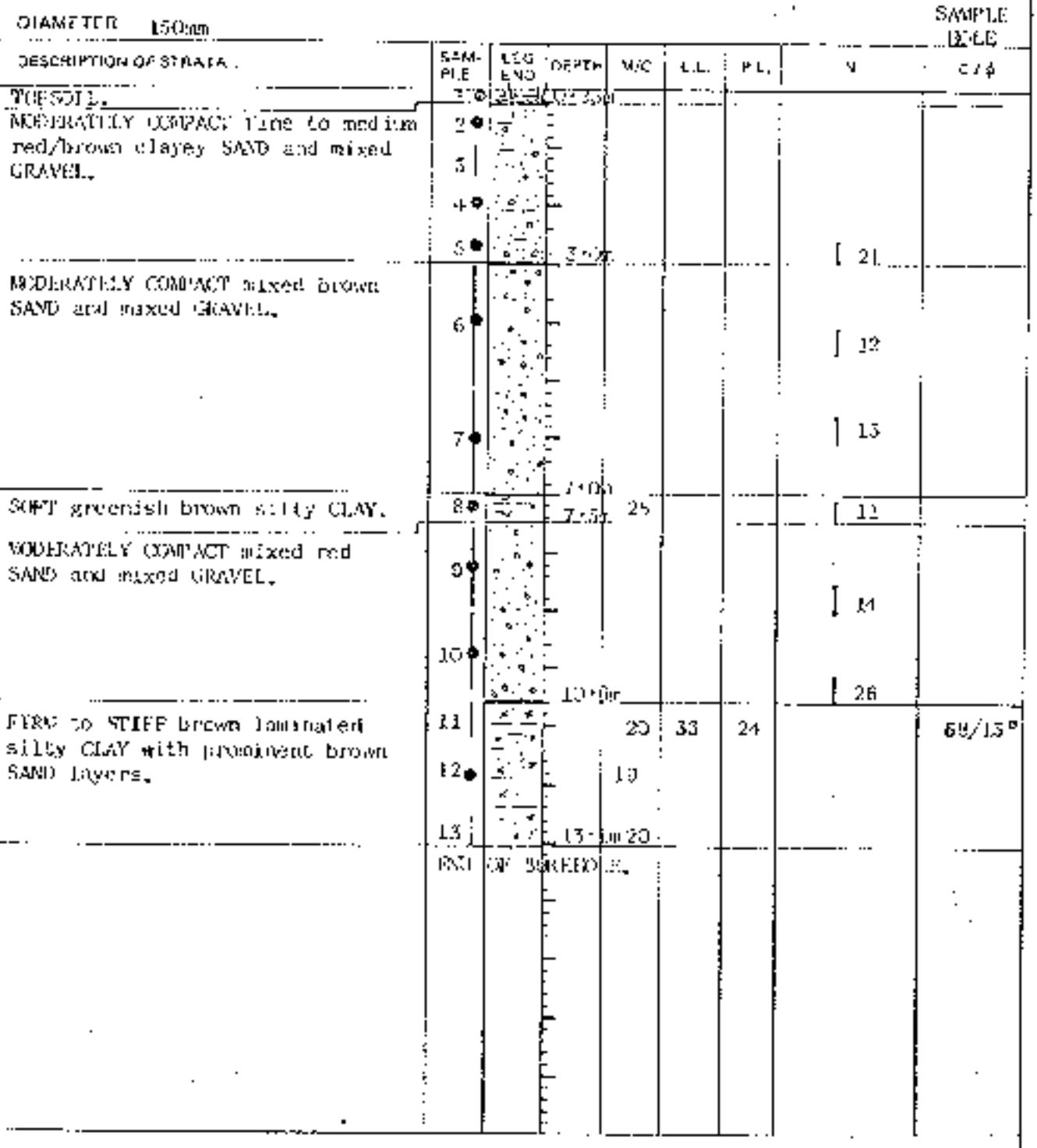
DRILLING METHOD Shell & Auger.

GROUND LEVEL 36·33m AOD.

DATE 22nd-24th February 1971.

SCALE 1 : 100

DIAMETER 150mm



Note: On boring to 10·0m water level rose overnight from 7·0m to 6·5m below ground level. On completion of hole and withdrawal of casing, hole collapsed to 7·2m below ground level and was dry.

G.K.N. FOUNDATIONS LTD.,
SITE INVESTIGATION DEPARTMENT

■ DISTURBED SAMPLE
| UNDISTURBED SAMPLE
◆ BULK DISTURBED SAMPLE

SYMBOLS USED IN BOREHOLE LOGS

ALL LINEAR DIMENSIONS ARE IN METRES

BS	-	Disturbed Bulk Sample
JS	-	Disturbed Jar Sample
WS	-	Water Sample
S		Standard Penetration Test
C	-	Core Penetration Test
CR%	-	Percentage Core Recovery
RQD%	-	Percentage Rock Quality Designate
mAOD	-	Metres Above Ordnance Datum

Intégral Géotechnique

JOB NO	5046/C
VALUE BY	BCB
DATE MADE	5/2/91

RECORD OF BOREHOLE 3

DATE	DEPTH TO WATER	DEPTH OF CASING	SAMPLES DEPTH From	SAMPLES DEPTH To	TYPE	TEST (SPT)	DEPTH	RL/DATUM LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m	m.O.D.	GROUND LEVEL @ 31.59m A.O.D
1/2/91		0.00	0.50		B				Stiff brown mottled light grey slightly organic silty CLAY with some rootlets
			1.00	1.45	S		1.00	30.59	
			1.00	1.45	D				
			1.50		B		1.50	30.09	Very stiff red brown mottled grey and black sandy SILT with occasional sub-rounded gravel and traces of coal fragments
			2.00	2.45	S	(33)			
			2.50		B				
			3.00	3.45	S	(29)			Stiff red brown occasionally mottled grey sandy silty CLAY with some sub angular and sub-rounded gravel and occasional cobbles
	3.40		3.00	3.45	D				
			3.50		B		3.50	28.09	
			4.00	4.45	S	(17)			
1/2/91			4.50		B				Firm and stiff becoming very stiff with depth, brown and red brown with some pale green grey mottling slightly sandy silty CLAY with occasional sub-rounded gravel becoming less frequent with depth, laminated in parts
2/2/91			5.00	5.45	S	(21)			
			5.00	5.45	D				
			5.50		B				
			6.00	6.45	S	(40)			
			6.50		B				
			7.00	7.45	S	(14)			
			7.00	7.45	D		7.00	24.59	
		7.50	7.50		B				
			8.00	8.45	S	(7)			Very soft to stiff soft to firm yellow brown, pale yellow brown and pale brown sandy silty CLAY/clayey SILT with occasional sand partings & lenses sub rounded gravel becoming more frequent and coarser with depth including sub-angular cobbles of sandy limestone below 10.70m: laminated in parts
2/2/91			8.50		B				
2/2/91			9.00	9.45	S	(14)			
			9.00	9.45	D				
			9.50		B				
			10.00	10.45	S	(21)			
			10.50		B				
			11.00	11.45	S	(39)			
			11.00	11.45	D		11.30	20.29	Very stiff red brown, pale green grey and occasionally yellow sandy silty CLAY with some fine sub rounded and angular gravel and occasional coal fragments
			11.50		B				
			12.00	12.45	S	(36)	12.00	19.59	
			12.00	12.45	D		12.40	19.19	Dense yellow/green mottled orange and grey very clayey silty fine SAND very sandy silty CLAY with occasional sub-angular sandstone gravel
4/2/91		12.70	12.70	13.14	S	(*)	13.30	18.29	
			12.70	13.14	D				Limestone bedrock/boulders?
									END OF BOREHOLE

Remarks

1. Equipment: Pilcon Hydrajet shell and auger drilling rig.
2. Standard/Cone Penetration Test Results: see attached sheets.
3. *Groundwater Levels: see attached sheets.
4. Chiselling:

Depth (m)	Time (Hours)
2.50 - 3.00	1.00
12.25 - 12.70	1.50

Type of Boring

Shell and Auger

Diameter of Boring

GL to 7.5m - 200 mm

7.5m to 13.7m - 150 mm

Casing Data

GL to 7.5m - 200 mm

GL to 13.7m - 150 mm

BOREHOLE 3

BOREHOLE NO. 3

2. Standard/Cone Penetration Test Results:

Depth (m)	Blows/75 mm Penetration	SPT 'N' Values
1.00 - 1.45	5/6/24/17/11/11	63
2.00 - 2.45	3/4/8/8/10/11	37
3.00 - 3.45	3/3/4/5/11/9	29
4.00 - 4.45	3/4/2/3/4/8	17
5.00 - 5.45	1/2/3/5/9/8	21
6.00 - 6.45	5/6/9/8/11/14	42
7.00 - 7.45	3/4/4/4/3/3	14
8.00 - 8.45	0/1/0/0/1/0	1 *
9.00 - 9.45	1/1/4/2/4/4	14
10.00 - 10.45	2/2/1/0/0/1	2 *
11.00 - 11.45	3/3/5/10/12/12	39
12.00 - 12.45	6/6/7/7/6/14	34
12.70 - 12.74	50 for 42 mm penetration	> 50

* Probably disturbed by drilling.

3. Groundwater Levels:

1. Struck water at 7.5m.

2 Standing at 3.4m at 8.00 am on 4.2.91.

OVE ARUP & PARTNERS

RECORD OF BOREHOLE 3R

JOB NO	27910
MADE BY	RG/JSS
DATE MADE	11.3.19

DAILY PROGRESS	DEPTH TO WATER	DEPTH OF CASING	SAMPLES FROM	SAMPLES TO	SAMPLES TYPE & REF	LOG END	DEPTH	REDUCED LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m		GROUND LEVEL (approx) = 11.59m AOD
7.3.19									
									New record of BH3 for description of strata encountered.
									Moderately strong light grey mainly bedded calcareous SANDSTONE (TRIASSIC SANDSTONE). Strong solution weathering present along bedding surfaces. In places becomes weak becoming poorly cemented sandstone. Core repeatedly broken 12.0m to 13.25m, 13.0 to 14.0m. Rapid penetration 14.0 to 14.9m with strong water inflow and core loss. Probably solutionally weathered zone.
									Moderately weak light green-grey clayey SILTSTONE with occasional thin calcite veining (TRIASSIC SILTSTONE).
									Very weak dark green-grey closely fissured silty MUDSTONE with lithorelict texture (TRIASSIC MUDSTONE). Clay partings and iron-stains on fissured surfaces. 0.1m thick band moderately strong light grey calcareous siltstone present.
									Moderately strong light grey SILTSTONE with thin calcite veining (TRIASSIC SILTSTONE).
									Recovered as weak dark grey to black laminated shaly MUDSTONE (TRIASSIC MUDSTONE). 0.2m only recovered in fragments. Probably completely solutioned weathered zone.
									Strong yellow grey re-crystallised LIMESTONE (CARBONIFEROUS LIMESTONE ?)
									END OF BOREHOLE

Notes:

1. Driller reports copious water during coring of rock. Water standing at 9.0m at end of day.

Method of boring:
Open Drilling 0.0 - 12.0m
Rotary Coring - 12.0 - 14.9m

Diameter of boring:
150mm to 12.0m
76mm to 13.2m

Casing:
Casing to 12.0m

BOREHOLE 3R

Intégral Géotechnique

RECORD OF BOREHOLE 4/4A

APPENDIX	
JOB NO	5046/C
LOGGED BY	MGH
DATE MADE	7.2.91

DAILY PROGRESS	DEPTH TO WATER	DEPTHS OF CASING	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	SAMPLES TYPE	ISOLATED PEAK	DEPTH	REDUCED LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m	A.O.D.	
									Ground level @ 30.32m A.O.D.
6.2.91		0.00	0.50		BS	0.4			TOPSOIL overlying firm brown sandy SILT/CLAY with sub-angular and sub-rounded gravel and cobbles
			1.00	1.45	D (30)		0.60	29.72	
			1.50		BS				Dense and very dense grey brown slightly clayey coarse SAND, sub-angular and sub-rounded GRAVEL and occasional cobbles of sandstone
			2.00	2.45	D 4				
			2.50		BS				
		2.40	3.00	3.45	D (15		2.50	27.82	
	1.10		3.50		BS				
									Firm to stiff brown, red brown and dark brown sandy silty CLAY with many sub-angular and sub-rounded gravel and cobbles of sandstone
			4.00	4.45	D (16				
			4.50		BS				
			5.00	5.45	D (17				
			5.50		BS				
6.2.91		5.70							
5.2.91			6.00	6.45	D (41)		5.80	24.52	
			6.50		BS				Dense grey brown slightly silty sandy sub-angular and sub-rounded GRAVEL and COBBLES of sandstone
			7.00	7.45	D (44)				
			7.50		BS				
			8.00	8.45	D 50/1		7.60	22.72	Very stiff orange brown and red brown very sandy silty CLAY with occasional sub angular and sub-rounded gravel of sandstone
			8.50		BS				
			9.00	9.45	D (29)		8.20	22.12	
			9.50		BS				Medium dense grey brown slightly silty sandy sub-angular to rounded GRAVEL with cobbles of sandstone
			10.00	10.45	D (29)				
			10.50		BS				
			11.00	11.45	D (27)		10.70	19.62	Stiff brown, orange brown, mottled orange and red brown sandy silty CLAY with many angular, sub-angular and sub-rounded gravel of sandstone, calcareous sandstone, iron-stone, quartz and grey brown mudstone, some soft black carbonaceous material below 11.00m
			11.50		BS				
5.2.91		11.20							
6.2.91			12.00	12.45	D 50/1				
			12.00	12.10	BS		11.80	18.52	Very dense weathered grey and dark grey silty angular to sub-rounded GRAVEL in a brown grey silty clay
7.2.91			12.55	12.65	D (*)				
			12.55	12.65	BS		12.55	17.77	END OF BOREHOLE

Remarks

1. Equipment: Pilcon Hydrajet Shell and Auger drilling rig.
2. Standard/Core Penetration Test Results: see attached sheet.
3. * Groundwater: see attached sheet.
4. Obstruction: Depth (m) — Time (Hours)

Depth (m)	Time (Hours)	
1.00 – 1.50	0.25	
2.00 – 2.10	0.75	mud
2.20 – 2.40	1.00 (in 250 mm hole)	
2.10 – 2.30	0.75	
11.40 – 11.80	0.75	RAG
11.80 – 12.55	1.50	

5. Borehole 4 abandoned at 5.70m due to flowed casing.

Type of Boring: Shell and Auger

Diameter of hole:
GL to 5.70m - 200 mm 4
GL to 2.40m - 250 mm
GL to 12.55m - 200 mm 4A

Casing Fitted:
GL to 5.70m - 200 mm 4
GL to 2.40m - 250 mm
GL to 11.50m - 200 mm 4A

BOREHOLE 4/4

BOREHOLE NO.4/4A

7 Standard/Cone Penetration Test Results:

Depth (m)	Blows/75 mm Penetration	'N' Values
1.00 - 1.45	3/4/6/10/11/11	38
2.00 - 2.45	9/13/15/20/15 for 220 mm penetration	> 50
3.00 - 3.45	1/1/2/2/3/4	11
4.00 - 4.45	2/2/3/3/4/6	16
5.00 - 5.45	2/3/3/4/5/5	17
6.00 - 6.45	4/7/10/10/12/9	41
7.00 - 7.45	3/7/15/7/8/14	44
8.00 - 8.45	3/7/7/8/9/9	33
9.00 - 9.45	3/6/6/8/7/8	29
10.00 - 10.45	3/4/6/6/9/8	29
11.00 - 11.45	6/6/9/12/7/6	27
12.00 - 12.14	27/23 for 145 mm penetration	> 50
12.55 - 12.65	25/25 for 100 mm penetration	> 50

3. Groundwater Levels:

1. Standing at 1.80m on 5.2.91 after pulling casing of BH4
2. Struck at 5.80m in BH4A and rose to 3.10m.
3. Standing at 3.20m at 8.00 am on 6.2.91.

Intégral Géotechnique

RECORD OF BOREHOLE 5

APPROX.	
JOB NO	5046/G
MADE BY	P.G.B.
DATE MADE	11.2.91

DATE PROGRESS	DEPTH TO WATER m	DEPTH OF CASING m	SAMPLES FROM m	SAMPLES TO m	SAMPLES TYPE	SAMPLES TEST	LOG	DEPTH m	R.L. (O.D.)	DESCRIPTION OF STRATA
									A.O.D.	GROUND LEVEL @ 28.55m A.O.D.
5.2.91			0.50		D					TOPSOIL over dense yellow brown and orange brown slightly sandy SILT with occasional cobbles and lenses of black material with an orange and perimeter and occasional sub rounded and sub-angular gravel
			1.00	1.45	D	50(30)				
			1.00	1.45	B	30				
			1.50		B	20				
			2.00	2.45	D	50(40)		1.70	26.85	
			2.50		B	50				Dense grey brown silty very sandy sub-angular and sub-rounded GRAVEL with some cobbles and clay bands
	2.40		3.00	3.45	D	50(28)				
			3.00	3.45	B	15				
			3.50		B	35				
			4.00	4.45	D	50(26)		3.60	24.95	
			4.50		B	20				
			5.00	5.45	D	50(25)				
			5.00	5.45	B	15				
			5.50		B	35				
		6.00	6.00	6.45	D	50(24)				Medium dense becoming dense and very dense with depth, brown very sandy sub-angular and sub-rounded GRAVEL with some cobbles
5.2.91			6.50		B	50		6.45	22.20	
6.2.91			7.00	7.45	D	50(29)				
			7.00	7.45	B	20				Dense brown gravelly fine to coarse SAND with occasional cobbles
			7.50		B	30				
			8.00	8.35	D	*				
			8.50		B	35				
			9.00	9.45	D	*				
			9.00	9.45	B	35		9.00	19.65	
			9.50		B	35				Very dense becoming dense with depth brown and orange brown fine sandy SILT/silty SAND with occasional fine to medium gravel, becoming more frequent with depth
			10.00	10.45	D	*				
			10.50		B	50				
			11.00	11.45	D	50(40)				
6.2.91			11.00	11.55	B	30				
7.2.91			11.40		B	45		11.40	17.05	
			12.00	12.45	D	(*)				Loose dark brown silty fine SAND with occasional fine to medium sub-rounded and rounded gravel below 12.50m
			12.50		B	45				
			13.00	13.45	D	*				
7.2.91		13.00	13.35	13.35	D	*		13.30	15.25	Redance/large boulder?
								13.35	15.20	END OF BOREHOLE

REMARKS

1. Equipment: Pilcon Wayfarer Shell and Auger drilling rig.
2. Standard/Cone Penetration Test Results: See attached sheet.
3. *Groundwater: See attached sheet.
4. Chiselling:

Depth (m)	Time (Hours)
2.70 - 3.00	1.5
3.50 - 3.80	1.5
8.30 - 8.70	1.5
13.30 - 13.35	1.0

METHOD OF BORING

Shell and Auger

DIAMETER OF HOLES

GL to 6.00m - 200 mm

GL to 13.30m - 150 mm

CASING USED

GL to 6.00m - 200 mm

GL to 13.30m - 150 mm

BOREHOLE 5

BOREHOLE NO.3

2. Standard/Cone Penetration Test Results:

Depth (m)	Blows/75 mm Penetration	'N' Value
1.00 - 1.45	7/7/9/10/9/8	36
2.00 - 2.45	11/8/13/11/12/10	46
3.00 - 3.48	7/13/12/9/5/6	37
4.00 - 4.45	7/10/8/6/6/6	26
5.00 5.45	3/5/6/7/7/9	29
6.00 - 6.45	8/7/5/5/7/7	24
7.00 7.45	5/10/12/12/16/11	49
8.00 - 8.45	9/9/50 for 37 mm penetration	> 50
9.00 - 9.45	11/17/19/16/20/15	> 50
10.00 - 10.45	6/12/15/19/18/20	> 50
11.00 - 11.45	5/8/11/9/9/11	40
12.00 - 12.45	1/1/1/1/1/2	5
13.00 - 13.39	10/19/25/50 for 96 mm penetration	> 50
13.35 13.35	50 for nn penetration	> 50

3. Groundwater levels:

1. Struck at 3.4m.
2. Standing at 3.4m at 8.00 am on 7.2.91.
3. Standing at 3.4m at 9.00 am on 7.2.91

OVE ARUP & PARTNERS

RECORD OF BOREHOLE 5R

APPENDIX	
JOB NO	42510
MADE BY	LJ/JBS
DATE MADE	11.2.91

WATER STRIKES	DEPTH TO WATER	DEPTH OF CASING	SAMPLES FROM	SAMPLES TO	SAMPLES TYPE AND REF.	CORE RUN	CORE %	RL/DEPTH LEVEL
	m	m	m	m			m	
6.2.91								
			11.2	14.8	3.1	3.6		14.7 / 14.25
8.2.91								

DESCRIPTION OF STRATA

GROUND LEVEL (Approx) 20.05m AOD

See record of BH 5 for description of strata encountered.

Moderately strong to strong light grey thinly bedded calcareous fine SANDSTONE, dipping at 5°. (TREASKIS SANDSTONE)
Vertical discontinuity present 14.1 to 14.3m.
Partings of weak khaki very silty sandstone at 13.0, 13.59, 14.3 and 14.4 to 14.5m
Small interconnected solution cavities present at 13.2 to 13.34, 5mm to 15mm ø, following bedding surfaces. Small interconnected solution cavities at 14.52 and 15.52m.

END OF BOREHOLE

REMARKS

TYPE OF BORING

Open Boring G.L. - 14.4m
Rotary Boring 14.4 - TD

DIAMETER OF BORING

170mm to 14.4m
76mm to 17.1m

CASING DETAILS

Casing to 14.2m

BOREHOLE 5R

Intégral Géotechnique

RECORD OF BOREHOLE **6**

APPROX	
JOB NO	5046/C
MADE BY	BGB
DATE MADE	31/1/91

DATE PROGRESS	DEPTH TO WATER	DEPTH OF CASING	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	SAMPLES REF	SAMPLES TYPE	DEPTH	RESOLVED LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m	A.O.D.	RESOLVED LEVEL @ 28.91m A.O.D.
28/1/91		3.00	0.50			BS			TOPSOIL overlying medium dense orange brown, brown, pale green grey and orange clayey silty SAND and sandy CLAY with cornstones sub-rounded fine to medium gravel of sandstone
			1.00	1.45		BS			
			1.00	1.45		BS			
			1.50			BS	1.30	27.61	
			2.00	2.45					
	4.20		2.50			BS			
			3.00	3.45					
			3.50			BS			
			4.00	4.45					Medium dense with thin layers of loose becoming dense below 5.0m, brown clayey SAND, and sub-rounded and sub-angular fine to coarse GRAVEL and COBBLES of sandstone, with some boulders below ? 5m
28/1/91		5.00	4.50			BS			
29/1/91			5.00	5.45					
			5.50			BS			
			6.00	6.45					
			6.50			BS			
			7.00	7.45					
			7.50			BS			
			7.80			BS	7.80	21.1	Very stiff purple red with some orange brown mottling friable slightly sandy silty CLAY with fine gravel sized lithorelicts of red purple silty mudstone and occasional medium gravel of sandstone
			8.00	8.45			8.00	20.91	
	8.70		8.20			BS	8.20	20.21	
29/1/91			9.00	9.45			9.10	19.81	Very stiff/hard red purple and red brown silty CLAY with mudstone lithorelicts
									Fragments of indurated strong red purple/red brown with occasional pale green grey mottling MUDSTONE, SILTSTONE and SANDSTONE with some silty clay
									END OF BOREHOLE

REMARKS

1. Equipment: Pilcon Wayfarer shell and auger drilling rig.
2. Standard/Cone Penetration Test Results: see attached sheet.
3. Groundwater: see attached sheet.
4. Chiselling:

Depth (m)	Time (hours)
3.70 - 3.80	0.50
8.70 - 9.10	1.50

TYPE OF BORING

Shell and Auger

DIAMETER OF BORING

0.00 to 9.00m - 230 mm

CASING USED

0.00 to 8.70m - 200 mm

BOREHOLE 6

BOREHOLE NO.6

2. Standard/Cone Penetration Test Results:

Depth (m)	Blows/75 mm Penetration	'N' Values
1.00 - 1.45	3/1/6/6/5/4	21
2.00 - 2.45	2/3/4/4/4/5	17
3.00 - 3.45	3/3/5/3/6/7	21
4.00 - 4.45	1/1/1/2/2/2	7
5.00 - 5.45	6/5/6/4/3/3	16
6.00 - 6.45	2/5/6/8/8/10	32
7.00 - 7.45	3/4/6/9/10/12	37
8.00 - 8.45	6/8/9/11/7/5	32
9.00 - 9.02	50 for 20 mm penetration	> 50

3. Groundwater Levels:

1. Struck water at 2.2m.
2. Standing at 2.2m at 8.00 am on 29.1.91.
3. Standing at 2.3m on completion of borehole.

OVE ARUP & PARTNERS

RECORD OF BOREHOLE 6R

JOB NO	42510
MADE BY	L./JSS
DATE MADE	11/2/91

DAILY PROGRESS	DEPTH TO WATER	DEPTHS OF CASING	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	CORE RUNS	GRAPHIC LOG	DEPTH	RELATIVE LEVEL
	m	m	m	m	m		m	
5.2.91								
			9.60	9.75	11.55		9.15	10.76
			11.55	11.70	10.95			
5.2.91							14.75	

DESCRIPTION OF STRATA

Upstand level (Approx) = 20.91m AOD

See record of hole for description of strata encountered

Strong, in places moderately strong becoming bedded medium grey and red-brown fossiliferous conglomerate consisting of sub-rounded gravel and cobble of sandstone, limestone in a matrix of red-brown silty mudstone, generally clast supported.
(PERMIAN CONGLOMERATE).
Abundant small 5mm to 30mm Ø solution cavities in core, derived from solutioning of calcareous crystals.
Drilling records repeated small drops during drilling indicating solution cavities.

END OF BOREHOLE

REMARKS

Type of boring
Open cutting 0.00 to 9.15m
Rotary coring 9.15 to 14.75m

Method of boring

Flush to 9.15m
Tapp to 14.75m

Casing

Casing to 9.60m

BOREHOLE 6R

Intégral Géotechnique

AGENCY

JOB NO 5046/C

DRAWN BY PCR

DATE MADE 4/2/91

RECORD OF BOREHOLE 7

CASING PROGRESS	DEPTH TO WATER	DEPTHS OF CASING	SAMPLES & TESTS: DEPTH FROM	SAMPLES & TESTS: DEPTH TO	SAMPLES & TESTS: TYPE	SAMPLES & TESTS: RESULT	LEGEND	CHAIN	RECORD LEVEL	DESCRIPTION OF STRATA
m	m	m	m					m	A.O.D.	
										GROUND LEVEL @ 31.05m A.O.D.
1/2/91		9.00	0.50		BS					TOPSOIL overlying firm brown silty sandy CLAY with occasional sub-rounded flint to medium gravel and a little coarse gravel of sandstone
			1.00	1.45	D	(14)				
			1.50		BS			0.90	30.15	
			2.00	2.45	D	(27)				Medium dense to dense grey brown coarse SAND and sub-rounded and sub-angular GRAVEL and COBBLES of sandstone
			2.50		BS					
			3.00	3.45	D	(*)				
			3.50		BS					
			4.00		WS					
			4.00	4.45	D	(20)				
			4.50		BS			4.40	26.65	
		▽4.00	5.00	5.45	D	(31)				Stiff and very stiff red brown silty sandy CLAY with many sub-rounded flint to coarse gravel of sandstone
			5.50		BS					
			6.00	6.45	D	(20)				
			6.50		BS			6.30	24.75	Medium dense red brown and brown clayey SAND and sub rounded GRAVEL with occasional cobbles and some boulders
			7.00	7.45	D	(4)		6.80	24.25	
			7.50		BS					Very soft pale grey brown with green brown and yellow tinged sandy silty CLAY with sub-rounded and sub angular gravel, cobbles and many boulders and inclusions of silt in places with many gravel and cobbles
			8.00	8.45	D	(0)				
			8.50		BS					
			9.00	9.45	D	(4)		8.80	22.25	Dense and very seamy many sub-angular and sub rounded GRAVEL and COBBLES of yellow brown and reddish with pale green grey mottling sandy limestone breccia with angular clasts of mudstone, red purple siltstone and white/grey quartz, and lenses/veins of multicoloured black, white and pink calcite/dolomite
1/2/91			9.50		BS					
1/2/91		9.50								
			10.00	10.45	D	(*)		9.90	21.15	
3/2/91			10.20		BS			10.20	20.85	
										Limestone bedrock/large boulder (?)
										END OF BOREHOLE

REMARKS

1. Equipment: Pilcon Wayfarer shell and auger 3-111kg rig.
2. Standard/Cone Penetration Test Results: See attached sheet
3. Piezometers: See attached sheet.
4. Chiselling:

Depth (m)	Time (Hours)
3.90 - 4.40	1.75
8.80 - 9.90	0.75
9.90 - 10.20	1.00

5. Piezometer installed at 7.00m.

TYPE OF BORING

Shell and Auger

DIAMETER(S) AND DEPTH

GL to 10.20m 200 mm

CASING DEPTH

GL to 9.20m 200 mm

BOREHOLE 7

BOREHOLE NO./

2. Standard/Cone Penetration Test Results:

Depth (m)	Blows/75 mm Penetration	'N' Values	
1.00 - 1.45	2/3/4/3/4/3	14	
2.00 - 2.34	3/5/6/6/8/7	27	
3.00 - 3.45	4/10/10/23/17 for 190 mm penetration	> 50	
4.00 - 4.45	2/3/4/4/6/14	28	
5.00 - 5.45	2/3/6/7/9/9	31	
6.00 - 6.45	4/7/8/8/7/6	29	
7.00 - 7.45	1/0/1/0/1/2	4	
8.00 - 8.45	1/0/0/0/0/0	0	*
9.00 - 9.23	10/3/45/5 for 80 mm penetration	> 50	
10.00 - 10.05	50 for no penetration	> 50	

* Probably disturbed by drilling.

3. Groundwater Levels:

1. Struck at 4.5m and rose to 4.7m.

2. Standing at 4.6m at 8.00 hr on 3.2.91.

Intégral Géotechnique

RECORD OF BOREHOLE 8

APPENDIX	
JOB NO	5040/C
LOGGED BY	DGB
DATE MADE	4/2/91

GEOL PERIOD	DEPTH TO WATER	DEPTHS OF CASING	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	SAMPLES TYPE	FIG. NO	DEPTH	RL/LEVEL (AOD)	DESCRIPTION OF STRATA
	m	m	m	m			m	m A.O.D.	GROUND LEVEL @ 22.35m A.O.D.
29/1/91		0.00	0.50		B				TOPSOIL overlying firm brown sandy silty CLAY with some rounded, sub-rounded and sub angular gravel
			1.00	1.45	C	(10)			
			1.50		B		0.90	21.45	
			3.00	3.45	C	(23)			Medium dense, occasionally loose in places, brown becoming grey brown below 1.50m slightly clayey coarse SAND/fine GRAVEL, sub angular and sub-rounded mostly to coarse GRAVEL and occasional cobbles of sandstone
	2.10		2.50		B				
			3.00	3.45	C	(21)			
			3.50		B				
29/1/91			4.00		B				
29/1/91			4.00	4.45	C	(21)			
			4.50		B				
			5.00	5.32	C	*			
			5.50		B				
			6.00	6.45	C	(61)			
			6.50		B				
			7.00	7.45	C	(17)			
			7.50		B		7.40	14.95	
			8.00	8.40	C	(7)			Soft becoming firm/stiff with depth, brown, orange brown, yellow brown and traces of red brown sandy silty CLAY with many sub-rounded and sub-angular gravel and cobbles of sandstone, sandy yellow brown limestone and quartz
			8.50		B				
			9.00	9.45	B	(15)			
30/1/91			9.50		B				
31/1/91		9.80	9.50	9.95	B	(17)			
			9.50	9.95	B		9.80	12.55	
			10.50		B				
			10.50	10.19	C	*			Very stiff yellow brown, orange, orange brown and red brown with some pale green grey mottles, slightly silty CLAY with occasional sub-angular and sub-rounded gravel of mudstone are mainly mixed grey limestone
							11.13	11.01	
			11.90	12.06	C	*	11.60	10.75	Limestone bedrock/boulder/
31/1/91									END OF BOREHOLE

REMARKS

1. Equipment: Pilcon Wayfarer shell and auger drilling rig.
2. Standard/Core Penetration Test Results: see attached sheet
3. Groundwater: see attached sheet.
4. Chiselling:

Depth (m)	Time (Hours)
2.71 - 2.80	0.50
3.40 - 3.50	0.25
5.30 - 5.50	0.50
10.00 - 10.95	0.75
11.30 - 11.60	1.50

TYPE OF BORING

Shell and Auger

DIAMETER OF BORING

GL to 11.60m - 200 mm

CASING DEPTHS

GL to 3.50m - 200 mm

BOREHOLE 8

BOREHOLE NO.8

2. Standard/Cone Penetration Test Results.

Depth (m)	Blows/75 mm Penetration	'N' Values
1.00 - 1.45	4/3/4/5/5/4	18
2.00 - 2.45	5/4/4/5/7/8	24
3.00 - 3.45	6/5/5/6/5/6	21
4.00 - 4.45	3/4/5/5/6/5	21
5.00 - 5.32	4/5/20/22/8 for 165 mm penetration	> 50
6.00 - 6.45	3/2/2/2/6/6	16
7.00 - 7.45	6/4/4/4/4/5	17
8.00 - 8.45	4/3/2/2/1/2	7
9.00 - 9.45	3/3/3/3/3/6	15
9.50 - 9.95	2/3/4/5/9/9	27
10.50 - 10.79	9/9/8/11/21/10 for 295 mm penetration	> 50
11.50 - 11.56	50 for 60 mm penetration	> 50

3. Groundwater:

1. Standing at 2.1m at 8.00 am on 30.1.91.

2. Standing at 4.6m at 8.00 am on 31.1.91.

Intégral Géotechnique

RECORD OF BOREHOLE 9

APPENDIX	
JOB NO	5046/C
MADE BY	P.G.B
DATE MADE	30/1/91

DATE / PROGRESS	DEPTH TO WATER	CASING DEPTH	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	SAMPLES TYPE	LEGEND	DEPTH	RL/DATUM LEVEL	DESCRIPTION OF STRATA
		m	m	m			m	A.O.D	
									GROUND LEVEL @ 54.13m A.O.D.
22/1/91		0.00	0.50		U	BS	0.50	53.63	TOPSOIL overlying friable red brown slightly sandy silty CLAY with sub-rounded fine medium and coarse gravel of sandstone, fine roots
			1.00	1.45	C	(24			
			1.50			BS			
			2.00	2.45	C	(22			
			2.50			BS			
	▽2.80								
			3.00	3.45	C	(16			Medium dense, orange and very dense brown clayey coarse SAND, sub-rounded GRAVEL and occasional cobbles of mainly sandstone with a thin layer of clay from 3.0 to 3.4m
			3.50			BS			
			4.00	4.42	D	*			
			4.50			BS			
			5.00	5.28	D	*			
			5.50			BS			
			6.00	6.45	C	(32			
	▽6.20		6.50			BS			
			7.00			BS	7.20	26.93	Stiff dark brown and yellow brown sandy silty CLAY with poorly sorted sub-rounded and sub-angular fine gravel of mainly sandstone
			7.50	7.97	S	(20			
			8.00			BS			
			8.50	8.45	C	(29			Medium dense brown clayey/slightly clayey coarse SAND, sub-rounded and sub-angular fine medium and coarse GRAVEL, some cobbles, with occasional thin lenses of firm orange brown and brown slightly sandy silty clay
			9.00	9.45	C	(22			
			9.50			BS			
23/1/91			10.00	10.39	C	*			
24/1/91			10.50			BS	10.30	23.83	Stiff and very stiff to hard pale yellow grey, orange brown, brown grey becoming pale grey brown with depth, silty CLAY with sub-angular gravel and cobbles of strong pale greenish grey and dark grey fossiliferous limestone
			11.00	11.38	D	*			
			11.50			BS			
24/1/91		11.70	12.00	12.09	D	*	11.80	42.33	
							12.46	21.23	Limestone boulder/bedrock
									END OF BOREHOLE

Notes:

1. Equipment: Pilcon Wayfarer wheel and auger drilling rig.
2. Standard/Cone Penetration Test Results: see attached sheet.
3. Piezometers: see attached sheet.
4. Caliching:

Depth (m)	Time (Hours)
4.20 - 4.41	0.5
5.10 - 5.30	0.5
10.20 - 11.02	1.0
12.09 - 12.35	1.0

TYPE OF BORING

Shell and Auger

DIAMETER OF BORING

GL to 12.60m - 200 mm

CASING TUBES

GL to 11.70m - 230 mm

BOREHOLE 9

BOREHOLE NO.9

2. Standard/Cone Penetration Test Results:

Depth (m)	Blows/75 mm Penetration	'N' Values
1.00 - 1.45	3/3/4/5/6/8	24
2.00 - 2.45	2/4/5/5/6/6	22
3.00 - 3.45	3/6/6/4/3/3	16
4.00 - 4.42	4/4/11/14/13/6 for 25 mm penetration	> 50
5.00 - 5.28	9/17/20/15/8/7 for 290 mm penetration	> 50
6.00 - 6.45	3/7/8/8/9/?	32
7.00 - 7.45	3/6/6/5/5/4	20
8.00 - 8.45	4/4/6/7/8/8	29
9.00 - 9.45	4/8/8/7/8/6	29
10.00 - 10.38	9/7/20/12/14/4 for 230 mm penetration	> 50
11.00 - 11.28	10/20/48/12 for 195 mm penetration	> 50
12.00 - 12.02	50 for 20 mm penetration	> 50

3. Groundwater Levels:

1. Struck at 2.8m.
2. Standing at 7.5m at 8.00 am on 24/1/91.
3. Rose to 0.2m on reaching limestone

OVE ARUP & PARTNERS

APPENDIX	
JOB NO	45410
MADE BY	[illegible]
DATE MADE	12.2.91

RECORD OF BOREHOLE 9R

DAILY PROGRESS	DEPTH TO WATER	DEPTH OF CASING	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	TYPE CDR / RQD	LEGEND	DEPTH	REDUCED LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m		GROUND LEVEL (approx) 34.[illegible] AOD
4.2.91									See record of BH 9 for description of strata encountered
		12.5	12.7	14.4	60 / 0		12.5	2[illegible].[illegible]	Weak grey very thinly bedded fissured silty MUDSTONE, bedding mostly horizontal, in places becoming laminated. (CARBONIFEROUS MUDSTONE). Band 14.1 to 14.3m contains abundant [illegible] fossils. Material weathered 12.[illegible] to 1[illegible].[illegible]m to a stiff brown silty clay with two thin bands of strong calcareous mudstone.
			15.6	16.4	82 / 31				
			16.4	18.0	64 / 46		15.0	2[illegible].[illegible]	Moderately strong to light yellow-grey thinly to medium bedded medium to coarse SANDSTONE. (CARBONIFEROUS SANDSTONE). Transition zone present at 15.0 to 15.[illegible]m consisting of dark grey sandstone with partings of disturbed mudstone.
4.2.91							1[illegible].[illegible]	1[illegible].[illegible]	END OF BOREHOLE

REMARKS

TYPE OF BORING

Open Holing G.L. - 12.5m
Rotary Coring 12.5 - 18.0m

DIAMETER OF BORING

170mm to 12.5m
76mm to 18.0m

CASING DEPTHS

Casing to 12.5m

BOREHOLE 9R

Intégral Géotechnique

LOCATION	
JOB NO	5046/C
MADE BY	P.G.B.
DATE MADE	30/1/91

RECORD OF BOREHOLE 10

DAILY PROGRESS	DEPTH TO WATER	DEPTH OF CASING	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	TYPE	LEGEND	DEPTH	REDUCED LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m	A.O.D.	GROUND LEVEL 33.08m A.O.D.
25/1/91		0.00	0.50		D				TOPSOIL overlying brown slightly sandy silty CLAY with sub-rounded fine to medium gravel of sandstone, and sandy silt inclusions
			1.00	1.45	C (35)		1.00	32.30	
			1.50		BS				Dense orange brown slightly clayey coarse SAND, and sub-angular and sub-rounded GRAVEL with cobbles of sandstone
			2.00	2.45	C (33)				
			2.50		BS				
	▼3.20		3.00	3.45	C (40)		3.20	29.88	
			3.50		BS				Medium dense to dense red brown and pale greenish grey clayey SAND, with many sub-angular and sub-rounded gravel and cobbles of sandstone
			4.00	4.45	C (24)		3.90	29.18	
			4.50		BS				
			5.00	5.45	C (35)				Medium dense and dense brown slightly clayey coarse SAND and fine to coarse sub-angular and sub-rounded GRAVEL and COBBLES, proportion of sand increasing with depth, and with occasional thin clay inclusions
			5.50		BS				
			6.00	6.45	C (25)				
			6.50		BS				
			7.00	7.45	C (27)				
			7.50		BS				
			8.00	8.45	C (29)				
			8.50		BS		8.40	24.68	Very stiff/hard red brown, orange brown and brown very sandy silty CLAY with sub-angular and sub-rounded gravel and cobbles
			9.00	9.45	C (46)		9.30	23.78	
			9.50		BS				
			10.00	10.45	C (35)				Medium dense and dense, becoming very dense below 11.0m, brown and orange brown clayey SAND, and fine to coarse rounded to sub-angular GRAVEL and COBBLES
			10.50		BS				
25/1/91									
26/1/91			11.00	11.45	C (37)				
			11.50		BS				
			12.00	12.45	C (30)				
			12.50		D				
			13.00	13.43	C *				
		13.60	13.50		BS		13.60	19.48	Weak pale yellow grey/green grey fine to medium grained SANDSTONE fragments with some dark brown staining on laminae and fractures
26/1/91			13.90	13.93	C *		13.90	19.18	
									END OF BOREHOLE

REMARKS

1. Equipment: Pilcon Wayfarer shell and auger drilling rig.
2. Standard/Cone Penetration test Results: see attached sheet.
3. *Groundwater: see attached sheet.
4. Chiselling:

Depth (m)	Time (Hours)
3.20 – 3.90	1.5
13.53 – 13.93	1.0

TYPE OF BORING

Shell and Auger

[illegible] OF BORING

GL to 13.90m – 200 mm

CASING SIZES

GL to 13.60m – 200 mm

BOREHOLE 10

BOREHOLE NO.10

2. Standard/Cone Penetration Test Results:

Depth (m)	Blows/15 cm Penetration	'N' Values
1.00 - 1.45	4/6/8/7/9/11	35
2.00 - 2.45	7/10/16/7/8/8	39
3.00 - 3.45	6/7/9/12/10/9	40
4.00 - 4.45	4/6/5/6/6/7	24
5.00 - 5.45	4/6/16/8/9/8	35
6.00 - 6.45	4/6/6/7/6/6	25
7.00 - 7.45	4/5/6/6/7/8	27
8.00 - 8.45	3/4/6/7/8/8	29
9.00 - 9.45	3/5/8/10/13/15	46
10.00 - 10.45	1/2/4/6/9/6	25
11.00 - 11.45	9/5/5/7/11/16	37
12.00 - 12.45	4/5/5/7/9/9	30
13.00 - 13.43	5/5/5/8/10/23 for 280 mm penetration	> 50
13.90 - 13.92	50 for 15 mm penetration	> 50

3. Groundwater Levels:

1. Struck at 3.9m and rose to 3.2m.
2. Remained at 3.2m during drilling.
3. At 2.6m at 8.00 am on 26/1/91.
4. At 2.8m at 2.00 pm on completion of borehole.

Intégral Géotechnique

RECORD OF BOREHOLE 11

AVENUE	
JOB NO	5046/G
MADE BY	P.G.B.
DATE MADE	31.1.91

DATE PROGRESS	DEPTH TO WATER	DEPTH OF CASING	SAMPLES FROM	SAMPLES TO	SAMPLES TYPE	FIELD TEST	GRAPHIC	RL (OD) LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m	A.O.D	GROUND LEVEL @ 12.50m A.O.D.
27/1/91		0.00	0.50		BS				TOPSOIL overlying stiff red brown, orange brown and brown slightly sandy silty CLAY and medium dense clayey/silty SAND with a little fine gravel
			1.00	1.45	S	(24)			
			1.00	1.45		BS			
	1.80		1.50			BS	1.00	11.00	
			2.00	2.45	S	(36)			Dense becoming very dense orange brown and brown clayey silty SAND becoming clayey coarse SAND with depth, sub-rounded fine to coarse GRAVEL , with occasional inclusions of pale grey, yellow orange and orange brown silty very sandy clay
			2.50			BS			
			3.00	3.31	D	*	3.20	39.20	
			3.50			BS			
			4.00	4.45	S	(15)			Medium dense/firm to stiff brown slightly silty clayey SAND/slightly silty sandy CLAY with some sub-rounded and sub-angular gravel and cobbles
			4.50			BS			
							4.70	37.80	
			5.00	5.41	D	*			
			5.00			BS			
			6.00	6.45	S	(31)			
			6.50			BS			
			7.00	7.45	S	(31)			Dense in places very dense pale brown and orange brown slightly silty coarse SAND, sub-angular and sub-rounded GRAVEL and COBBLES, with some boulders, thin layers of yellow clayey SAND/sandy CLAY from 7.00 to 8.10m
			7.50			BS			
			8.00	8.45	S	(34)			
			8.50			BS			
			9.00	9.45	S	(39)			
			9.50			BS			
			9.80	10.63	D	(6)	9.80	32.90	
		10.50	10.50			BS			Soft becoming soft to firm red brown slightly sandy CLAY with sub-angular gravel and cobbles of red brown with some corrosion staining, siltstone with small tenacs and veins of white/grey evaporite material
27/1/91			11.00			BS			
28/1/91			11.00	11.36	D	*	11.00	21.50	
			11.00	11.36		BS			
			11.25	11.78	D	*	11.25	20.25	Stiff red brown silty CLAY with many fragments of weak and very weak red brown mudstone
			11.75	11.78		BS			
									END OF BOREHOLE

REMARKS

1. Equipment: Pilcon Wayfarer shell and auger drilling rig.
2. Standard/Cone Penetration Test Results: see attached sheet.
3. Groundwater: see attached sheet.
4. Obstructions:

Depth (m)	Time (hours)
3.15 - 3.30	0.15
7.60 - 7.90	0.50
11.00 - 11.75	1.00

TYPE OF BORING

Shell and Auger

DIAMETER OF HOLE

0.00 to 11.50m - 200 mm

CASING TABLE

0.00 to 10.50m - 200 mm

BOREHOLE 11

BOREHOLE NO.11

2. Standard/Cone Penetration Test Results:

Depth (m)	Blows/75 mm Penetration	'N' Values
1.00 - 1.45	2/4/4/6/7/7	24
2.00 2.45	5/7/9/9/10/8	36
3.00 3.31	4/10/22/26/4 for 255 mm penetration	> 50
4.00 - 4.45	2/2/3/3/4/5	15
5.00 5.41	6/8/13/13/17/7 for 260 mm penetration	> 50
6.00 - 6.45	5/8/12/8/8/9	37
7.00 - 7.45	6/6/11/11/9/10	33
8.30 - 8.75	5/5/7/9/9/9	34
9.00 9.45	5/7/9/10/9/11	39
10.00 10.45	1/0/0/2/2/2	6
11.00 - 11.31	10/10/13/15/22 for 305 mm penetration	> 50
11.75 - 11.78	50 for 30 mm penetration	> 50

3. Groundwater Levels:

1. Struck water at 2.1m and rose to 1.1m.
2. Sealed off below 3.3m and hole dry to 4.7m.
3. Struck water at 4.7m and rose to 1.6m.
4. Standing at 1.5m before drilling resumed on 26.1.91.

OVE ARUP & PARTNERS

SHEET No.	
Job No.	42510
MADE BY	[illegible]
DATE MADE	11.3.91

RECORD OF BOREHOLE 11 R

DAILY PROGRESS	DEPTH TO WATER	DEPTHS OF CASING	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	SAMPLES TYPE OR ROCK	LEGEND	DEPTH	REDUCED LEVEL	DESCRIPTION OF STRATA
	m	m	m	m			m		GROUND LEVEL (Approx) = 32.50m AOD
6.2.91									See the end of 3911 for description of strata encountered
			[illegible] 11.5	14.25	U6 37		11.50	[illegible]	Strong, in places moderately strong thinly bedded medium grey and red-brown CONGLOMERATE consisting of sub-rounded gravel and cobbles of carboniferous limestone in a matrix of red-brown silty mudstone, generally clast supported. Bedding near horizontal. (TRIASSIC CONGLOMERATE).
6.2.91							14.25	[illegible]	Driller reported rapid penetration for 100mm at 11.8m, infilled with dark brown clayey silt.
									END OF BOREHOLE

REMARKS

TYPE OF BORING
Open Holing O.D. ... 11.5
Rotary Boring 11.5 - 1...

DIAMETER OF BORING
120mm to 11.5m
76mm to 14.25m

CASING NOTES
Casing to 11.6m

BOREHOLE 11 R

Intégral Géotechnique

RECORD OF BOREHOLE 12

APPENDIX	
JOB NO	5046/C
MADE BY	M.C.B.
DATE MADE	8.2.91

DAILY PROGRESS	DEPTH TO WATER	DEPTH OF CASING	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	SAMPLES TYPE	LEGEND	DEPTH	RL/OLD (AOD)	DESCRIPTION OF STRATA
	m	m	m	m			m	m A.O.D.	
							0	GROUND LEVEL @ 33.30m A.O.D.	
4.2.91		0.60	0.50		JS				TOPSOIL overlying brown, yellow brown and orange brown with some pale green grey mottling and occasional nodules/lenses of black with rusty orange patches, slightly sandy SILT/CLAY with occasional sub-rounded gravel of sandstone below 1.50m becoming slightly sandy silty CLAY with many sub-rounded gravel of sandstone
			0.50	0.95	D(14)				
			0.50	0.95	B				
			1.50	1.95	D(46)				
			1.50	1.95	B		1.70	31.60	
			2.60	3.05	U(50)				
	*2.50		2.60		BS				
			3.50	3.95	D(51)				
			3.50		BS				
			4.50	4.95	D(34)				
			4.50		BS				
			5.50	5.95	D(31)				Very dense becoming dense to plasma medium dense grey brown and brown slightly silty very sandy sub-angular and sub-rounded GRAVEL with cobbles of sandstone
			5.50		BS				
			6.50	6.95	D(45)				
			6.50		BS				
			7.50	7.95	D(23)				
6.2.91			7.50		BS				
5.2.91			8.50	8.95	D(16)				
			8.50		BS				
			9.60	9.95	D(20)		9.50	23.80	
			9.60		BS				Medium dense brown and dark brown slightly clayey coarse SAND with occasional sub-rounded gravel of sandstone
			10.50	10.95	D(19)				
			10.50		BS		10.70	22.60	
			10.90		JS				Stiff becoming very stiff dark brown and brown silty CLAY, very sandy in parts with occasional sub angular and sub rounded gravel of sandstone, cobbles and clayey silt lenses
			11.50	11.95	D(21)				
			11.50		BS				
			12.40		JS		12.10	21.20	
			12.50	13.05	D(44)				
			12.60		BS				
			13.50	13.95	D(37)				
			13.50		BS				
			14.50	15.00	D(61)				Dense brown slightly silty fine to coarse SAND and sub-angular to rounded GRAVEL and occasional cobbles of sandstone
5.2.91			14.50		BS				
6.2.91									
			15.50	15.95	D(49)				
			15.50		BS				
			16.50	16.95	D(55)				
			16.80				16.80	16.50	
			17.50	17.95	D(116)				Very dense pale brown/orange/yellow slightly clayey very sandy sub-angular limestone GRAVEL with occasional cobbles and limestone breccia
			17.50		BS				
			18.50	18.95	D(96)				
			18.50		BS				
			19.20		BS		19.20	14.10	Very stiff/hard red brown and brown silty CLAY with many fine sub-angular and angular gravel of limestone and pale brown silty sandstone/siltstone
		18.55	19.55	20.00	D(101)				
6.2.91			19.55		BS		20.00	13.30	END OF BOREHOLE

REMARKS

1. Equipment: Pilcon Hayfactor Shell and Auger drilling rig.
2. Standard/Cone Test Results: see attached sheet.
3. Piezometer: see attached sheet.
4. Chiselling: Depth (m) 19.05 - 19.30; Time (Hours) 0.75

TYPE OF BORING

Shell and Auger

DIAMETER OF BORING

GL to 20.00m - 250 mm

CASING TUBES

GL to 19.55m - 200 mm

BOREHOLE 12

BOREHOLE NO.12

2. Standard/Cone Penetration Test Results:

Depth (m)	Blows/75 mm Penetration	'N' Values
1.00 - 1.45	2/2/2/3/4/5	15
1.50 - 1.95	9/14/16/10/10/10	46
2.60 - 3.05	5/11/12/14/11/13	50
3.50 - 3.95	6/12/12/13/14/12	51
4.50 - 4.95	3/8/8/9/9/8	34
5.50 - 5.95	4/6/8/9/9/11	37
6.50 - 6.95	7/9/10/11/11/13	45
7.50 - 7.95	3/5/6/6/6/7	23
8.50 - 8.95	4/6/10/8/10/11	39
9.50 - 9.95	3/2/3/4/5/8	20
10.50 - 10.95	3/4/4/5/4/5	18
11.50 - 11.95	4/6/7/10/13/13	41
12.60 - 13.05	4/6/8/10/12/14	44
13.50 - 13.95	3/6/5/9/12/10	37
14.55 - 15.00	4/6/9/10/11/11	41
15.50 - 15.95	5/9/10/12/13/10	49
16.50 - 16.95	5/7/9/12/16/18	55
17.50 - 18.95	10/14/20/26/31/39	116
18.50 - 18.95	9/12/15/19/26/34	95
19.55 - 20.00	4/8/12/20/27/32	101

Continued/....

BOREHOLE NO.12 (Continued)

3. Groundwater levels:

1. Struck at 2.50m.
2. Dropped to 7.80m at end of drilling on 4.2.91.
3. 2.50m at start of drilling 5.2.91.
4. 2.50m at start of drilling 6.2.91.
5. 2.50m on completion of borehole.

Intégral Géotechnique

RECORD OF BOREHOLE 13

Job no.	5046/C
Made by	P.G.D.
Date made	13.2.91

Daily progress	Depth of water	Casing or casing	Samples Depth from	Samples Depth to	Samples Type	Legend	Depth	Reduced Level	Description of strata
	m	m	m	m			m	m O.D.	GROUND LEVEL @ 0.30 m O.D.
7.2.91			0.00		BS				TOPSOIL overlying loose pale brown grey, orange brown, yellow brown and dark brown slightly sandy clayey SILT with occasional accompanying gravel becoming boulder towards base
	1.60		0.50	0.95	B(6)				
			1.00		BS		1.35	2.96	
			1.50	1.95	B(6)		1.70	2.61	Loose yellow and grey silty SAND and GRAVEL
			1.50		BS				
			1.70		JS				
			2.50	2.95	B(12)				
			2.50		BS				Firm to stiff red brown and brown mainly silty CLAY with occasional sub-rounded and sub-angular gravel of sandstone
			3.00	3.45	B(13)				
			3.50	3.95	JS				
			3.50		BS				
			4.00	4.45	B(24)				
			4.50		BS				
			5.00	5.45	B(35)		5.40	21.51	
			5.50		BS				Medium dense and dense brown silty very sandy sub-angular and sub rounded GRAVEL with some cobbles of sandstone
			6.00	6.45	B(24)				
			6.50		BS				
			7.00	7.45	B(12)		7.50	21.31	Stiff yellow brown silty CLAY with sub-angular and sub-rounded gravel of sandstone
7.2.91			7.50		BS				
8.2.91			8.00		JS		5.80	23.01	Very stiff red brown and orange brown very sandy CLAY with occasional fine to coarse sub-angular and sub-rounded gravel
			8.50	8.95	B(52)				
			9.00		BS		8.80	22.41	Bedrock/large boulders of pale yellow grey calcareous sandstone and red purple siltstone
8.2.91			9.00	9.50	B		9.50	21.81	
		9.00							END OF BOREHOLE

Remarks

1. Equipment: Pilcon Wayfarer shell and auger drilling rig.
2. Standard/Cone Penetration Test Results: see attached sheet.
3. Groundwater: see attached sheet.
4. Chiselling: Depth (m) 8.90 - 9.10; Time (Hours) 1.5
5. Piezometer installed at 7.00m.

Type of Boring

Shell and Auger

Diameter of Boring

GL to 9.50m - 200 mm

Casing Data

GL to 7.50m - 200 mm

BOREHOLE 13

BOREHOLE NO.13

2. Standard/Cone Penetration Test Results:

Depth (m)	Blows/75 mm Penetration	'N' Values
0.50 - 0.95	1/2/1/2/1/2	8
1.50 1.95	2/2/2/1/2/1	6
2.50 - 2.95	1/2/3/2/4/3	12
3.50 - 3.95	2/4/3/5/5/6	19
4.50 - 4.95	3/4/11/5/4/4	24
5.50 - 5.95	5/7/7/9/9/10	35
6.50 - 6.95	3/6/9/7/7/6	29
7.50 - 7.95	2/3/5/8/9/7	27
8.50 - 8.95	3/7/9/11/10/22	52
9.50 9.52	50 for 20 mm penetration	> 50

3. Groundwater Levels:

1. Struck at 1.4m.
2. Standing at 1.9m at end of drilling on 7.2.91
3. Standing at 1.4m at start of drilling on 8.2.91.

OVE ARUP & PARTNERS

RECORD OF BOREHOLE 13 R

APPENDIX	
JOB NO	12150
MADE BY	RGS
DATE MADE	14.3.91

DAILY PROGRESS	DEPTH TO WATER (m)	DEPTH OF CASING (m)	SAMPLES DEPTH FROM (m)	SAMPLES DEPTH TO (m)	TYPE CR % RQD %	LEGEND	DEPTH (m)	REDUCED LEVEL	DESCRIPTION OF STRATA
									GROUND LEVEL (Approx) = 31.11m AOD
									See record of BH 13 for description of strata encountered.
							10.5	20.61	
			10.5	13.5	100 / 100				Strong in places, moderately strong medium bedded medium grey and red-brown CONGLOMERATE with bands of very weak clayey red-brown mudstone. Conglomerate sub rounded gravel and cobbles of carboniferous limestone and yellow siltstone in a matrix of red brown silty sandstone, generally clast supported. (TRIASSIC CONGLOMERATE). Abundant small 5 - 40mm ø solution cavities 10.5 to 11.0m and 12.6 to 13.1m. Cavities derived from solutioning of calcareous crystals. Red-brown very weak fissured mudstone with clay bands at 11.1 to 11.3m, 11.35 to 11.5, 11.7 to 12.0, 12.2 to 12.22m.
14.2.91							[illegible]	17.[illegible]	
									END OF BOREHOLE

REMARKS

BORING DETAILS

Open Holing G.L. to 10.5m

Rotary Coring 11.5 to 13.5m

DIAMETER OF BORING

150mm to 10.5m

75mm to 10.5 to 13.5m

CASING DETAILS

Casing to 10.5m

BOREHOLE 13 R

Intégral Géotechnique

JOB NO	5046/C
MADE BY	P.G.B.
DATE MADE	13.2.91

RECORD OF BOREHOLE 14/14A

DAILY PROGRESS	DEPTH TO WATER	DEPTHS OF CASING	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	SAMPLES TYPE	SAMPLES (SPT) BLOWS	DEPTH	LEVEL (mAOD)	DESCRIPTION OF STRATA
	m	m	m	m			m	m AOD	
									GROUND LEVEL @ 30.58m A.O.D.
6.2.91			0.50		BS		0.20	30.38	TOPSOIL
7.2.91			1.00	1.45	D	S(12)			Loose brown and yellow brown clayey SAND
			1.00	1.45	BS		1.00	29.58	
			1.50		BS				
			2.00	2.45	D	S(24)			
			2.50	2.95	D	S(15)			
6.2.91	*2.10	2.70	2.50	2.95	D				Stiff brown, red brown and dark brown slightly sandy silty CLAY with sub-angular and sub-rounded gravel and occasional cobbles
			3.00		BS				
			3.50	3.95	D	S(21)			
			4.00		BS				
			4.50	4.95	D	S(22)			
			4.50	4.95	D		4.60	25.98	
			5.00		BS				Medium dense slightly silty very sandy sub-angular and sub-rounded GRAVEL and COBBLES
			5.50	5.95	D	S(19)			
			5.50	6.00	BS				
			6.50	6.95	D	S(14)			
			6.60		BS		6.60	23.98	Firm red brown and brown CLAY with sub angular and sub-rounded gravel and cobbles
			7.00	7.45	D	S(23)	7.20	23.38	Medium dense brown SAND
			7.60		BS		7.60	22.98	Medium dense brown very sandy sub-angular and sub-rounded GRAVEL with some cobbles
			8.00	8.45	D	S(22)			
			8.00		BS		9.10	21.48	
			9.00	9.45	D	S(13)			Firm to stiff yellow brown and orange brown slightly sandy CLAY with occasional sub-angular and sub-rounded gravel
			9.50		BS				
7.2.91									
8.2.91			9.00	10.45	D				
			10.00		BS		10.30	20.28	Firm to stiff yellow brown CLAY with angular gravel and cobbles of limestone
			11.00	11.45	D		10.80	19.78	
8.2.91		11.20	11.20		BS		11.20	19.38	Limestone bedrock/large boulder?
									END OF BOREHOLE

REMARKS

1. Equipment: Hilco mid/Eaves Shell and Auger drilling rig.
2. Standard/Cone Penetration Test Results: see attached sheet.
3. Piezometers: see attached sheet.
4. Chiselling:

Depth (m)		Time (Rmin)
2.70 -	(BH14)	1.00
9.60 -	5.10	0.50
7.60 -	7.70	0.25
10.30 -	10.30	0.75
10.90 -	11.20	1.10

5. Borehole 14 abandoned 2.70m due to large obstruction.

TYPE OF BORING

Spell and Auger

DIAMETER OF BORING

0L to 2.70m - 200 mm (BH14)

GL to 11.20m - 200 mm (BH14A)

CASINGS USED

GL to 2.70m - 200 mm (BH14)

GL to 10.30m - 200 mm (BH14A)

BOREHOLE 14/14

BOREHOLE NO.14/14A

2. Standard/Cone Penetration Test Results

Depth (m)	Blows/15 mm Penetration	'N' Values
1.00 - 1.45	2/2/4/3/3/2	12
2.00 - 2.45	2/3/4/4/6/10	24
2.50 - 2.95	4/5/3/3/4/5	15
3.50 - 3.95	2/3/3/5/6/7	21
4.50 - 4.98	3/4/4/4/5/9	22
5.50 - 5.95	4/4/4/3/7/5	19
6.50 - 6.95	3/3/5/5/2/3	14
7.00 - 7.45	2/3/5/7/7/9	23
8.00 8.45	4/5/5/5/5/7	22
9.00 - 9.45	2/2/3/3/4/3	13
10.00 - 10.44	10/2/5/8/18/19 for 28% mm penetration >	50
11.00 11.00	11.00 for no penetration	50

3. Groundwater Levels:

1. Struck at 5.00m, rose to 2.15m
2. Standing at 2.70m at 8.00 am on 2.2.91.

OVE ARUP & PARTNERS

RECORD OF BOREHOLE 14R

JOB NO	42510
MADE BY	RCS
DATE MADE	14.7.91

DAILY PROGRESS	DEPTH TO WATER	DEPTH OF CASING	SAMPLES DEPTH FROM	SAMPLES DEPTH TO	SAMPLES TYPE AND No	FIELD TESTS	DEPTH	RECOVERY (RQD)	DESCRIPTION OF STRATA
m	m	m	m	m			m		

GROUND LEVEL (Approx) = 10.50m AOD

See record of BH 14 for description of strata encountered.

Very weak to weak mainly bedded fissured silty MUDSTONE, bedding nearly horizontal. (CARBONIFEROUS MOSTOCHE)
Laminated in parts with bands of moderately weak to moderately strong muddy siltstone at 12.0 to 12.74, 12.8 to 12.84 13.0 to 13.03m. Weathered to a silty clay with broken mudstone 12.2 to 12.4m and 13.1 to 13.4m.
Lamellibranch fossils at 12.5m.
Lenticular on vertical fissure 12.5 to 12.84m

Dense grit with sand partings. (TRANSITION ZONE)

Moderately strong light yellow-grey closely to medium bedded medium to coarse SANDSTONE. (CARBONIFEROUS SANDSTONE)

END OF BOREHOLE

REMARKS

Type of Boring:
Open Hole 0.0 to 12.5m
Rotary Coring 12.5 to 15

Diameter of Borings:
150mm to 12.5m
75mm to 15.0m

Completed:

Cased to 12.5m

BOREHOLE 14R

TRIAL PIT 11 — Approx Ground Level = 28.8m AOD

Depth (m)	Strata
0.0 - 0.5	Loose brown very clayey SILT with many roots. (TOPSOIL)
0.5 - 1.6	Medium dense brown, grey and orange brown slightly clayey silty SAND with some fine to medium sub-rounded to rounded gravel of sandstone. (ALLUVIUM)
1.6 - 2.8	Dense brown SAND and fine to coarse sub-rounded GRAVEL with some cobbles and occasional broken boulders of grey sandstone. Becoming damp at 2.4m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 2.4m
2. Slight to moderate groundwater ingress at 2.6m.
3. Bulk sample taken at 0.8m.

TRIAL PIT 12

Approx Ground Level = 27.7m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly clayey SILT with some roots (TOPSOIL)
0.2 - 0.9	Medium dense orange brown and buff silty SAND, slightly clayey in places, with some medium and coarse sub-rounded gravel and occasional fine gravel of grey sandstone. (ALLUVIUM)
0.9 - 3.0	Medium dense to dense reddish brown very sandy fine to coarse sub-rounded to rounded GRAVEL some cobbles and occasional broken boulders mainly grey with occasional black iron-rich sandstone. Becoming damp at 2.0m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit stable.
2. Slight groundwater ingress at base of pit.
3. CBR test carried out at 0.6m.
4. Bulk sample taken at 0.6m.

TRIAL PIT 13 — Approx Ground Level = 28.6m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly clayey SILT with many roots. (TOPSOIL)
0.2 - 0.4	Loose brown slightly clayey SILT with medium and coarse sub-angular to sub-rounded gravel of sandstone. (TRANSITION ZONE)
0.4 - 0.5	Soft to firm light grey mottled orange brown sandy very clayey SILT. Very sandy in places. (ALLUVIUM)
0.5 - 1.3	Medium dense to dense orange brown and grey silty very sandy fine to coarse sub-rounded to rounded GRAVEL with occasional cobbles of sandstone. (GLACIAL SAND AND GRAVEL)
1.3 - 2.7	Dense orange brown SAND and fine to coarse sub-rounded to rounded GRAVEL with some cobbles and occasional broken boulders all of grey sandstone. Becoming damp at 1.9m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 1.0m.
2. Moderate groundwater ingress at 2.2m. Rose to 2.4m in 5 minutes.
3. Bulk sample taken at 1.3m.

TRIAL PIT 14 — Approx Ground Level = 30.2m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly clayey sandy SILT with many roots (TOPSOIL)
0.2 - 1.0	Loose to medium dense orange brown clayey SILT with occasional medium and coarse sub-rounded gravel of grey sandstone and occasional rootlets. (TRANSITION ZONE)
1.0 - 3.2	Medium dense to dense brown very sandy fine to coarse sub-rounded to rounded GRAVEL with occasional cobbles all of grey sandstone. Becoming dense at 1.5m. With occasional platey sub rounded broken boulders below 2.3m. Becoming damp at 2.5m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit stable.
2. Slight to moderate groundwater ingress at 3.0m.
3. Bulk sample taken at 2.8m.

TRIAL PIT 15 — Approx Ground Level = 29.0m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown clayey SILT with many roots. (TOPSOIL)
0.2 - 0.7	Loose to medium dense orange brown and buff very silty SAND with occasional medium sub-rounded gravel of grey sandstone. (ALLUVIUM)
0.7 - 2.8	Medium dense to dense orange brown very sandy fine to coarse sub-rounded GRAVEL. Becoming reddish brown and silty at 1.1m. Becoming damp at 1.9m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 2.2m.
2. Slight to moderate, becoming strong groundwater ingress at 2.2m.
3. Pit dug some 10m from stream.
4. CBR test carried out at 0.4m.
5. Bulk sample taken at 0.4m.

TRIAL PIT 16 — Approx Ground Level - 28.2m AOD

Depth (m)	Strata
0.0 - 0.3	Loose dark brown slightly clayey SILT with many roots. (TOPSOIL)
0.3 - 0.9	Medium dense orange brown silty SAND with some fine to coarse sub-rounded gravel of sandstone. (TRANSITION ZONE)
0.9 - 2.4	Medium dense brown sandy fine to coarse sub-rounded to rounded GRAVEL with some cobbles and occasional broken boulders all of grey sandstone. Becoming medium dense to dense at 1.8m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 2.0m.
2. Moderate groundwater ingress at 2.0m.
3. Bulk sample taken at 1.5m.
4. Occasional traces of black coal at about 1.3m.

TRIAL PIT 17 Approx Ground Level = 19.8m AOD

Depth (m)	Strata
0.0 - 0.3	Loose brown slightly clayey SILT with many roots. (TOPSOIL)
0.3 - 0.5	Loose to medium dense orange brown silty SAND with some fine to coarse sub rounded gravel of sandstone. (TRANSITION ZONE)
0.5 - 3.0	Medium dense brown very sandy fine to coarse sub-rounded GRAVEL with occasional cobbles. Becoming medium dense to dense below 1.0m with occasional sub-rounded large broken boulders. Becoming damp at 2.4m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit slightly unstable to 0.5m and collapsing below 2.8m.
2. Slight to moderate groundwater ingress at 2.8m.
3. Bulk sample taken at 2.4m.

TRIAL PIT 16 — Approx Ground Level = 31.1m AOD

Depth (m).	Strata
0.0 - 0.3	Loose dark brown sandy SILT with many roots. (TOPSOIL)
0.3 - 0.5	Loose orange brown clayey SILT with occasional medium and coarse sub-rounded gravel of grey sandstone. (TRANSITION ZONE)
0.5 - 1.3	Loose to medium dense orange brown and grey very sandy fine to coarse sub-rounded GRAVEL with occasional sub-rounded cobbles. (GLACIAL SAND AND GRAVEL)
1.3 - 3.5	Medium dense brown very sandy fine to coarse sub-rounded GRAVEL with some sub rounded cobbles and occasional broken boulders of grey, and occasionally red, sandstone. Occasional traces of soft maroon silty clay around cobbles at 2.3m. Occasional light brown sandstone boulders at 2.8m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit slightly unstable.
2. Slight water ingress at 3.4m.
3. Bulk sample taken at 1.5m.

TRIAL PIT 10 — Approx Ground Level = 31.1m AOD

Depth (m)	Strata
0.0 - 0.3	Loose dark brown sandy SILT with many roots. (TOPSOIL)
0.3 - 0.9	Loose to medium dense orange brown slightly clayey SILT with occasional medium and coarse sub-angular gravel and occasional rootlets. (TRANSITION ZONE)
0.9 - 1.2	Medium dense brown silty SAND and fine to coarse sub-rounded GRAVEL. (GLACIAL SAND AND GRAVEL)
1.2 - 2.6	Medium dense brown very sandy fine to coarse sub rounded to rounded GRAVEL with some cobbles and occasional broken boulders all of grey sandstone. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 1.4m.
2. Moderate groundwater ingress at 1.4m.
3. Pit dug some 15m from a ditch with water flowing.

TRIAL PIT 2C

Approx Ground Level = 32.9m AOD

Depth (m)	Strata
0.0 - 0.2	Loose orange brown slightly clayey SILT with many roots. (TOPSOIL)
0.2 - 0.8	Medium dense orange very clayey SILT with occasional medium and coarse sub-rounded gravel of grey sandstone. (TRANSITION ZONE)
0.8 - 1.2	Medium dense brown silty very clayey SAND with occasional medium and coarse sub-rounded gravel. (GLACIAL SAND AND GRAVEL)
1.2 - 2.3	Medium dense to dense brown slightly clayey silty very sandy fine to coarse sub-rounded GRAVEL with some sub-rounded cobbles of grey sandstone and traces of soft maroon very sandy clay. (GLACIAL SAND AND GRAVEL)
2.3 - 3.6	Firm to stiff maroon silty CLAY with some fine to coarse sub rounded to rounded gravel of grey, light brown and maroon sandstone. Becoming firm, damp and very sandy at 2.8m. (GLACIAL CLAY)

Notes

1. Sides of pit stable.
2. No groundwater encountered.

TRIAL PIT 21 Approx Ground Level ... 32.1m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly clayey SILT with many roots (TOPSOIL)
0.2 - 0.8	Loose to medium dense orange brown slightly clayey SILT with occasional medium and coarse sub-rounded gravel of grey sandstone (TRANSITION ZONE)
0.8 - 2.8	Medium dense to dense orange brown and grey very sandy fine to coarse sub-rounded to rounded GRAVEL with occasional cobbles of grey sandstone. Becoming damp at 2.1m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 2.1m

2. Moderate groundwater ingress at 2.7m.

TRIAL PIT 22 — Approx Ground Level = 30.7m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly clayey SILT with many roots. (TOPSOIL)
0.2 - 0.7	Loose to medium dense orange brown slightly clayey SILT with occasional medium and coarse sub-rounded gravel of grey sandstone. (TRANSITION ZONE)
0.7 - 1.5	Medium dense orange brown and grey very sandy fine to coarse sub-rounded to rounded GRAVEL with occasional cobbles of grey sandstone. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 0.7m.
2. Moderate to strong groundwater ingress at 1.1m.
3. Pit dug some 7m from a ditch with flowing water.
4. Bulk samples taken at 1.3m.

TRIAL PIT 23 Approx Ground Level = 32.4m AOD

Depth (m)	Strata
0.0 0.2	Loose dark brown slightly clayey SILT with many roots. (TOPSOIL)
0.2 - 1.0	Medium dense orange brown slightly sandy clayey SILT with occasional medium and coarse sub-rounded gravel of grey sandstone. (TRANSITION ZONE)
1.0 - 2.0	Medium dense to dense brown very sandy fine to coarse sub rounded to rounded GRAVEL with some cobbles and occasional broken boulders of grey sandstone. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 0.4m.
2. Moderate to strong groundwater ingress at 1.5m.
3. Bulk sample taken at 1.6m.

TRIAL PIT 24

Approx Ground Level = 34.8m AOD

Depth (m)	Strata
0.0 - 0.3	Loose brown slightly clayey SILT with many roots. (TOPSOIL)
0.3 - 0.9	Medium dense orange brown sandy, very clayey in places, SILT with occasional fine to coarse sub-rounded gravel of grey sandstone. (TRANSITION ZONE)
0.9 - 3.0	Medium dense to dense orange brown SAND and grey fine to coarse sub rounded to rounded GRAVEL of sandstone. Becoming very sandy gravel at 1.5m. Becoming damp at 2.5m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit slightly unstable below 2.5m.
2. Slight to moderate groundwater ingress at 2.7m.
3. Bulk sample taken at 0.8m.

TRIAL PIT 25 — Approx Ground Level = 35.4m AOD

Depth (m)	Strata
0.0 - 0.3	Loose brown slightly clayey SILT with many roots. (TOPSOIL)
0.3 - 0.8	Medium dense orange brown slightly sandy clayey SILT with occasional medium and coarse sub rounded of grey sandstone. (TRANSITION ZONE)
0.8 - 3.6	Medium dense to dense brown very sandy fine to coarse sub rounded to rounded GRAVEL with some cobbles of grey sandstone. Occasional broken boulders below 1.7m, becoming damp at 1.8m. (GLACIAL SAND AND GRAVELS)

Notes

1. Sides of pit stable.
2. Slight groundwater ingress at 3.5m.
3. Bulk sample taken at 1.2m.

TRIAL PIT 26 — Approx Ground Level = 34.6m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown clayey SILT with many roots. (TOPSOIL)
0.2 - 0.7	Loose to medium dense reddish brown slightly clayey SILT with occasional medium and coarse sub-rounded gravel of grey sandstone. (TRANSITION ZONE)
0.7 - 1.4	Medium dense brown silty SAND with some fine to coarse sub-rounded gravel of sandstone. (GLACIAL SAND AND GRAVEL)
1.4 - 3.2	Medium dense to dense brown very sandy fine to coarse sub-rounded to rounded GRAVEL with occasional boulders of grey sandstone. Occasional large broken boulders below 2.8m. Becoming damp at 1.7m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 2.2m.
2. Slight to moderate groundwater ingress at 2.8m.
3. Bulk sample taken at 1.7m.

TRIAL PIT 27 — Approx Ground Level = 33.3m AOD

Depth (m)	Strata
0.0 - 0.4	Loose dark brown clayey SILT with many roots. (TOPSOIL)
0.4 - 0.9	Medium dense light brown slightly clayey silty SAND with occasional medium and coarse sub-rounded gravel of grey sandstone. (TRANSITION ZONE)
0.9 - 1.4	Medium dense reddish brown slightly clayey SAND with some fine and medium sub-rounded to rounded gravel of sandstone. (GLACIAL SAND AND GRAVEL)
1.4 - 2.8	Medium dense to dense brown very sandy fine to coarse sub-rounded to rounded GRAVEL with some cobbles and occasional boulders of grey sandstone. Becoming damp at 1.6m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 1.8m.
2. Moderate groundwater ingress at 2.5m.

TRIAL PIT 28

Approx Ground Level = 32.1m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly sandy SILT with many roots. (TOPSOIL)
0.2 - 0.5	Loose orange brown slightly clayey SILT with occasional medium and coarse sub-rounded gravel. (TRANSITION ZONE)
0.5 - 1.0	Medium dense light grey with orange mottling slightly clayey, very clayey in places, silty SAND. (ALLUVIUM)
1.0 - 1.9	Dense reddish brown silty SAND with much grey, dark red and brown fine and medium gravel of sandstone. (GLACIAL SAND AND GRAVEL)
1.9 - 3.0	Medium dense to dense brown very sandy fine to coarse sub-rounded to rounded GRAVEL with some cobbles and occasional broken boulders all of grey sandstone. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 2.1m.
2. Slight to moderate groundwater ingress at 2.0m.
3. Bulk sample taken at 2.8m.

TRIAL PIT 29 — Approx Ground Level = 34.4m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly sandy SILT with occasional fine and medium sub-rounded gravel and many roots. (TOPSOIL)
0.2 - 1.0	Loose to medium dense orange brown slightly sandy very clayey SILT with occasional medium and coarse sub-rounded gravel and occasional traces of black coal fragments. (GLACIAL SAND AND GRAVEL : NORTH SIDE OF PIT ONLY)
0.2/1.0 - 2.1	Medium dense orange brown silty SAND with some fine to coarse sub-rounded gravel of grey sandstone. (GLACIAL SAND AND GRAVEL)
2.1 - 3.9	Medium dense to dense brown SAND and fine to coarse sub-rounded to rounded GRAVEL with some cobbles and occasional boulders all of grey sandstone. Becoming damp at 3.1m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit slightly unstable between 0.4m and 1.0m.
2. Slight groundwater ingress at base of pit.
3. Bulk sample taken at 1.6m.

TRIAL PIT 30

Approx Ground Level = 31.6m AOD

Depth (m)	Strata
0.0 - 0.4	Loose dark brown clayey SILT with many roots and occasional medium and coarse gravel below 0.2m. (TOPSOIL)
0.4 - 0.8	Loose orange brown slightly sandy clayey SILT with occasional medium and coarse sub-rounded gravel. (ALLUVIUM)
0.8 - 1.5	Medium dense to dense reddish brown slightly clayey silty very sandy fine to coarse sub-rounded to rounded GRAVEL with occasional cobbles of grey sandstone. (GLACIAL SAND AND GRAVEL)
1.5 - 3.3	Firm to stiff maroon silty CLAY with some fine to coarse sub-rounded gravel mainly of grey sandstone, with occasional light brown sandstone. (GLACIAL CLAY)

Notes:

1. Sides of pit slightly unstable to 1.5m.
2. Slight groundwater ingress at 1.4m and 2.2m.
3. Slight to moderate groundwater ingress at 3.2m.
4. Bulk sample at 1.7m.
5. Pit was dug in a very wet field with small patches of standing water.

TRIAL PIT 31

Approx Ground Level = 31.0m AOD

Depth (m)	Strata
0.0 - 0.4	Loose dark brown very clayey SILT with many roots. (TOPSOIL)
0.4 - 1.4	Medium dense light grey with orange brown mottling silty SAND with occasional pockets of clayey sand. (ALLUVIUM)
1.4 - 1.9	Medium dense brown very sandy fine to course sub-rounded GRAVEL of grey sandstone. (GLACIAL SAND AND GRAVEL)
1.9 - 3.2	Stiff maroon silty CLAY with occasional medium and coarse sub-rounded gravel and cobbles of grey sandstone. Occasional pockets of soft to firm reddish brown silty clay and light grey sand. (GLACIAL CLAY)

Notes

1. Sides of pit stable.
2. No groundwater ingress observed.

TRIAL PIT 32 — Approx Ground Level = 30.3m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly sandy SILT with many roots. (TOPSOIL)
0.2 - 0.7	Loose to medium dense brown slightly sandy SILT with occasional roots. (TRANSITION ZONE)
0.7 - 0.9	Loose to medium dense light grey slightly silty SAND. (ALLUVIUM : EAST SIDE OF PIT ONLY)
0.7/0.9 - 1.1	Medium dense orange brown and buff very clayey SILT with much fine gravel of black sub-angular to sub-rounded sandstone. (ALLUVIUM)
1.1 - 3.3	Medium dense to dense damp dark brown very sandy fine to coarse sub-rounded GRAVEL of grey and black iron-rich sandstone, and some cobbles of grey sandstone. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit slightly unstable below 2.3m.
2. Slight groundwater ingress at 2.0m.
3. CBR test carried out at 0.6m.
4. Bulk sample taken at 0.6m.

TRIAL PIT 33 — Approx Ground Level = 32.2m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly clayey sandy SILT with many roots. (TOPSOIL)
0.2 - 0.8	Loose to medium dense brown silty SAND and fine to coarse GRAVEL. (GLACIAL SAND AND GRAVEL)
0.8 - 2.8	Medium dense orange brown and grey very sandy fine to coarse sub-rounded to rounded GRAVEL with occasional cobbles and traces of grey sand lenses. Becoming medium dense to dense with some cobbles and occasional broken boulders at 1.5m. Becoming damp at 2.2m. (GLACIAL SAND AND GRAVEL)
2.8 - 3.4	Stiff maroon silty CLAY with some fine to medium sub-rounded to rounded gravel of grey and light brown sandstone. (GLACIAL CLAY)

Notes

1. Sides of pit slightly unstable at 0.8m.
2. Slight groundwater ingress at 2.4m.
3. Bulk samples taken at 0.8m and 3.0m.

TRIAL PIT 34 — Approx Ground Level - 34.2m AOD

Depth (m)	Strata
0.0 - 0.4	Loose dark brown very clayey SILT with some roots. (TOPSOIL)
0.4 - 0.8	Loose dark grey very clayey SILT with much decaying grass and roots. (BURIED TOPSOIL)
0.8 1.5	Medium dense orange brown slightly clayey sand SILT with some fine to coarse sub rounded gravel. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 1.2m.
2. Very strong ingress of groundwater at 1.0m from north side of pit - pit abandoned.
3. 100mm diam. clay pipe encountered at 1.0m, slight water seepage from it.
4. This pit was dug in the vicinity of a circular feature observed on aerial photographs.

TRIAL PIT 35 — Approx Ground level = 32.5m AOD

Depth (m)	Strata
0.0 - 0.3	Loose dark brown very sandy SILT with many roots. (TOPSOIL)
0.3 - 0.8	Medium dense damp light brown and light grey silty SAND, becoming slightly clayey with depth. (ALLUVIUM)
0.8 - 1.2	Medium dense reddish brown and grey slightly clayey silty SAND with occasional medium and coarse sub-rounded gravel of grey sandstone (GLACIAL SAND AND GRAVEL)
1.2 - 2.3	Medium dense to dense reddish brown silty very sandy fine to coarse sub-rounded GRAVEL with occasional cobbles and boulders. Becoming damp below 1.4m. (GLACIAL SAND AND GRAVEL)
2.3 - 3.3	Firm to stiff maroon silty CLAY with some sub-rounded to rounded fine to coarse gravel of grey, buff and black sandstone. (GLACIAL CLAY)

Notes

1. Sides of pit slightly unstable below 1.3m.
2. Slight groundwater ingress at 1.4m.

TRIAL PIT 06

Approx Ground Level = 32.2m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly clayey SILT with some roots. (TOPSOIL)
0.2 - 0.8	Loose to medium dense light grey, buff and orange brown slightly clayey silty SAND with occasional medium and coarse sub-rounded gravel. (ALLUVIUM)
0.8 - 2.7	Medium dense to dense brown very sandy fine to coarse sub-rounded to rounded GRAVEL with occasional cobbles of grey sandstone. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 1.7m.
2. Slight groundwater ingress at 1.7m.
3. Bulk sample taken at 1.7m.

TRIAL PIT 37 — Approx Ground Level - 32.5m AOD

Depth (m)	Strata
0.0 - 0.4	Loose dark brown slightly sandy SILT with some roots. (TOPSOIL)
0.4 - 0.7	Loose to medium dense brown sandy very clayey SILT with occasional medium to coarse sub-rounded gravel. (TRANSITION ZONE)
0.7 - 1.6	Loose to medium dense light grey and orange brown silty SAND, very clayey in places, with occasional medium and coarse sub-rounded gravel of sandstone. (ALLUVIUM)
1.6 - 3.0	Medium dense to dense brown very sandy fine to coarse sub rounded to rounded GRAVEL with occasional cobbles of grey sandstone. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 1.6m.
2. Slight to moderate groundwater ingress at 2.8m.
3. Bulk sample taken at 1.4m.

TRIAL PIT 35

Approx Ground Level = 33.3m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly sandy SILT with many roots and a trace of fine to medium gravel. (TOPSOIL)
0.2 - 0.6	Loose to medium dense orange brown slightly clayey SILT with occasional medium and coarse sub-rounded gravel of grey sandstone (TRANSITION ZONE)
0.7 3.3	Medium dense to dense brown very sandy fine to coarse sub-rounded to rounded GRAVEL with some cobbles and occasional broken boulders of grey sandstone. Becoming damp at 2.1m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 2.8m.
2. Slight groundwater ingress at 2.8m.

TRIAL PIT 39 — Approx Ground Level = 32.7m AOD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly sandy SILT with many roots. (TOPSOIL)
0.2 - 0.7	Loose to medium dense slightly clayey SILT with occasional medium and coarse sub-rounded gravel of grey sandstone. (TRANSITION ZONE)
0.7 - 3.1	Medium dense to dense brown very sandy fine to coarse sub-rounded to rounded GRAVEL with some cobbles and occasional broken boulders of grey sandstone. Becoming damp at 2.4m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit slightly unstable below 2.8m.
2. Slight groundwater ingress at 2.6m.

TRIAL PIT 40 — Approx Ground Level = 32.7m AOD

Depth (m)	Strata
0.0 - 0.3	Loose dark brown slightly clayey SILT with many roots. (TOPSOIL)
0.3 - 1.1	Medium dense orange brown silty very sandy fine to coarse sub rounded to rounded GRAVEL with some cobbles of grey sandstone. (TRANSITION ZONE)
1.1 - 3.0	Medium dense to dense brown very sandy fine to coarse sub rounded to rounded GRAVEL with some cobbles and occasional broken boulders of grey sandstone. Becoming damp below 2.1m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit collapsing below 2.4m.
2. Slight to moderate groundwater ingress at 2.5m.
3. Bulk sample taken at 2.2m.

TRIAL PIT 41 — Approx Ground Level = 28.7m OAD

Depth (m)	Strata
0.0 - 0.2	Loose dark brown slightly clayey SILT with many roots (TOPSOIL)
0.2 - 0.8	Loose to medium dense orange brown very clayey SILT with some fine to coarse sub-rounded gravel of grey sandstone. (ALLUVIUM)
0.8 - 3.5	Medium dense brown very sandy fine to coarse sub-rounded to rounded GRAVEL with some cobbles and occasional broken boulders of grey sandstone. Becoming medium dense to dense at 1.5m. Becoming damp at 2.5m. (GLACIAL SAND AND GRAVEL)

Notes

1. Sides of pit slightly unstable to 0.8m
2. Moderate groundwater ingress at 3.4m.

APPENDIX C

TEST RESULTS – PREVIOUS INVESTIGATIONS

TABLE II continued

INDEX PROPERTY TESTS RESULTS

Borehole No	Sample No	Depth Below G.L.	M/C	L.L.	P.L.	Casagrande Symbol
72	5	3.0	14	32	25	ML
72	7	4.5	13	30	23	CL
72A	2	0.3	52	40	36	OM
72A	3	0.45	25	26	20	CL
73	3	1.5	18	24	19	CL
73	5	3.0	16	25	16	CL
73A	3	0.4	23	30	24	ML
76	3	1.5	22	32	21	CL
77	11	11.0	20	35	24	ML
81	3	1.5	15	27	22	ML
82	3	1.5	15	20	16	SC
83	3	1.5	13	27	25	ML
84	3	1.5	14	29	22	CL
85	4	2.5	13	28	19	CL
85	7	7.5	19	52	17	CH
85A	8	7.4	16	37	25	CM
86	3	1.5	19	33	19	CL
86	5	3.5	15	34	16	CL
87	13	7.5	26	60	37	MH
87	17	12.5	25	43	20	CM
88	6	2.9	24	65	30	CH
88	12	7.0	22	56	24	CH
89	8	3.7	14	29	22	CL
89A	4	2.0	15	21	18	CL
90	3	1.5	18	25	20	CL
90	6	5.0	18	33	26	ML
90A	3	1.5	19	32	24	CL
90A	5	3.5	12	31	19	CL
90B	3	0.5	20	34	16	CL
91	5	2.0	12	19	16	SC
92	6	3.5	8	25	19	CL
95	3	1.5	16	27	21	CL
96	3	1.5	14	25	17	CL
97	3	1.5	22	26	20	CL
98	5	3.0	21	37	19	CL
99	3	1.5	13	21	18	SC
100	3	1.5	12	31	17	CL
101	3	1.5	9	20	15	CL
102	3	1.5	14	22	17	CL
103	7	4.5	25	29	17	CL
104	3	1.5	16	26	21	CL

TABLE III continued

UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Bore hole No	Sample No	Depth Below G.L.	Bulk Density kg/cu.m	Moisture Content %	Cell Pressure kN/m^2	Max. Diff. in P' Stress kN/m^2	Apparent Cohesion kN/m^2	ϕ
75	3	1.0 m – 1.5 m	2047	16	150 300 450	344.28 455.01 491.14	107	6°
77	11	10.5 m – 11.1 m	2066	15	150 300 450	254.13 357.05 437.97	68	13°
83	3	1.0 m – 1.5 m	1976	12	150 300 450	47.94 76.2 113.29	39	0°
84	3	1.0 m – 1.5 m	1985	16	150 300 450	142.0 200.0 280.0	10	13.5°
85	7	7.0 m – 7.5 m	1931	12	150 300 450	203.71 312.94 350.79	100	6.5°
	13	14.5 m – 15.0 m	2170	15	150 300 450	310.54 460.76 622.23	51	20°
86	3	1.0 m – 1.5 m	1989	16	150 300 450	152.89 193.4 280.56	45	6°
	5	3.0 m – 3.5 m	2127	13	150 300 450	455.8 759.76 –	40	30°
87	13	7.0 m – 7.5 m	1952 1972 1990	24 28 26	150 300 450	248.42 246.41 259.96	109	0°
	17	12.0 m – 12.5 m	1909	23	150 300 450	153.56 229.13 260.5	122	0°

TABLE III

UNDRAINED TRIAXIAL COMPRESSION TEST RESULTS

Bore hole No	Sample No	Depth below G.L.	Bulk Density kg/cu.m	Moisture Content %	Cell Pressure kN/m^2	Max. Diff. in P Stress kN/m^2	Apparent Cohesion kN/m^2	ϕ
43	5	2.5 m – 3.0 m	2100 2115 2115	33 35 36	150 300 450	75.82 79.23 168.74	38	0°
45	7	7.3 m – 7.5 m	1931	12	150 300 450	269.0 315.0 350.0	100	65°
49A	15	9.2 m – 9.7 m	2056	17	150 300 450	93.52 136.84 197.5	68	3°
60	6	3.6 m – 4.1 m	1994	11	150 300 450	229.0 287.2 407.5	70	9°
61	5	3.6 m – 4.1 m	1900	15	150 300 450	59.2 89.83 138.95	43	0°
62	8	4.5 m – 5.0 m	1902	20	150 300 450	60.51 125.47 180.59	61	0°
65	3	1.5 m – 2.0 m	2039	14	150 300 450	151.96 193.66 246.81	42	7°
71	3	1.0 m – 1.5 m	1984	9	150 300 450	87.14 130.47 184.85	45	2°
	5	2.5 m – 3.0 m	1968	25	150 300 450	36.52 45.26 77.84	27	0°
72	5	2.5 m – 3.0 m	2066	12	150 300 450	28.65 53.17 73.02	26	0°
	7	4.0 m – 4.5 m	2260	10	150 300 450	103.79 434.15 465.87	140	8°

TABLE V continued

CONSOLIDATION TESTS RESULTS

Bore hole No	Sample No	Depth Below G.L.	Applied Pressure kN/m²	Voids Ratio	Coeff. of Vol. Decrease m²/kN x 10⁻³	Coeff. of Consol. mm²/sec.
73	5	2.5 m – 3.0 m	0 26.8 53.6 107.25 214.5 429	0.321 0.300 0.290 0.276 0.259 0.238	0.599 0.284 0.205 0.129 0.077	2.25 1.23 1.21 2.11 2.04
84	5	8.5 m – 9.0 m	0 26.8 53.6 107.25 214.5 429	0.442 0.430 0.419 0.400 0.378 0.35[illegible]	0.313 0.295 0.204 0.149 0.092	5.09 2.23 4.99 4.75 2.05
85	13	14.5 m – 15.0 m	0 26.8 53.6 107.25 214.5 429	0.357 0.394 0.39[illegible] 0.381 0.362 0.337	0.069 0.088 0.132 0.128 0.086	2.28 2.27 2.25 4.54 2.14
86	9	7.3 m – 7.9 m	0 26.8 53.6 107.25 214.5 429	0.348 0.346 0.341 0.333 0.320 0.303	0.074 0.116 0.125 0.086 0.061	1.28 1.27 2.25 4.56 2.17
87	7	2.7 m – 3.2 m	0 26.8 53.6 107.25 214.5 429	0.822 0.815 0.803 0.776 0.737 0.693	0.139 0.249 0.281 0.205 0.148	5.11 5.06 4.95 4.77 1.13

TABLE V

CONSOLIDATION TESTS RESULTS

Bore hole No	Sample No	Depth Below G.L.	Applied Pressure kN/m^2	Voids Ratio	Coeff. of Vol. Decr. $m^2/kN \times 10^{-3}$	Coeff. of Consol. $mm^2/sec.$
43	5	2.5 m – 3.0 m	0 26.8 53.6 107.25 214.5 429	0.557 0.546 0.536 0.522 0.504 0.478	0.258 0.246 0.199 0.113 0.080	5.10 5.02 2.21 2.15 2.10
46	3	1.0 m – 1.5 m	0 26.8 53.6 107.25 214.5 429	0.466 0.441 0.424 0.399 0.350 0.294	0.637 0.449 0.319 0.332 0.199	3.12 1.22 2.12 2.01 4.18
62	3	1.0 m – 1.5 m	0 26.8 53.6 107.25 214.5 429	0.573 0.551 0.529 0.495 0.452 0.436	0.522 0.746 0.442 0.208 0.051	2.26 2.16 2.09 1.59 1.08
63	2	1.5 m – 2.0 m	0 26.8 53.6 107.25 214.5 429	0.605 0.596 0.581 0.559 0.535 0.502	0.199 0.355 0.256 0.148 0.100	2.28 5.02 4.91 4.77 4.59
72	7	4.0 m – 4.5 m	0 25.8 53.6 107.25 214.5 429	0.336 0.338 0.334 0.327 0.316 0.299	– 0.599 0.962 0.863 0.669	1.28 1.28 2.27 2.24 2.19

TABLE VI

SULPHATE AND pH TEST RESULTS

Bore hole No	Sample No	Description of Sample	Soluble Sulphate Present as SO_4	pH Value
37	W	Ground water	4.05 pts/100 000	7.5
37A	W	Ground water	4.34 pts/100 000	7.9
39	W	Ground water	5.28 pts/100 000	7.0
40	W	Ground water	4.80 pts/100 000	7.7
45	W	Ground water	5.01 pts/100 000	7.8
49A	W	Ground water	5.35 pts/100 000	8.0
49B	W	Ground water	3.50 pts/100 000	7.7
57	W	Ground water	1.65 pts/100 000	7.4
58	3	Very sandy clay	0.011%	7.6
59	W	Ground water	13.45 pts/100 000	7.1
68	2	Marl	0.030%	7.0
69	W	Ground water	10.20 pts/100 000	7.1
75	3	Sandy silty clay	0.027%	7.2
76	W	Ground water	3.84 pts/100 000	7.0
77	3	Clayey sand and gravel	0.015%	7.1
78	W	Ground water	5.02 pts/100 000	7.0
85	W	Ground water	2.61 pts/100 000	7.2
85A	W	Ground water	3.09 pts/100 000	6.9
88	6	Laminated silty clay	0.050%	8.0
88	W	Ground water	10.51 pts/100 000	8.0
98	W	Ground water	5.05 pts/100 000	7.5
100	W	Ground water	6.04 pts/100 000	7.5
103	7	Laminated silty clay	0.042%	8.0
104	3	Sandy silty clay	0.013%	6.2
114	3	Sandy silty clay	0.0[illegible]6%	7.9
115	3	Sandy silty clay	0.016%	7.8
116	5	Sandy silty clay	0.030%	8.0
117	5	Fissured silty clay	0.020%	8.0
118	3	Sandy silty clay	0.002%	8.0
140	3	Clayey sand and gravel	0.013%	7.5
142	5	Clay and gravel	0.012%	7.4
143	3	Clayey sand and gravel	0.010%	7.8
144	5	Clayey sand and gravel	0.023%	6.0
155	4	Sandy clay and gravel	0.033%	7.6
156	2	Very sandy clay	0.028%	8.0
157	3	Very sandy clay	0.019%	7.8
168	W	Ground water	0.617 pts/100 000	7.6
170	W	Ground water	4.32 pts/100 000	7.0
172	W	Ground water	1.85 pts/100 000	7.4
174	W	Ground water	1.17 pts/100 000	7.5
176	W	Ground water	0.96 pts/100 000	7.5
182	2	Sandy silty clay	0.03[illegible]%	7.8
184	W	Ground water	6.31 pts/100 000	7.5
185	W	Ground water	5.76 pts/100 000	8.0

Trial Pit No. 12
Depth (m) 0·6

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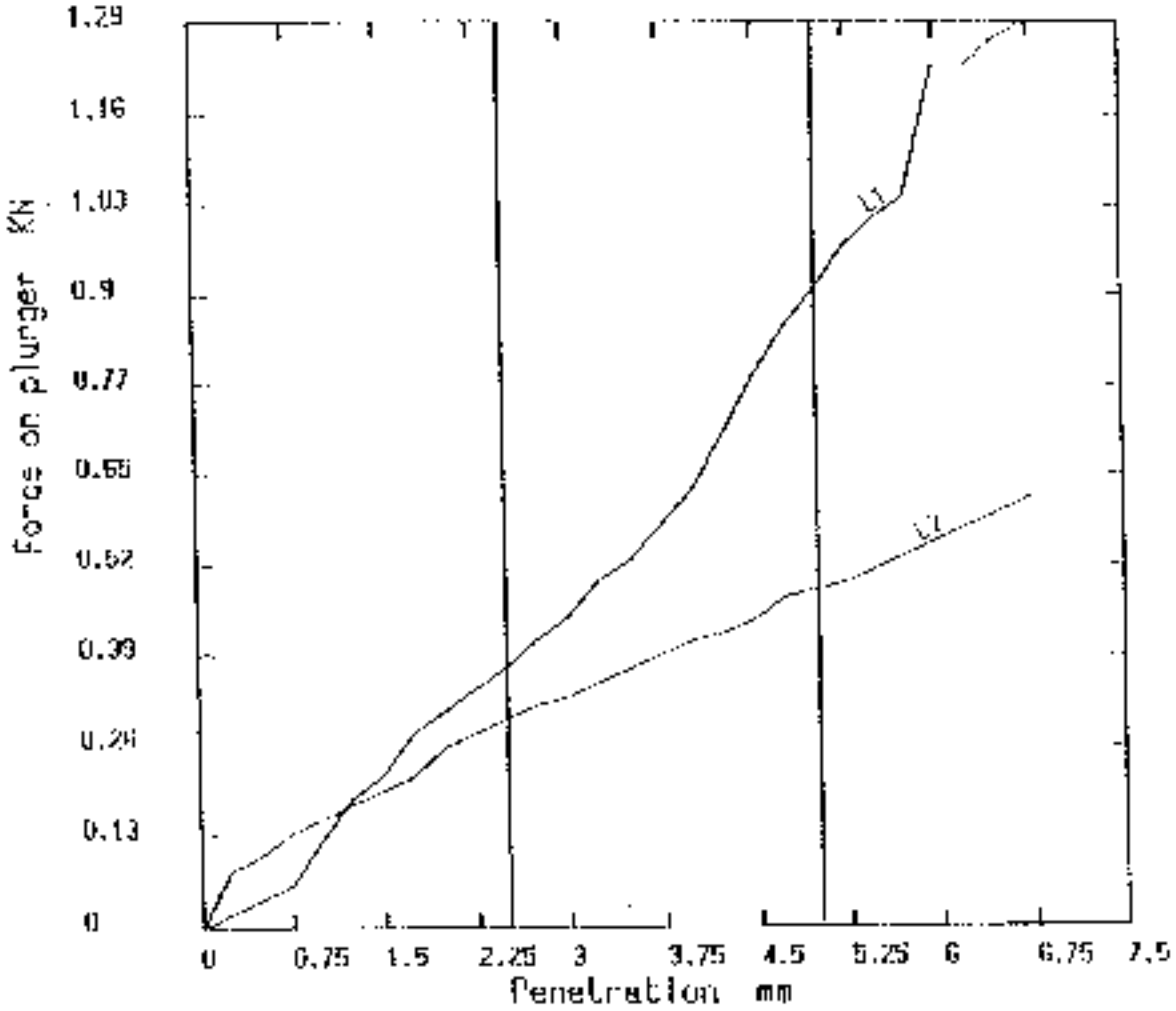
B.S.1377 TEST 16 CALIFORNIA BEARING RATIO TEST RESULTS



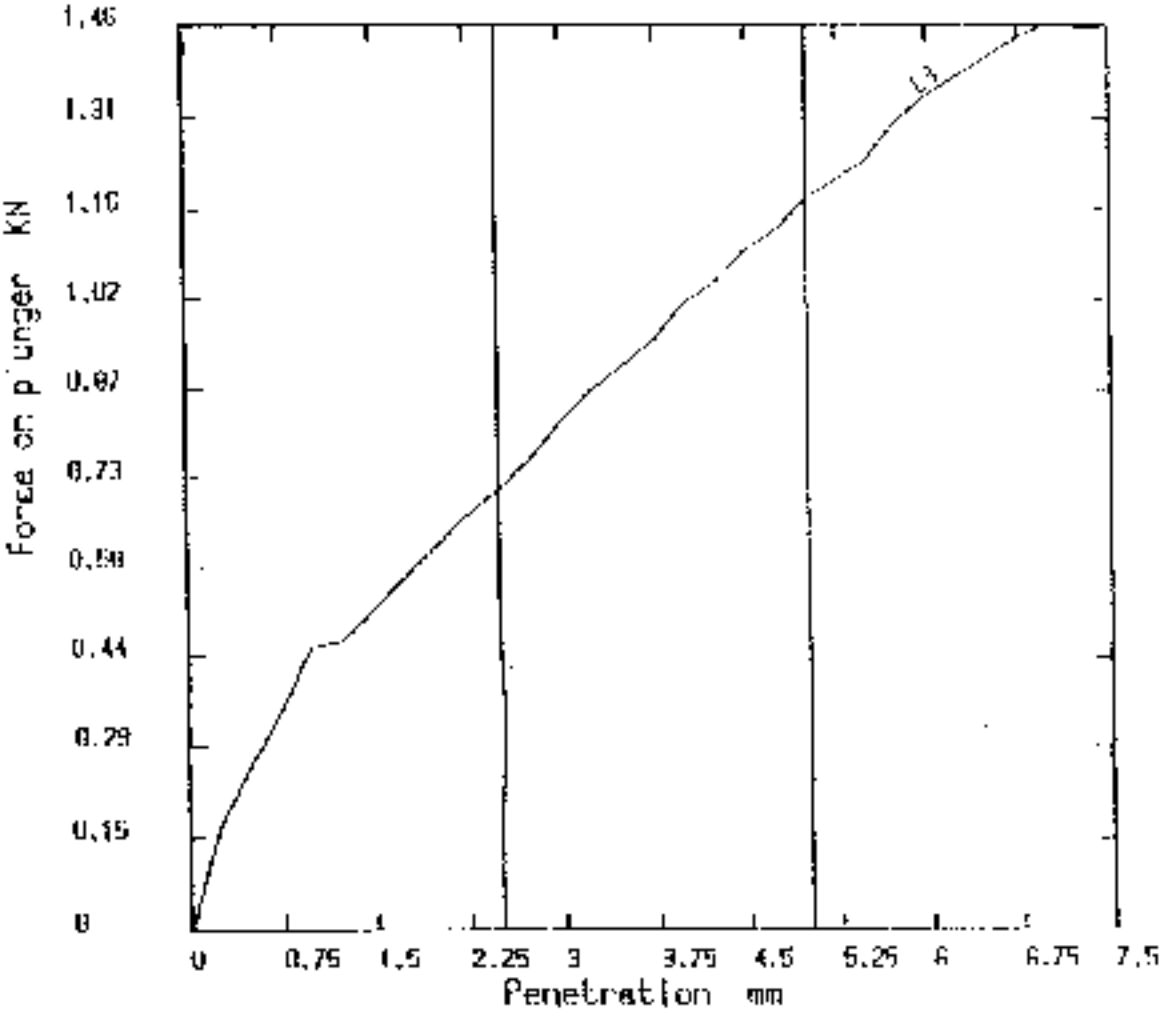
Moisture Content Values
Location 1
M/C = 16.3%
Location 2
M/C = 16.7%

C.B.R. Values
Location 1 (L1)
% CBR at 2.5 mm 2.79
% CBR at 5.0 mm 4.57
Location 2 (L2)
% CBR at 2.5 mm 2.24
% CBR at 5.0 mm 2.41

Trial Pit No. 12
Depth (m) 0·6

Intégral Géotechnique

B.S.1377 TEST 16 CALIFORNIA BEARING RATIO TEST RESULTS



Moisture Content Value
Location 3
M/C = 14.25%

C B R Values
Location 3 (19)
% CBR at 2.5 mm 5.34
% CBR at 5.0 mm 5.9

Trial Pit No. 15
Depth (m) 0·4

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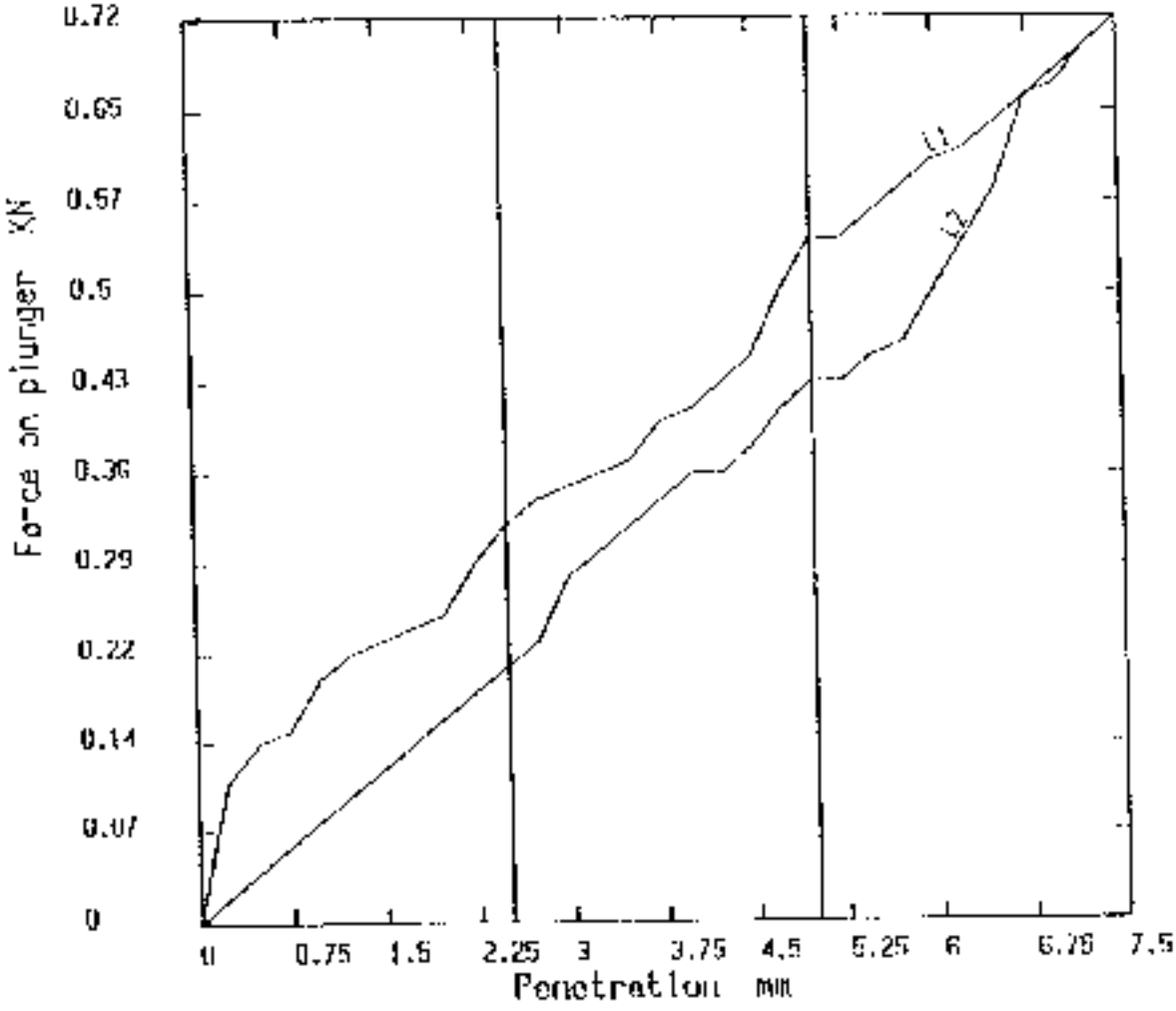
B.S.1377 TEST 16 CALIFORNIA BEARING RATIO TEST RESULTS



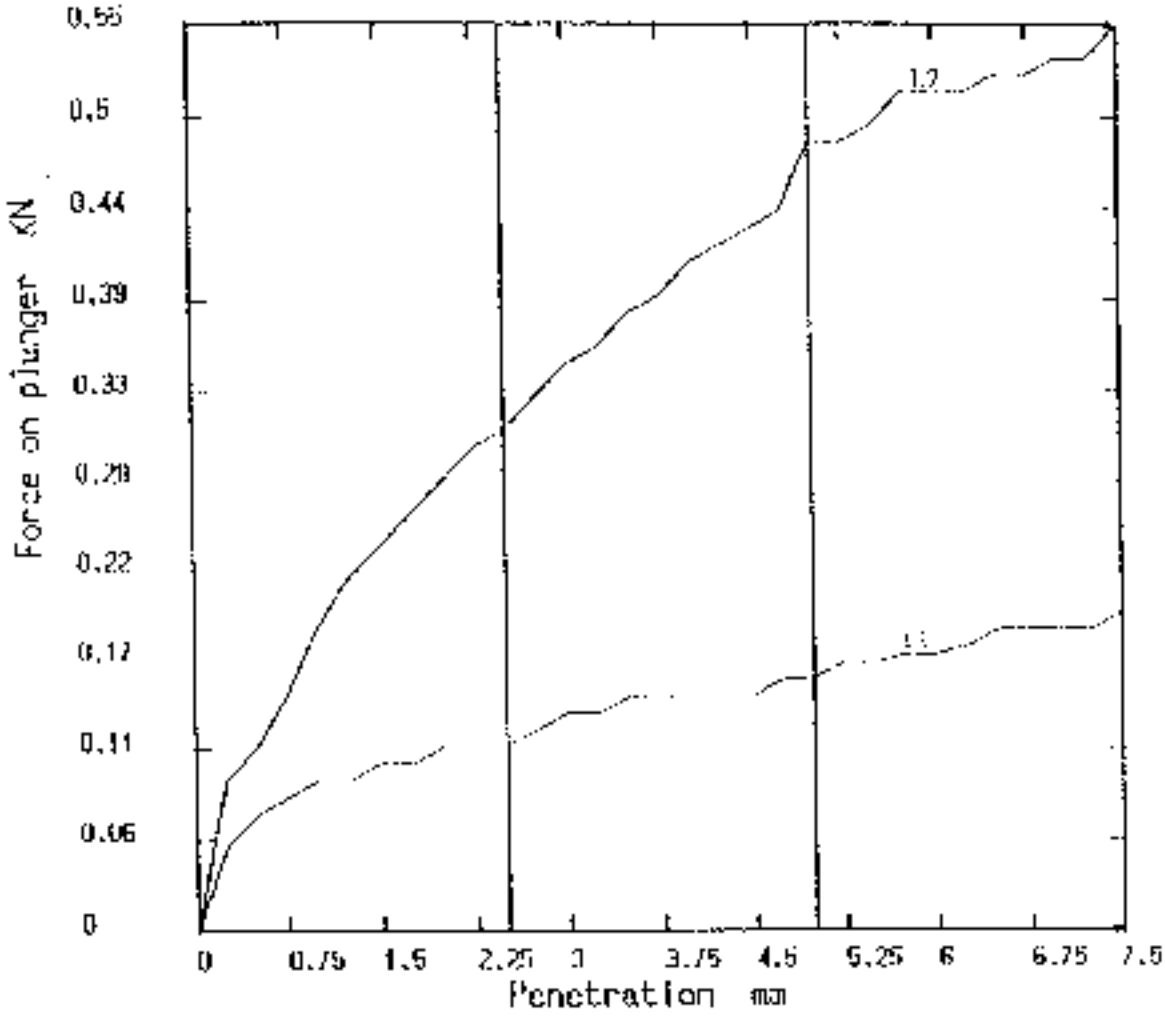
Moisture Content
Location 1
M/C = 23.24%
Location 2
M/C = 21.07%

C.B.R. Values
Location 1 (L1)
% CBR at 2.5 mm 2.4
% CBR at 5.0 mm 2.72
Location 2 (L2)
% CBR at 2.5 mm 1.55
% CBR at 5.0 mm 2.16

Trial Pit No. 32
Depth (m) 0·6

Intégral Géotechnique

B.S.1377 TEST 16 CALIFORNIA BEARING RATIO TEST RESULTS



Moisture Content Values

Location 1

M/C = 32.1%

Location 2

M/C = 31.7%

C.B.R. Values

Location 1 (L1)

% CBR at 2.5 mm 0.85

% CBR at 5.0 mm 0.77

Location 2 (L2)

% CBR at 2.5 mm 2.37

% CBR at 5.0 mm 2.41

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PENCOED

Laboratory test results

TRIAL PIT NO	DEPTH (m)	INDEX PROPERTIES				COMPACTION			O.M.C.	CHEMICAL TESTS			
		Nat. (%)	LL (%)	PL (%)	PI (%)	Rem (kg)	Max. γ_d (kg/m^3)	O.M.C (%)	Mean (%)	pH	Total Sulphate (%)	Groundwater Sulphate (g/l)	Organic content
10	0.6	15	NP	NP	NP								
11	0.8									8.6	0.25		
12	0.5	18							11.0				
13	1.5					4.5	2160	11.0					
15	0.4												2.9
17	2.4					4.5	2150	9.0		7.5	0.10		
18	1.4					4.5	2160	8.5					
20	1.3					4.5	2220	11.0					

MC - Natural Moisture Content LL - Liquid Limit PL - Plastic Limit O.M.C - Optimum Moisture Content Rem - Dry Density

PI - Plasticity Index NP - Non Plastic CBR tests carried out on remoulded samples compacted at their own

PENCOED

Intégral Géotechnique

Laboratory test results

TRIAL PIT NO.	DEPTH (m)	INDEX PROPERTIES				COMPACTION			C.B.R.	CHEMICAL TESTS			
		NMC (%)	LL (%)	PL (%)	PI (%)	Ron (Mg)	Max. ρ_d (Mg/m^3)	O.M.C. (%)	Mean (%)	pH	Total Sulphate (%)	Groundwater Sulphate (g/l)	Organic Content
23	1.6					4.5	1955	9.5					
25	1.2					4.5	2095	6.0					
26	1.7	13							1.2				
28	1.8					4.5	2140	8.5					
31	0.7	23											
32	0.6	20							<1.0				
33	0.8					4.5	2025	10.0					
36	1.7					4.5	2215	9.0					
40	2.2	11							2.3				

NMC - Natural Moisture Content LL - Liquid Limit PL - Plastic Limit O.M.C. - Optimum Moisture Content ρ_d - Dry Density

PI - Plasticity Index NP - Non Plastic CBR tests carried out on remoulded samples compacted to their NMC

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PENCOED

Laboratory test results

BOREHOLE NO.	DEPTH (m)	INDEX PROPERTIES				COMPACTION			G.S.D.	CHEMICAL TESTS			
		NMC (%)	LL (%)	PL (%)	PI (%)	MDD (Mg/m³)	Max C_d (kg/L)	O.M.C. (%)	Fines (%)	pH	Total Sulphate (%)	Groundwater Sulphate (g/l)	Organic Content
2	1.5									7.0	0.13		
2	5.0	19											
2	5.5		29	16	13								
2	9.0	20											
3	1.2	6.7											
3	2.0		30	NP	NP								
3	3.0	15											
3	4.0		26	15	12								

NMC - Natural Moisture Content LL - Liquid Limit PL - Plastic Limit O.M.C. - Optimum Moisture Content ρ_d - Dry Density

PI - Plasticity Index NP - Non Plastic Tick boxes carried out on recorded samples numbered in their NMC

Intégral Géotechnique

PENCOED

Laboratory test results

BOREHOLE NO.	DEPTH (m)	INDEX PROPERTIES				COMPACTION			C.B.R.	CHEMICAL TESTS			
		NMC (%)	LL (%)	PL (%)	PI (%)	Max (kg)	Max. D.d (kg/m³)	O.M.C. (%)	Max (%)	pH	Total Sulphate (%)	Groundwater Sulphate (g/l)	Organic Content
3	5.0	16											
3	6.5		33	17	16								
3	7.0	25											
3	9.0	29											
3	9.5									7.3	0.19		
4	11.0	15											
3	12.0	19											
6	13.0	10											

NMC - Natural Moisture Content LL - Liquid Limit PL - Plastic Limit O.M.C. - Optimum Moisture Content D.d - Dry Density

PI - Plasticity Index NP - Non Plastic

CBR tests carried out on remoulded samples compacted at their NMC

Intégral Géotechnique

PENCOED

Laboratory test results

BOREHOLE NO.	DEPTH (m)	INDEX PROPERTIES				COMPACTION			C.B.R.	CHEMICAL TESTS			
		NMC (%)	LL (%)	PL (%)	PI (%)	Dmax (Mg/m³)	Max. Dry Density (Mg/m³)	O.M.C (%)	Mean (%)	pH	Total Sulphate (%)	Groundwater Sulphate (g/l)	Organic Content
6	8.0	15	37	20	17								
8	8.5									7.0	0.05		
8	4.5 W									7.5		0.05	
8	9.0	15											
9	7.0	13											
9	7.5 W									7.9		0.05	
9	10.5		39	17	20								
10	8.5		NP	NP	NP								

NMC - Natural Moisture Content LL - Liquid Limit PL - Plastic Limit O.M.C - Optimum Moisture Content Yd - Dry Density

PI - Plasticity Index NP - Non Plastic CBS tests carried out on remoulded samples compacted to their NMC

Intégral Géotechnique

PENCOED

Laboratory test results

BOREHOLE NO.	DEPTH (m)	INDEX PROPERTIES				COMPACTION			C.B.R.	CHEMICAL TESTS			
		NMC (%)	LL (%)	PI (%)	PI (%)	Spec (kg)	Max. γ_d (kg/m^3)	O.M.C. (%)	Mean (%)	pH	Total Sulphate (%)	Groundwater Sulphate (g/l)	Organic Content
11	1.0	13											
11	3.0 M											0.02	
11	10.5		29	17	12								
11	11.0	15								7.8	0.0		

NMC - Natural Moisture Content LL - Liquid Limit PL - Plastic Limit O.M.C. - Optimum Moisture Content γ_d - Dry Density

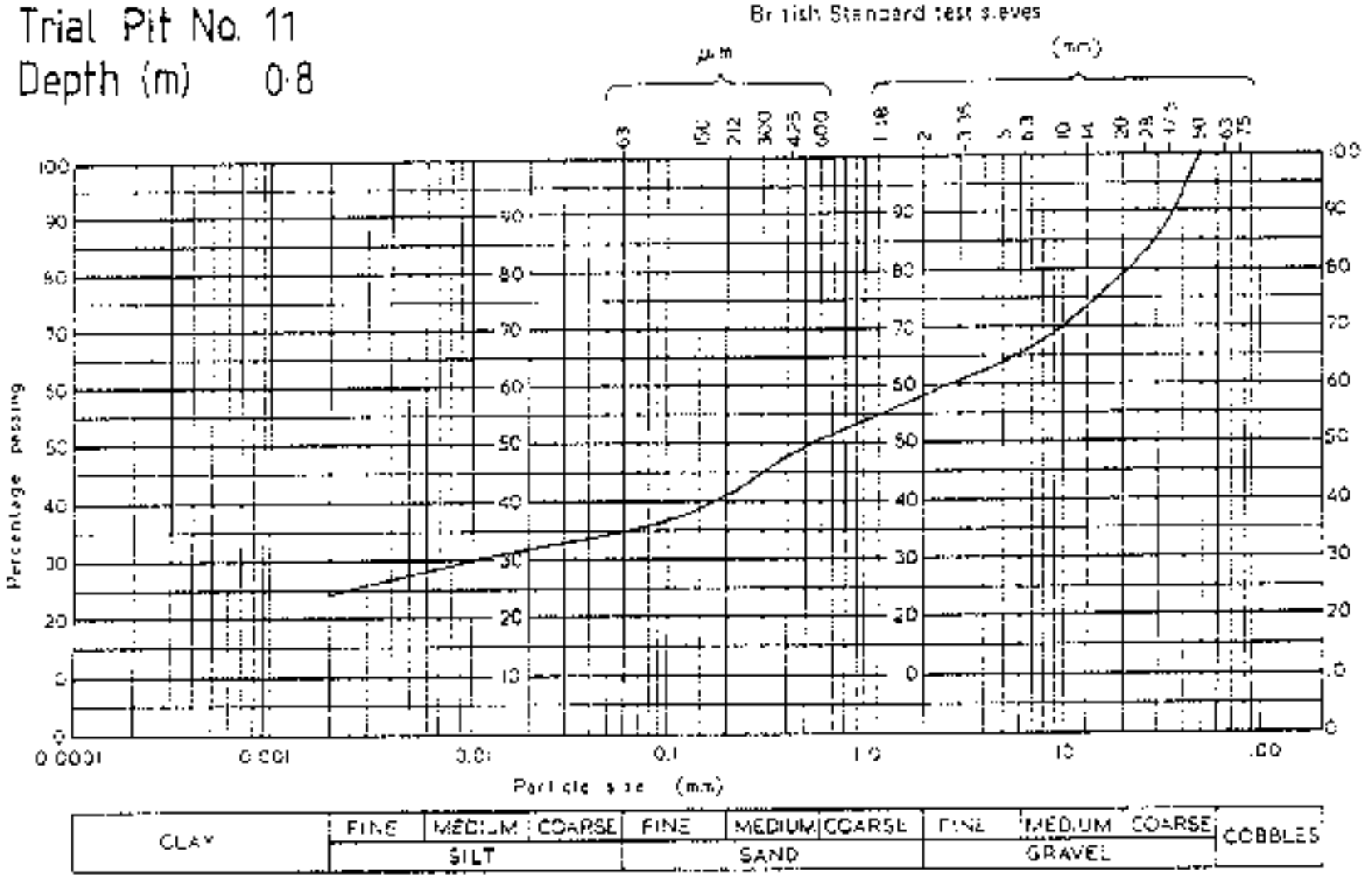
PI - Plasticity Index NP - Non Plastic (*) Tests carried out on remoulded samples compared to class 6N/C

PENCOED

Intégral Géotechnique

Particle size distribution chart

Trial Pit No. 11
Depth (m) 0·8

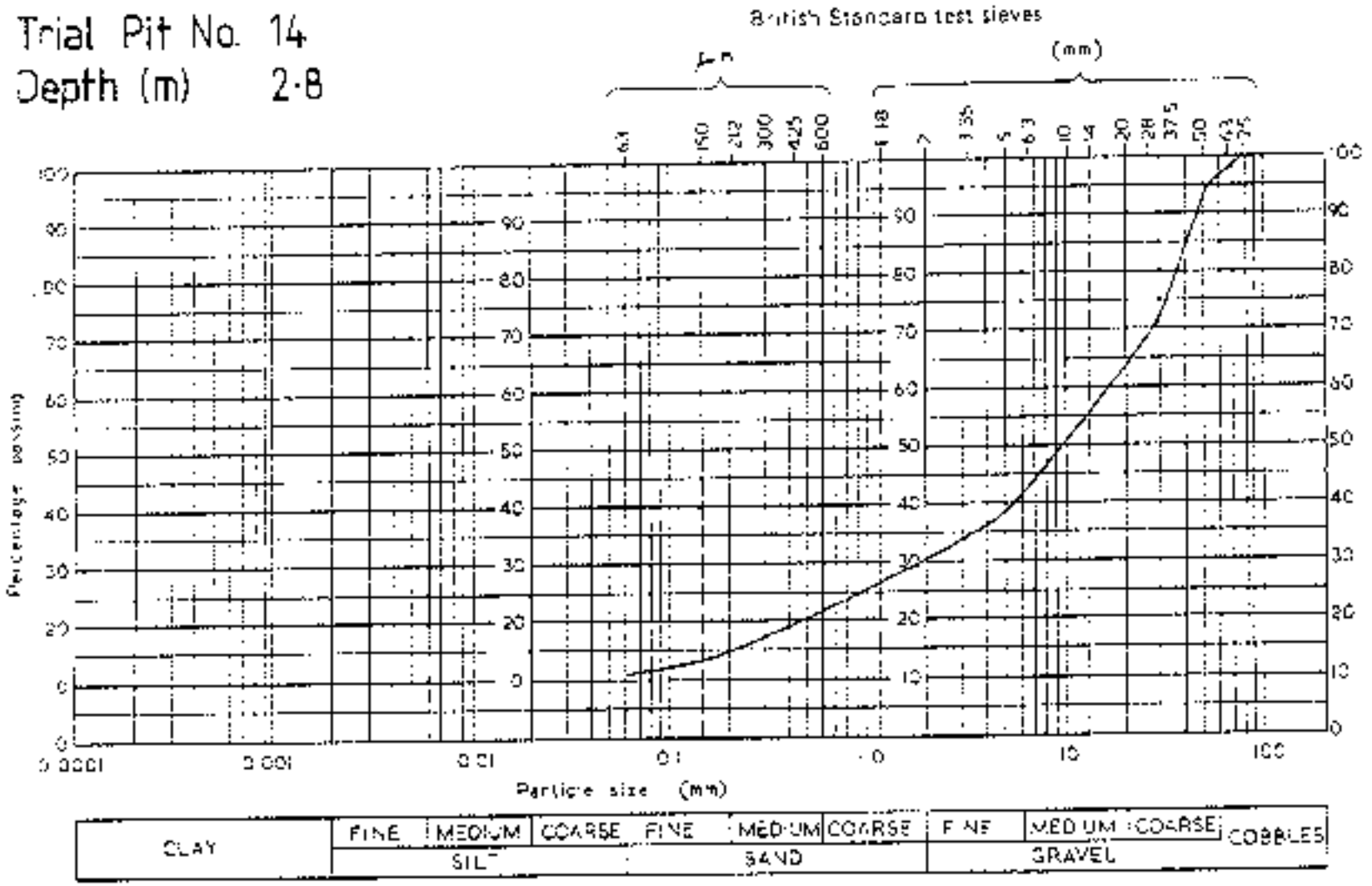


PENCOED

Intégral Géotechnique

Particle size distribution chart

Trial Pit No. 14
Depth (m) 2·8

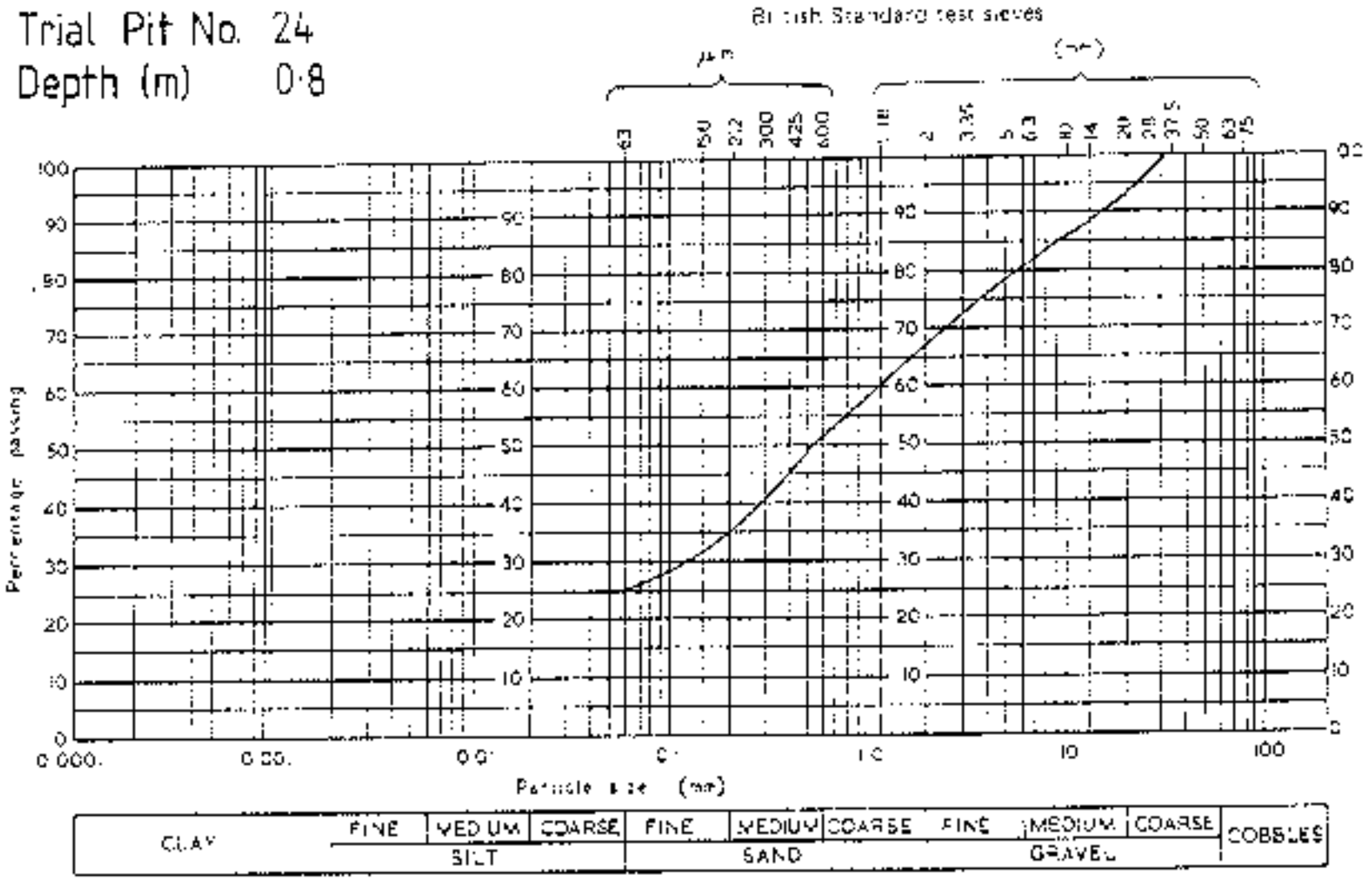


PENCOED

Intégral Géotechnique

Particle size distribution chart

Trial Pit No. 24
Depth (m) 0·8

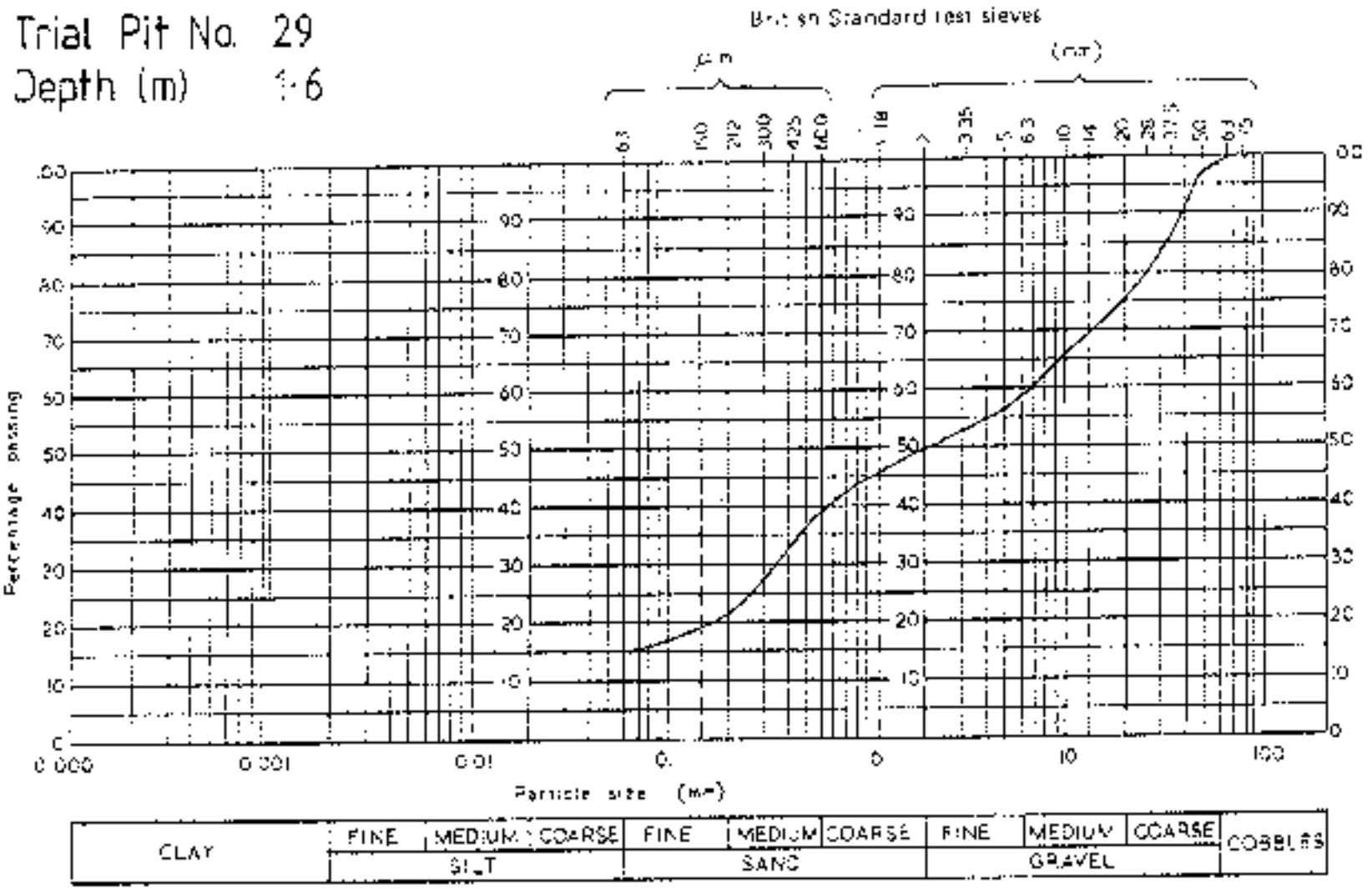


PENCOED

Intégral Géotechnique

Particle size distribution chart

Trial Pit No. 29
Depth (m) 1·6

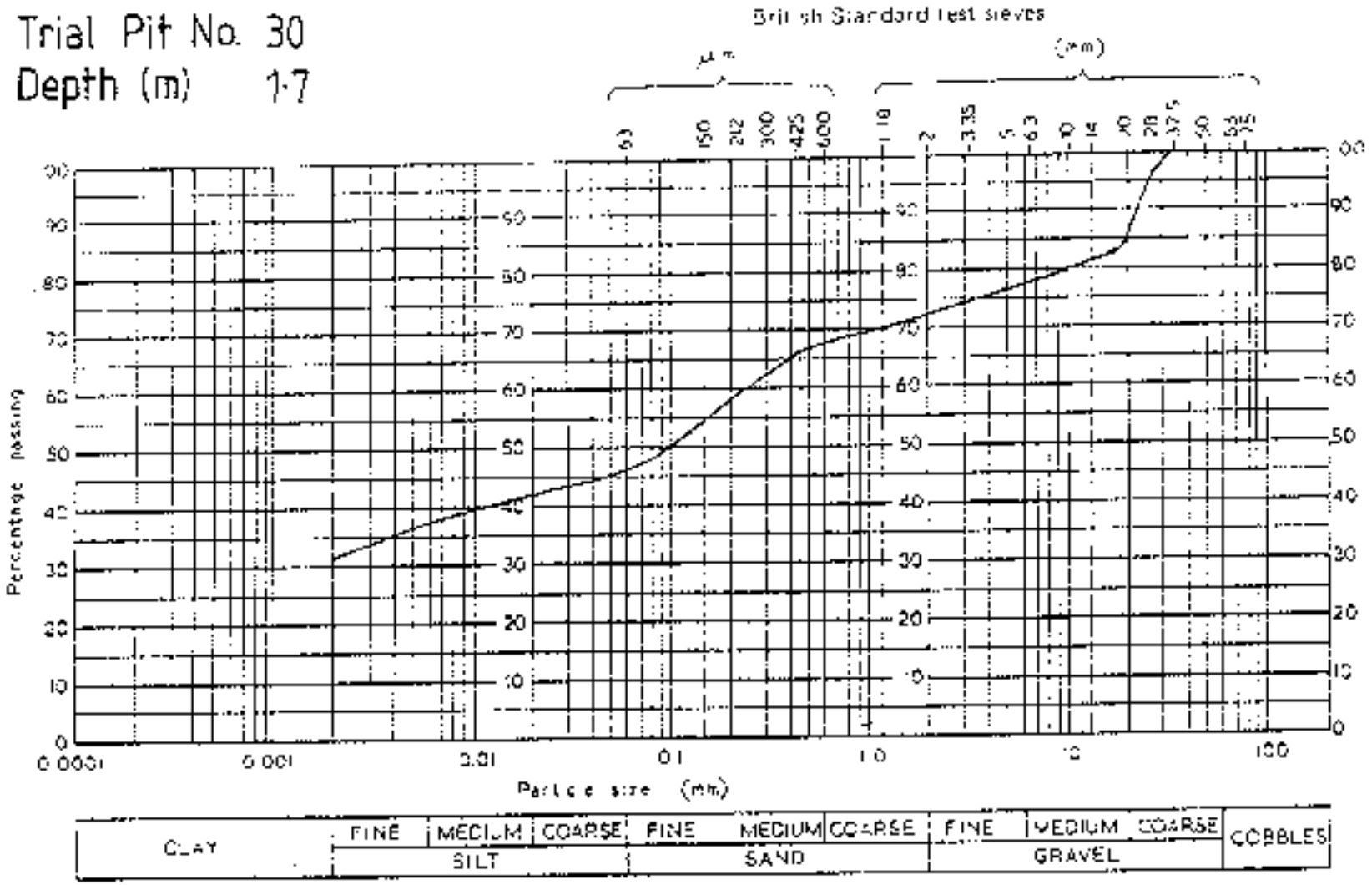


PENCOED

Intégral Géotechnique

Particle size distribution chart

Trial Pit No. 30
Depth (m) 1·7

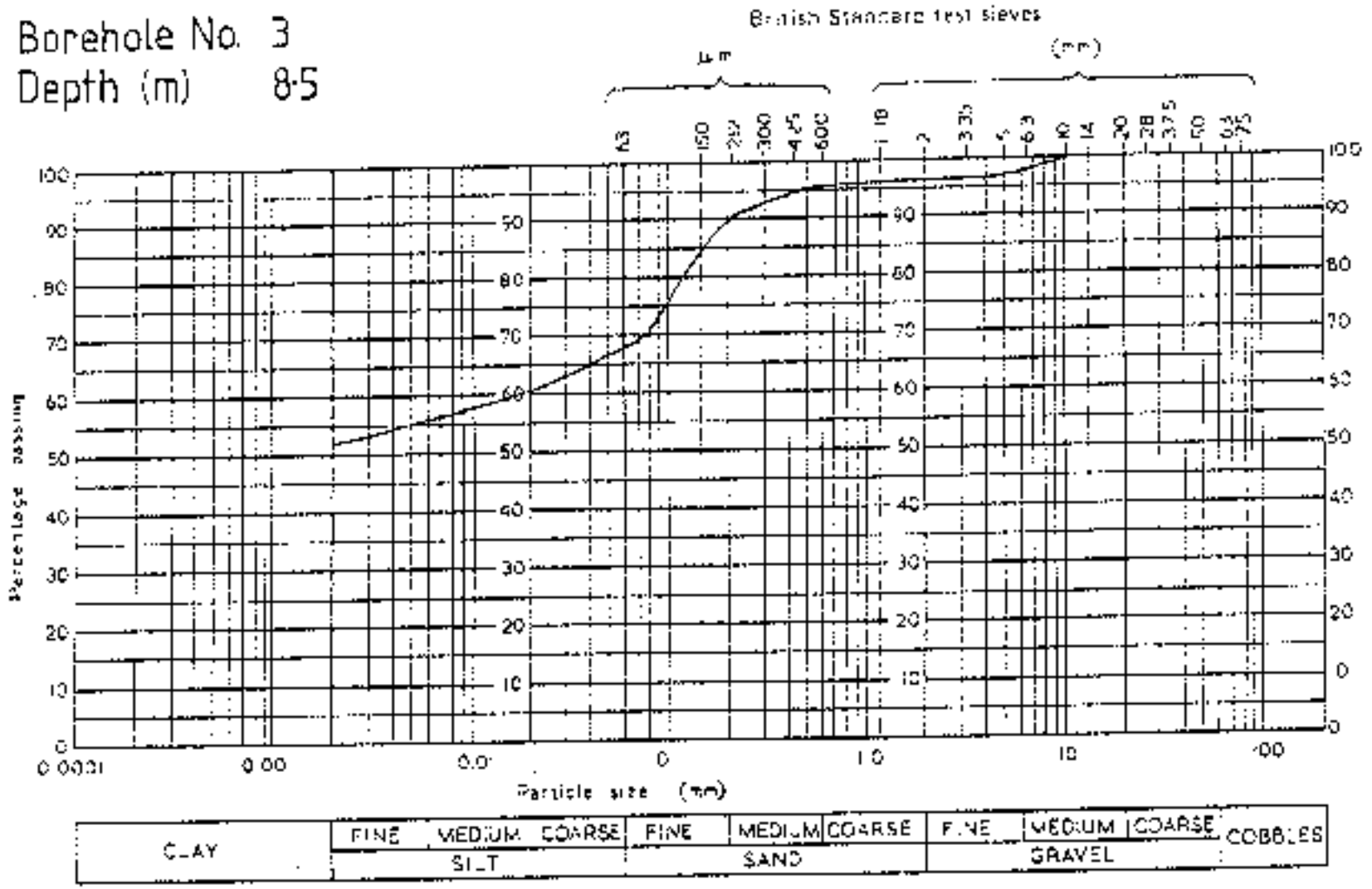


PENCOED

Intégral Géotechnique

Particle size distribution chart

Borehole No. 3
Depth (m) 8·5

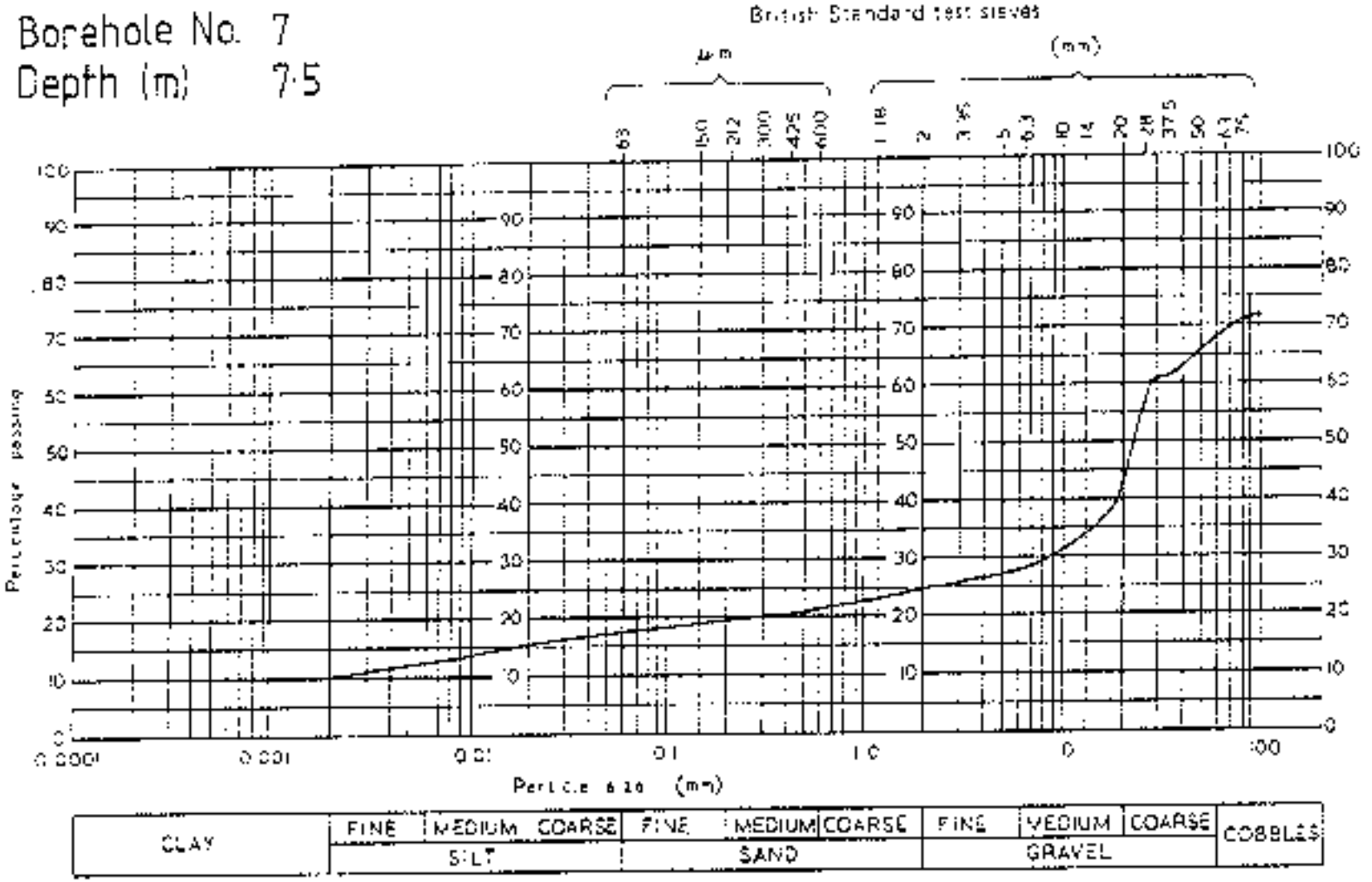


PENCOED

Intégral Géotechnique

Particle size distribution chart

Borehole No. 7
Depth (m) 7·5

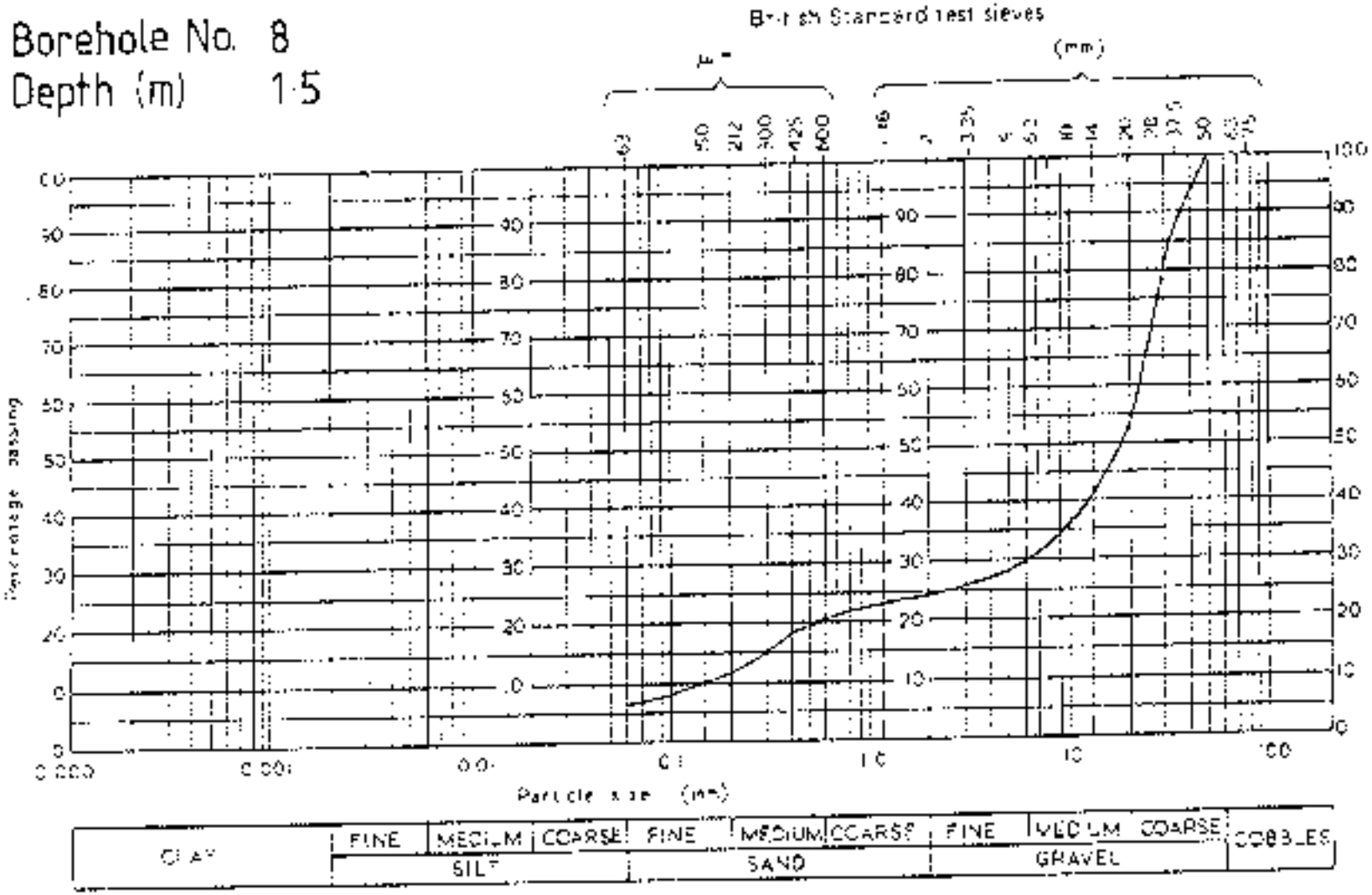


PENCOED

Intégral Géotechnique

Particle size distribution chart

Borehole No. 8
Depth (m) 1·5

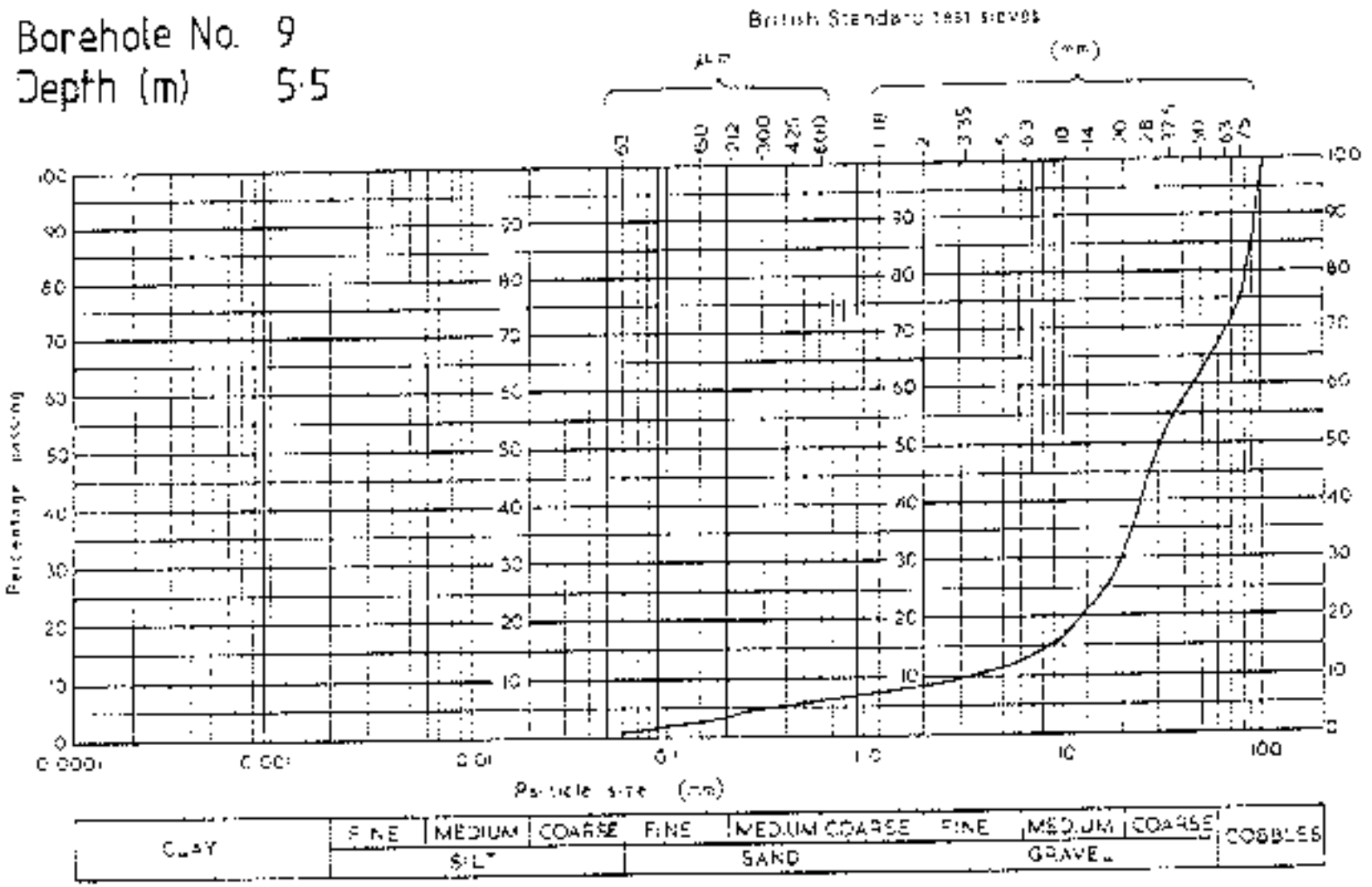


PENCOED

Intégral Géotechnique

Particle size distribution chart

Borehole No. 9
Depth (m) 5·5

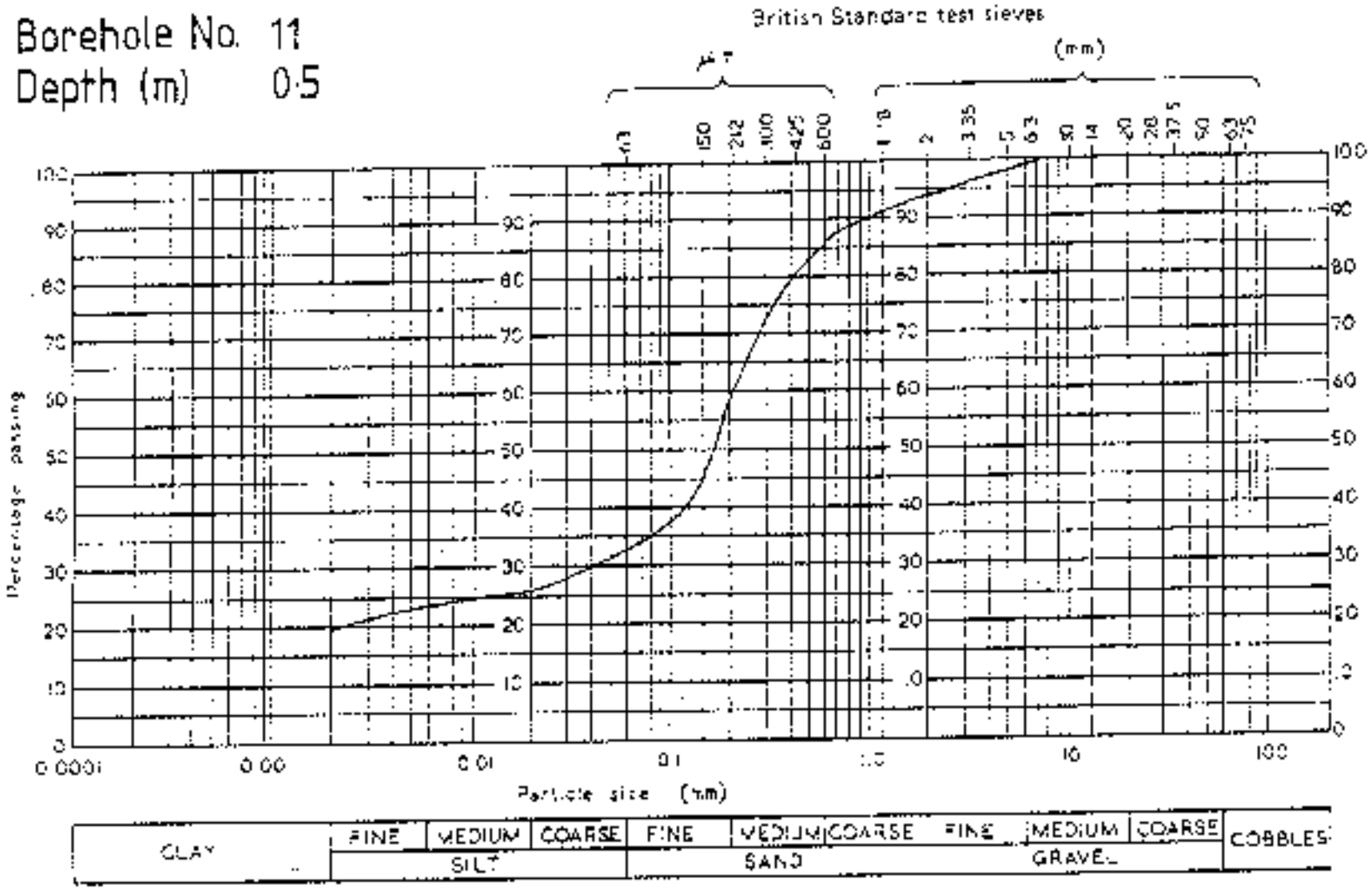


PENCOED

Intégral Géotechnique

Particle size distribution chart

Borehole No. 11
Depth (m) 0·5

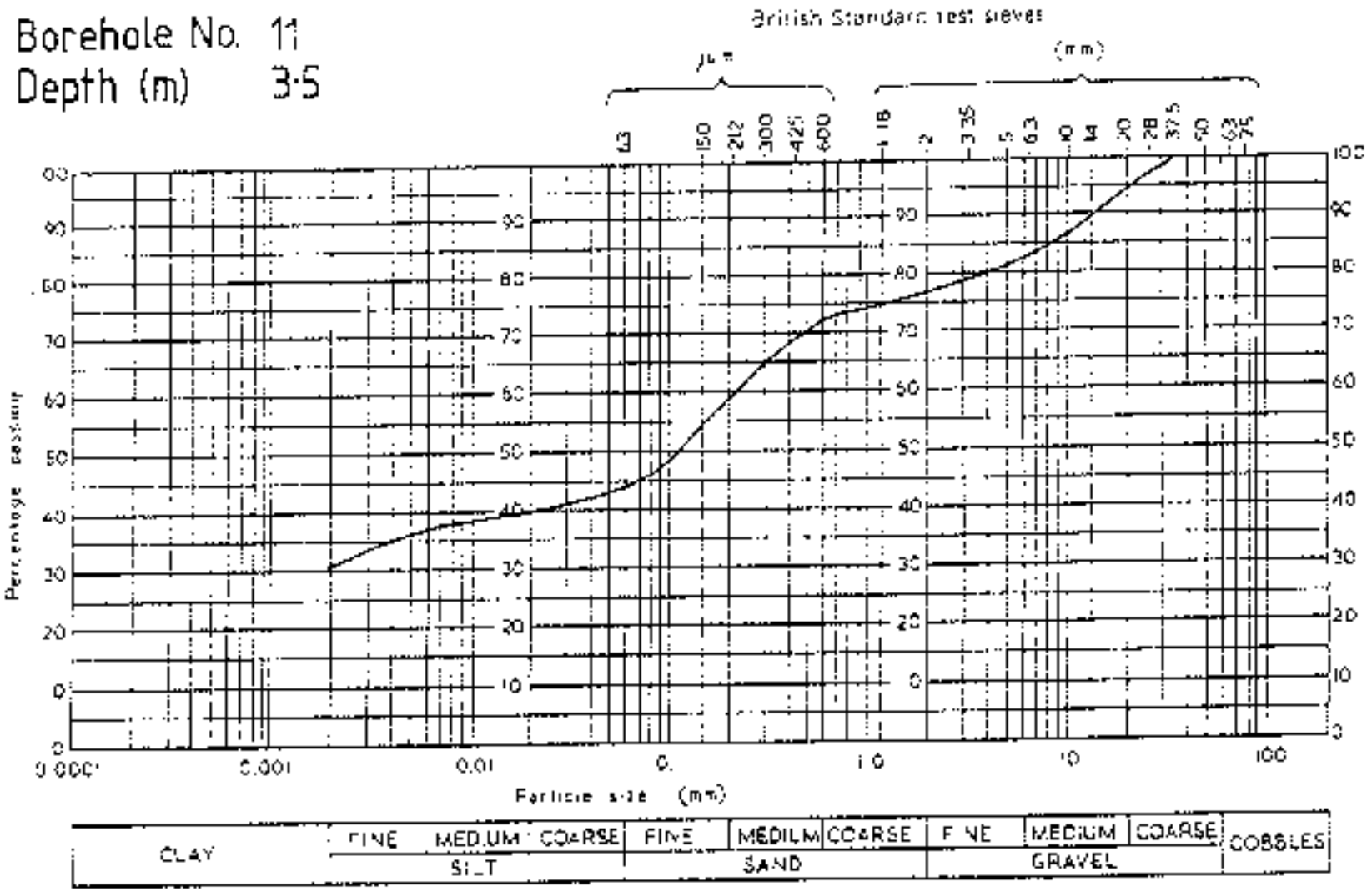


PENCOED

Intégral Géotechnique

Particle size distribution chart

Borehole No. 11
Depth (m) 3·5

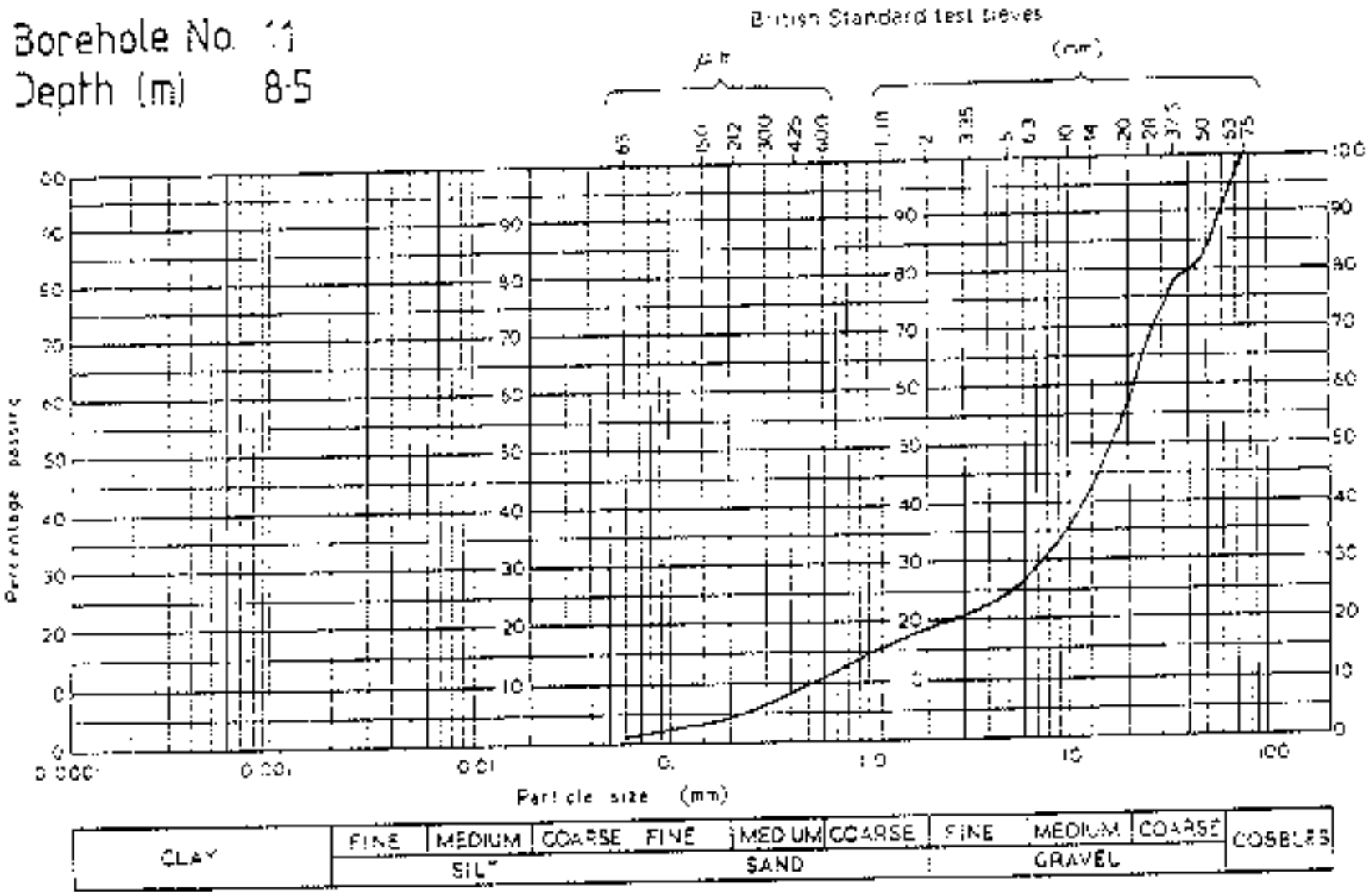


PENCOED

Intégral Géotechnique

Particle size distribution chart

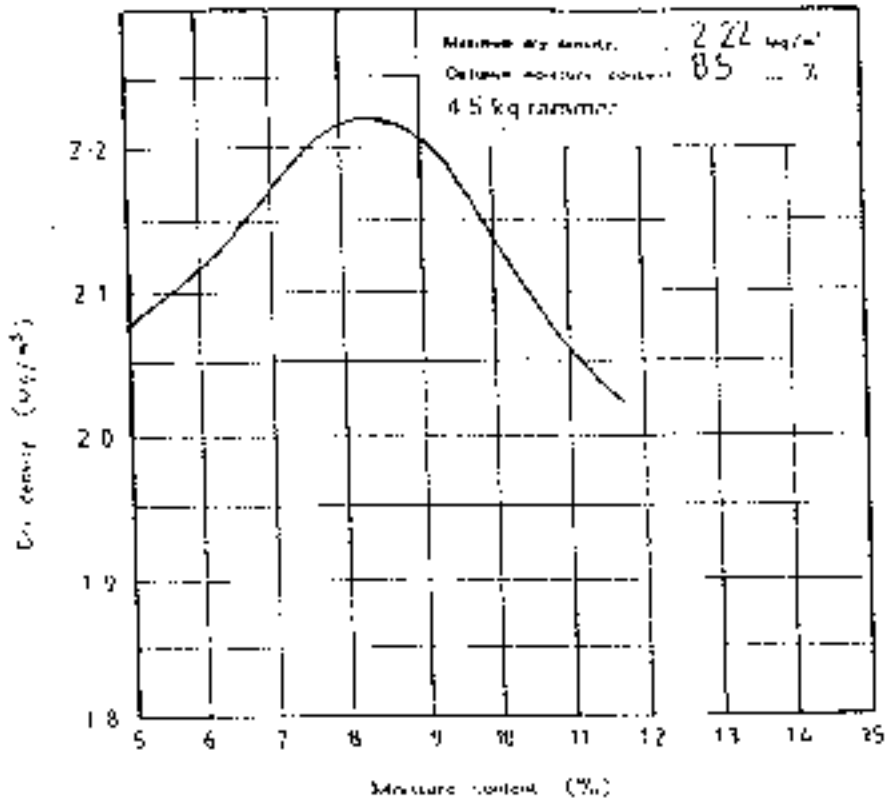
Borehole No. 11
Depth (m) 8·5



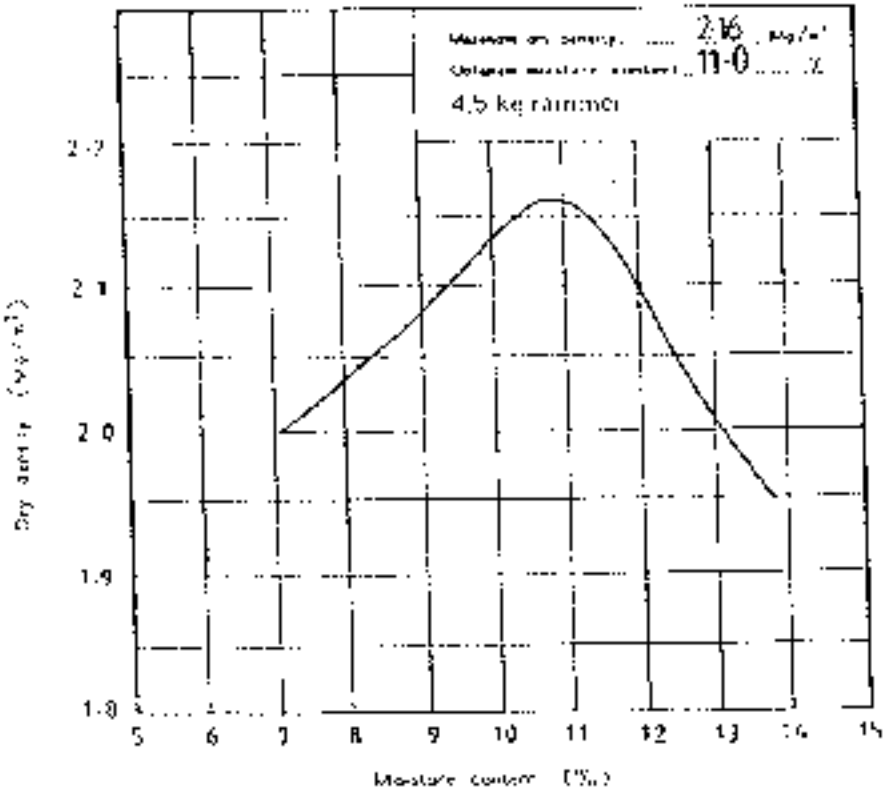
PENCOED

Intógral Géotechniquo

Dry density/moisture content relationship



Trial Pit No. 4
Depth (m) 1·5

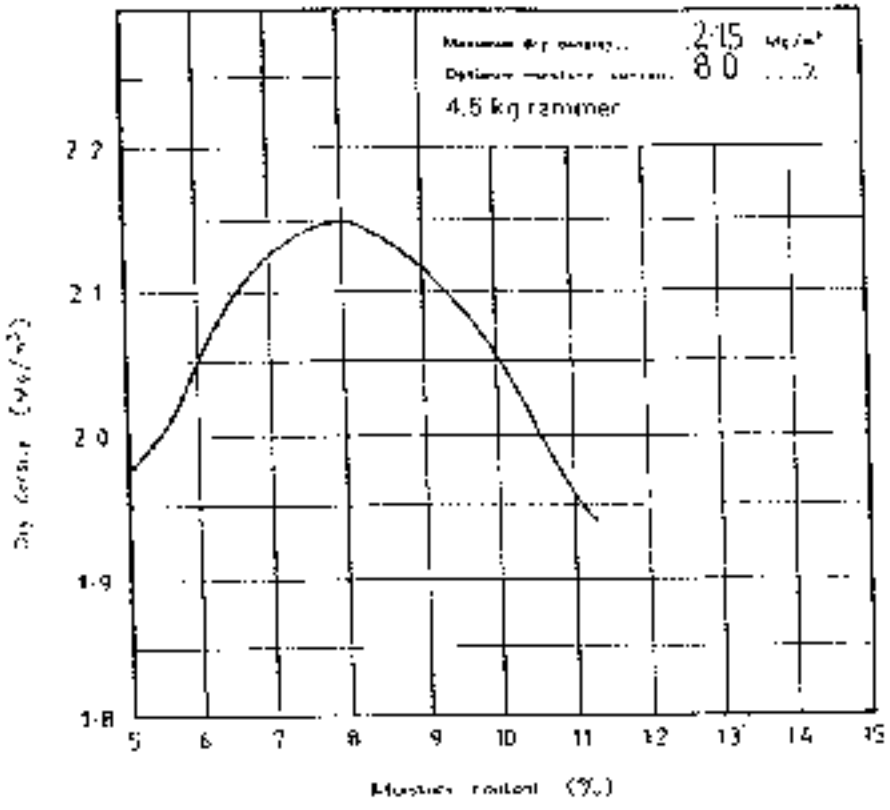


Trial Pit No. 13
Depth (m) 1·3

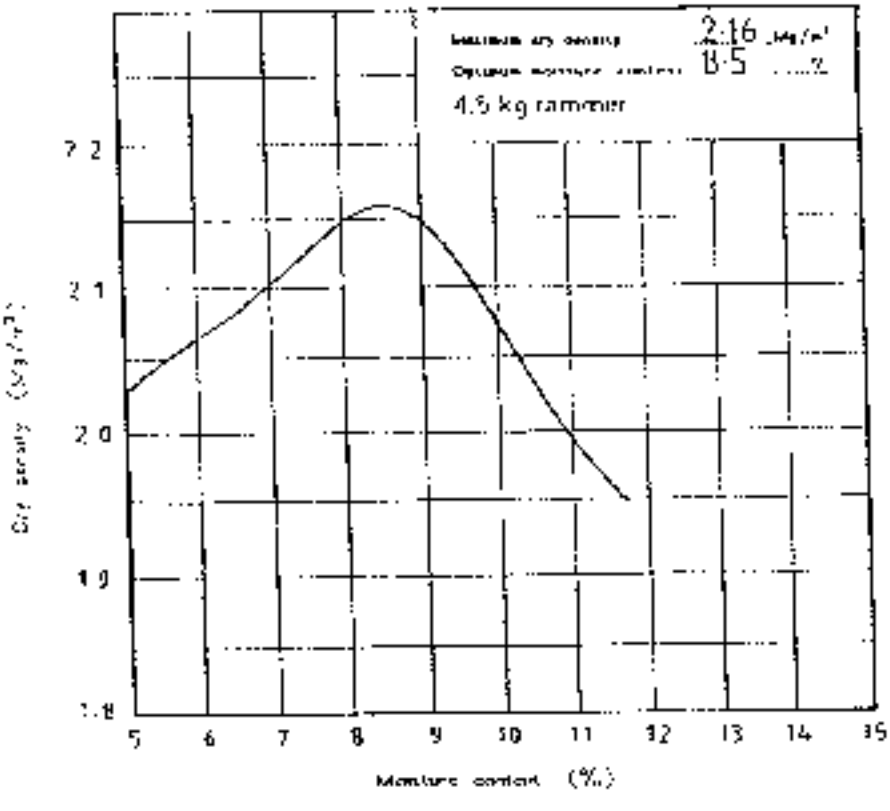
PENCOED

Intégral Géotechnique

Dry density/moisture content relationship



Trial Pit No. 17
Depth (m) 2·4

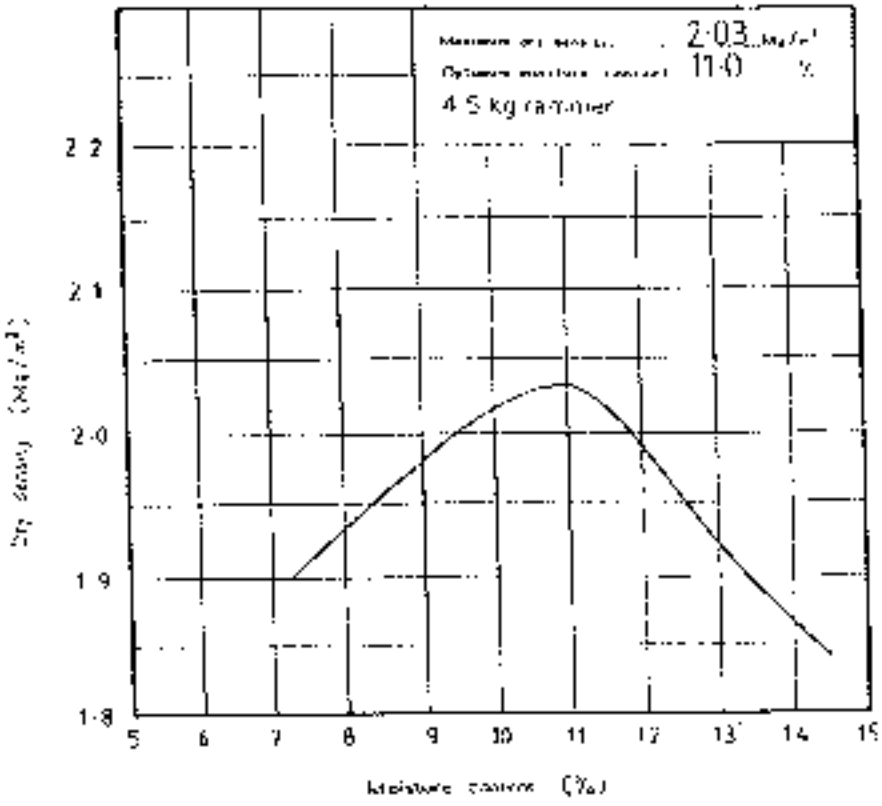


Trial Pit No. 18
Depth (m) 1·5

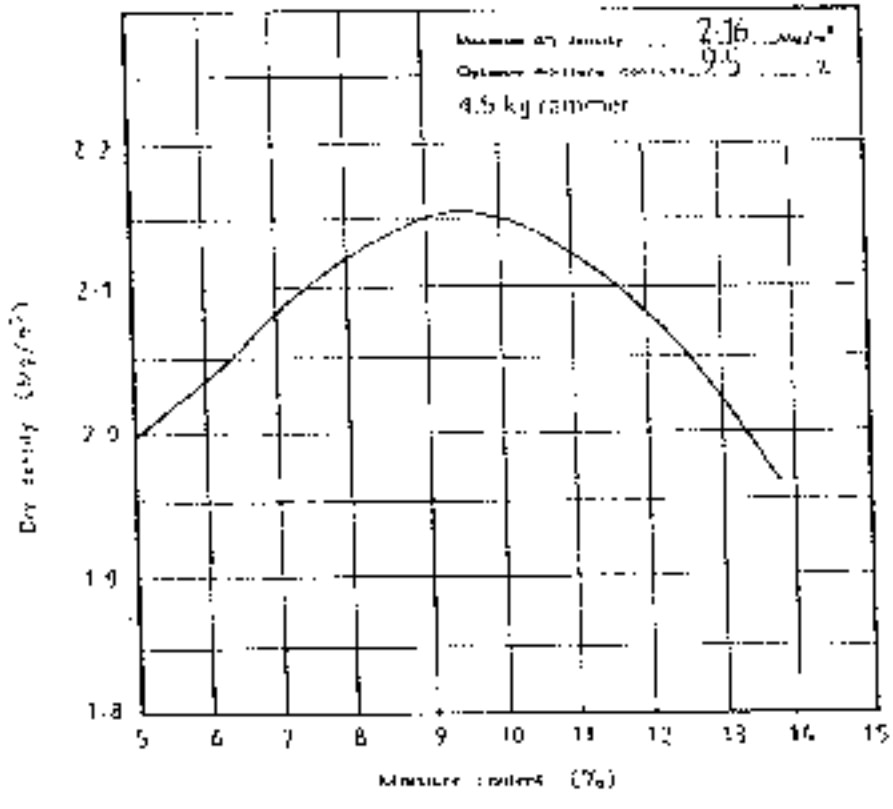
PENCOED

Intégral Géotechnique

Dry density/moisture content relationship



Trial Pit No. 22
Depth (m) 1·3

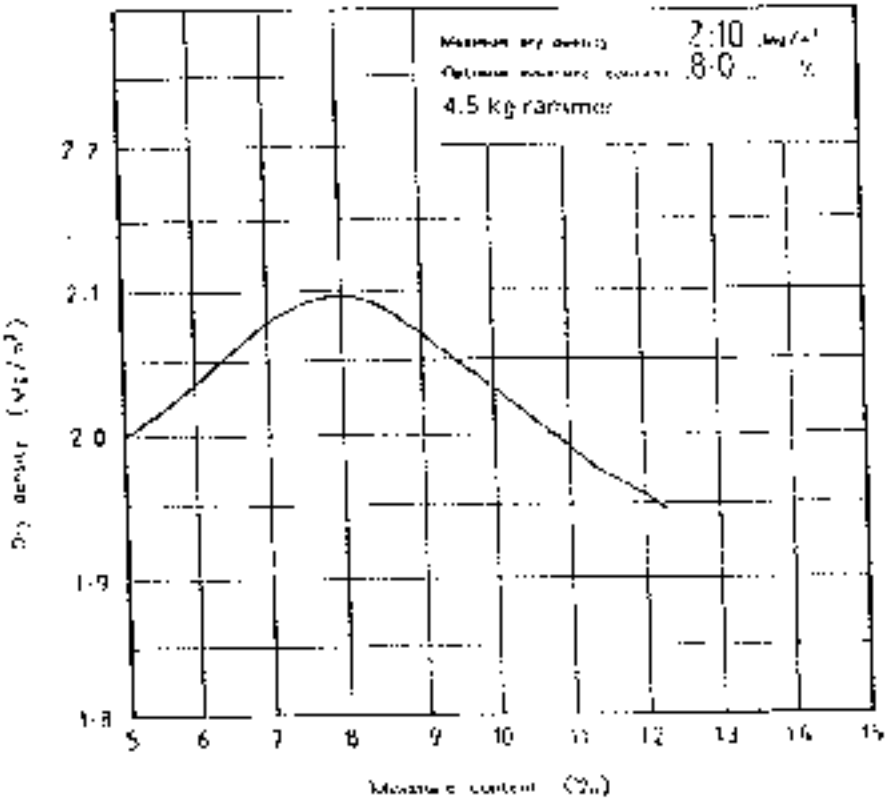


Trial Pit No. 23
Depth (m) 1·6

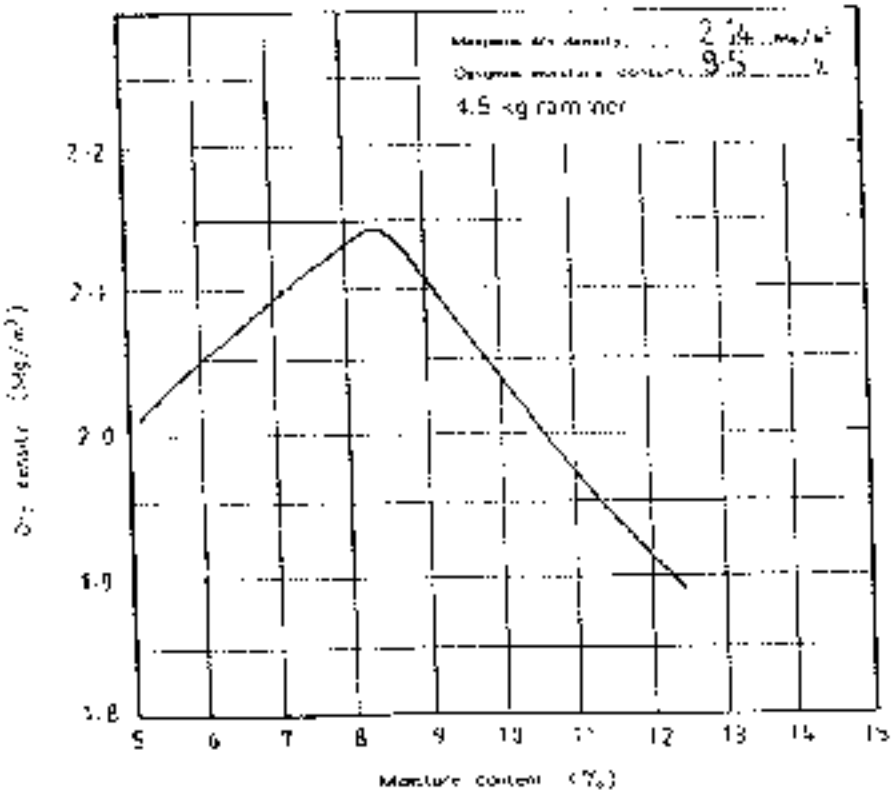
PENCOED

Intégral Géotechnique

Dry density/moisture content relationship



Trial Pit No. 25
Depth (m) 1·2

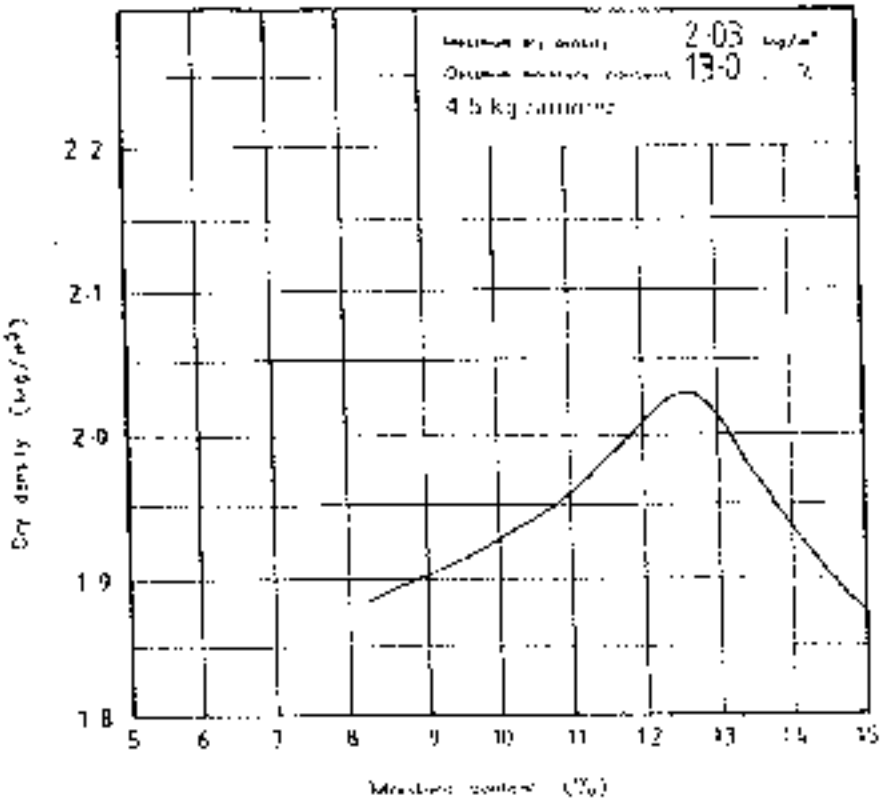


Trial Pit No. 28
Depth (m) 2·8

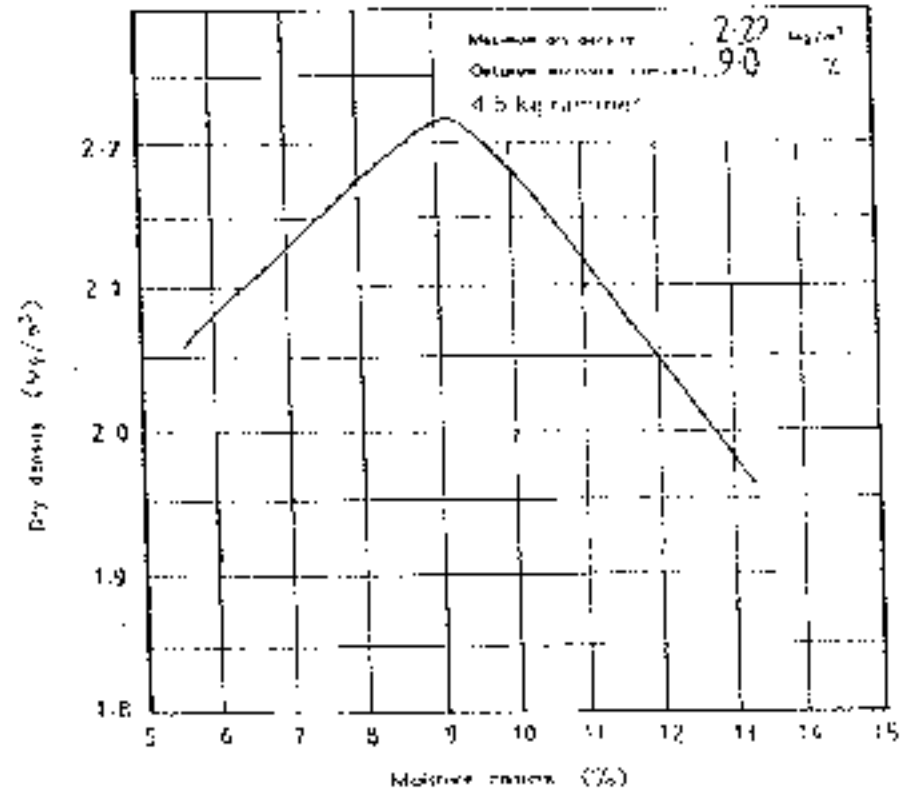
PENCOED

Intégral Géotechnique

Dry density/moisture content relationship



Trial Pit No. 33
Depth (m) 0·8



Trial Pit No. 36
Depth (m) 1·7

Soil Mechanics

The UK's leading geotechnical specialists

Report No H5118

Pencoed Technology Park

FACTUAL REPORT ON GROUND INVESTIGATION

Carried out for : Welsh Development Agency

Engineer : Ove Arup and Partners

Date : November 2005

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PENCOED TECHNOLOGY PARK

FACTUAL REPORT ON GROUND INVESTIGATION

Report No: **H5118**

Date: **November 2005**

Client:

Welsh Development Agency
QED Centre, Main Avenue
Treforest Industrial Estate
Pontypridd
CF37 5YR

Engineer:

Ove Arup and Partners
4 Pierhead Street
Capital Waterside
Cardiff
CF10 4QP

CONTENTS

1 INTRODUCTION

During August 2005 Soil Mechanics (SM) were commissioned by Ove Arup and Partners (Arup), on behalf of Welsh Development Agency (WDA), to carry out a ground investigation at Pencoed Technology Park. The investigation was required to obtain geotechnical information for the proposed building development.

The scope of the investigation, which was specified by Arup, comprised trial pits with in situ testing and laboratory testing. The investigation was carried out in accordance with the contract specification and relevant standards (see References). The fieldwork was carried out between 22nd and 25th August 2005.

This report presents the factual records of the fieldwork and laboratory testing

No information regarding any previous ground investigation covering the site was forwarded to Soil Mechanics by Arup.

2 THE SITE AND GEOLOGY

2.1 The Site

Pencoed Technology Park is situated approximately 1.5km east of the town of Pencoed in South Wales. The site is at National Grid reference SS 971 810, see Site Location Plan in Enclosure D.

The site covers an area of approximately 65 hectares and comprises generally flat undeveloped farm land. The site has no boundary conditions.

2.2 Published Geology

The published geological maps covering the site, BGS Sheet 261 and 262 Bridgend (1974) shows the solid geology to comprise Triassic mudstones overlain by superficial deposits comprising River Gravels.

3 FIELDWORK

3.1 General

The fieldwork was carried out in general accordance with BS 5930 (1999) and Part 9 of BS 1377 (1990).

The trial pit and in situ test locations were selected by Arup as shown on the Exploratory Borehole Location Plan in Enclosure D. The locations were set out from local features by Arup. Trial pit co-ordinates as shown on the logs have been supplied by Arup.

3.2 Exploratory Holes

The exploratory holes are listed in the following table.

SUMMARY OF EXPLORATORY HOLES

TYPE	QUANTITY	MAXIMUM DEPTH (m)	REMARKS
Trial Pits	35	4 50m	Designated TP101 to TP135

The trial pits were logged and photographed by Arup. The trial pit logs presented in Enclosure A have been supplied to SM by Arup for inclusion in this report.

The records provided by Arup show descriptions of the materials encountered and details of the samples taken, together with observations made during trial pitting. No photographs of the trial pits have been passed on to SM by Arup for inclusion in this report.

On completion of the fieldwork all geotechnical samples were transported to the Bridgend laboratory of SM for temporary retention and testing.

3.3 Instrumentation and Monitoring

There was no requirement for any instrumentation or monitoring of any of the trial pits.

3.4 In Situ Testing

The hand vane testing enclosed in Enclosure B was carried out by Arup and issued to SM for inclusion in this report.

Other in situ testing was carried in accordance with BS 5930 (1999) and Part 9 of BS 1377 (1990) unless otherwise stated. The testing is summarised below and the results are presented in Enclosure B.

SUMMARY OF IN SITU TESTING

TYPE	QUANTITY	REMARKS
California Bearing Ratio	11	Carried out in Trial Pits TP101 to TP111

4 LABORATORY TESTING

4.1 Geotechnical Testing

The testing was scheduled by Arup and was carried out by SM at the Bridgend laboratory in accordance with BS 1377 (1990) unless otherwise stated. The testing is summarised below and the results are presented in Enclosure C.

SUMMARY OF GEOTECHNICAL LABORATORY TESTING

TYPE	REMARKS
Moisture Content Determination	23
Atterberg Limit Determination	21
Particle Size Distribution Analysis	13
Sedimentation by pipette	13
pH and Water Soluble Sulphate Content of Soils	6
Dry Density / moisture content relationship using 4 5kg hammer	14

4.2 Geoenvironmental Testing

There was no requirement for any geoenvironmental testing.

Prepared By	**S Miller BSc MSc**
Reviewed By	**A Figgis BSc**
Approved for Issue By	

REFERENCES

British Standards and Codes of Practice

BS 1377 : 1990 : Methods of test for soils for civil engineering purposes. British Standards Institution.

BS 5930 : 1999 : Code of practice for site investigations. British Standards Institution.

Specification for Ground Investigations. Thomas Telford Services Ltd (1993)

Geological Maps

BGS Sheet 261 and 262 Bridgend (1974)

ENCLOSURE A

EXPLORATORY HOLE RECORDS

Trial Pit Logs Trial pits excavated by SM but logged by Arup. Trial pit logs supplied by Arup for inclusion in this report	TP101 to TP135

ARUP | Trial Pit Log

Job No	Hole ref	Page
69829-00	**TP101**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7334.1611 809.7037	35.60	22-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			35.5		(0.10)	TOPSOIL	1	
0.10-0.90	D 1				0.10	Loose to medium dense reddish brown slightly clayey fine SAND with frequent rounded to subrounded gravel of sandstone	2	
					(0.80)			
			34.7		0.90			
0.90-2.80	B 2					Medium dense slightly clayey sandy rounded COBBLES of sandstone	3	
					(1.90)			
			32.8		2.80			
2.80-3.60	D 3					Soft to firm maroon brown slightly sandy CLAY with occasional rounded to subrounded gravel of sandstone.	4	
					(0.80)			
			32.0		3.60			
						Trial pit completed at 3.6m depth		

Remarks

Investigation/cluster ref: Main

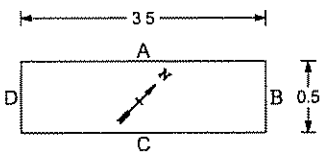
Orientation= 45deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.1m depth: Slight inflow

Shoring/Support: None

Stability: Sides collapsing slightly in cobbles



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP102	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7278.9386 909.151	34.50	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			34.4		(0.10)	TOPSOIL	1	
0.10-1.00	D 1				0.10	Loose to medium dense yellow brown very silty fine SAND with some subrounded gravel of sandstone	2	
					(0.90)			
			33.5		1.00			
						Medium dense brown slightly gravely silty fine SAND. Gravel is rounded to subrounded of sandstone and mudstone	3	
					(0.90)			
			32.6		1.90			
1.90-3.80	B 2					Medium dense brown clayey SAND with frequent rounded to subrounded gravel and occasional cobbles of sandstone and occasional pockets of yellow sand.	4	
					(1.90)			
			30.7		3.80			
						Trial pit completed at 3.8m depth		

Remarks

Investigation/cluster ref: Main

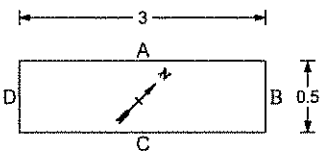
Orientation= 45deg.
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.8m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	**TP103**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7241.206 839.378	33.90	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
0.00-0.50	D 1		33.8		(0.10)	TOPSOIL	1	
					0.10	Soft to firm red brown sandy CLAY with many rootlets at the surface.	2	
					(0.40)			
			33.4		0.50			
0.50-3.10	B 2					Loose to medium dense yellow brown slightly clayey fine to coarse SAND with frequent rounded to subrounded gravel and cobbles of sandstone	3	
					(2.60)			
						2.50 - 2.60 Flat rounded cobbles and small boulders of sandstone encountered		
			30.8		3.10			
						Trial pit completed at 3.1m depth		

Remarks

investigation/cluster ref: Main

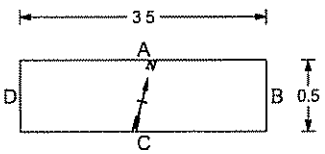
Orientation= 75deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.1m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No	Hole ref	Page
69829-00	**TP104**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7146.3762 807.6398	32.70	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			32.6		(0 10)	TOPSOIL	1	
0 10-1 30	J 2				0.10	Medium dense to dense brown clayey fine to coarse SAND with some rounded gravel of sandstone	2	
0 10-1 30	B 1				(1 20)			
			31.4		1.30			
					(1 00)	Medium dense red brown clayey gravely SAND and COBBLES of sandstone Many cobbles sheared to thin slabs when excavated	3	
			30.4		2.30			
					(0 90)	Frim red brown sandy CLAY with frequent rounded cobbles of sandstone and some pockets of yellow brown clay	4	
			29.5		3.20			
						Trial pit completed at 3 2m depth		

Remarks

Investigation/cluster ref: Main

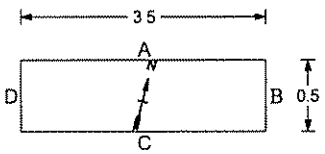
Orientation= 75deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3 2m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP105	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7071.6524 741.1841	31.70	23-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
0 00-0 50	D 1		31.2		(0.50) 0.50	TOPSOIL: Soft dark brown slightly sandy SILT with many rootlets	1	
			29.6		(1 60) 2.10	Medium dense orange gravely clayey fine to coarse SAND with occasional rounded to subrounded cobbles of sandstone Gravel is rounded to subrounded of sandstone	2	
2 10-3 90	B 2		27.8		(1 80) 3.90	Dense sandy GRAVEL and COBBLES of sandstone and sandstone-quartz conglomerates with pockets of firm brown clay and occasional boulders	3	
						Trial pit completed at 3 9m depth		

Remarks

Investigation/cluster ref: Main

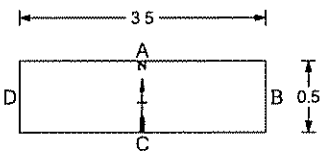
Orientation= 90deg
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

1 2m depth: Becoming damp

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	**TP106**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7025.9491 652.2391	32.50	23-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			32.4		(0.10)	TOPSOIL	1	
0.10-1.60	D 1				0.10	Medium dense orange brown slightly clayey slightly gravely fine to coarse SAND with occasional rounded to subrounded cobbles of sandstone	2	
					(1.50)			
			30.9		1.60			
1.60-4.50	B 2					Medium dense brown very clayey fine to coarse SAND and GRAVEL with occasional to frequent rounded to subrounded cobbles and rare small boulders of sandstone. Gravel is rounded to subrounded of sandstone	3	
					(2.90)			
			28.0		4.50			
						Trial pit completed at 4.5m depth		

Remarks

Investigation/cluster ref: Main

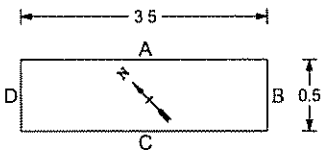
Orientation= 135deg.
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

2.6m depth: Becoming damp

Shoring/Support: None

Stability: Slight instability below 2.6m



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	**TP107**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6951.4586 585.5221	31.50	23-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			31.1		(0.40) 0.40	TOPSOIL: Reddish brown slightly sandy CLAY	1	
0 40-1 90	D 1				(1 50)	Medium dense orange brown slightly clayey SAND with occasional rounded gravel of sandstone	2	
			29.6		1.90			
1 90-3 80	B 2				(1 90)	Medium dense to dense brown very clayey SAND and GRAVEL with frequent rounded cobbles of sandstone	3	
			27.7		3.80			
						Trial pit completed at 3 8m depth		

Remarks

Investigation/cluster ref: Main

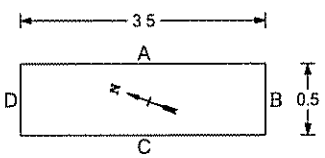
Orientation= 160deg.
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

2 1m depth: Becoming damp

Shoring/Support: None

Stability: Sides collapsing slightly below 1 9m



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup
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ARUP | Trial Pit Log

Job No	Hole ref	Page
69829-00	**TP108**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6858.0846 549.7269	31.00	23-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			30.8		(0.20) 0.20	TOPSOIL	1	
0.20-1.90	D 1				(1.70)	Soft orange brown slightly sandy CLAY	2	
			29.1		1.90			
1.90-4.20	J 3				(2.30)	Medium dense red brown clayey gravelly fine to coarse SAND with some cobbles Cobbles become frequent with depth	3	
1.90-4.20	B 2							
			26.8		4.20			
						Trial pit completed at 4.2m depth		

Remarks

Investigation/cluster ref: Main

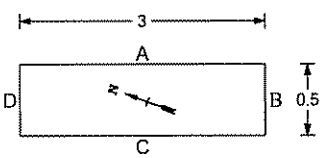
Orientation= 160deg.
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

2m depth: Becoming damp

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No	Hole ref	Page
69829-00	**TP109**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6766.5073 509.5573	30.60	24-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			30.3		(0.30) 0.30	TOPSOIL	1	
0.30-1.10	D 1				(0.80)	Soft light brown slightly sandy SILT/CLAY	2	
			29.5		1.10			
1.10-3.80	B 2				(2.70)	Loose to medium dense brown slightly clayey fine to coarse SAND and rounded GRAVEL of sandstone with some rounded cobbles of sandstone 2.60 - 2.70 Boulders encountered	3	
			26.8		3.80			
						Trial pit completed at 3.8m depth		

Remarks

Investigation/cluster ref: Main

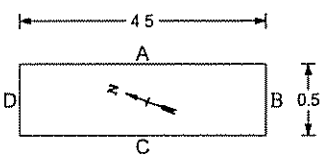
Orientation= 160deg.
Plant: Cat 428C Excavator
Backfilled: 24-Aug-05

Groundwater

3.8m depth: No water encountered

Shoring/Support: None

Stability: Sides partially collapsed in loose sands and gravels from 1.1 to 2.3m



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	**TP110**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6669.5896 484.9207	30.70	24-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			30.5		(0.20) 0.20	TOPSOIL	1	
0 20-0 70	J 1				(0.50)	Soft orange brown slightly gravely slightly sandy CLAY Gravel is rounded fine to coarse of sandstone	2	
			30.0		0.70			
0 70-3 90	B 2				(3 20)	Loose to medium dense clayey very gravely fine to coarse SAND with frequent rounded to subrounded cobbles of sandstone, becoming sandy gravel with depth Gravel is rounded to subrounded fine to coarse of sandstone 2 50 - 3 90 Occasional small boulders encountered	3	
			26.8		3.90			
						Trial pit completed at 3.9m depth		

Remarks

Investigation/cluster ref: Main

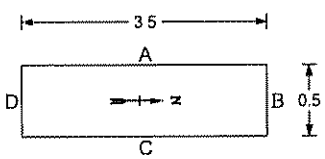
Orientation= 0deg
Plant: Cat 428C Excavator
Backfilled: 24-Aug-05

Groundwater

3 9m depth: No water encountered

Shoring/Support: None

Stability: Trial pit abandoned due to collapse of backface from 2 9m



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP111	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6569.7435 479.3754	29.50	24-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			29.2		(0.30) 0.30	TOPSOIL	1	
0.30-0.90	J 1		28.6		(0.60) 0.90	Loose red brown slightly gravely silty SAND. Gravel is rounded to subrounded of sandstone	2	
0.90-3.70	B 2		25.8		(2.80) 3.70	Loose to medium dense slightly clayey/silty gravely fine to coarse SAND with frequent rounded to subrounded cobbles of sandstone, becoming very sandy gravel and cobbles with depth. Gravel is fine to coarse rounded to subrounded of sandstone	3	
						Trial pit completed at 3.7m depth		

Remarks

Investigation/cluster ref: Main

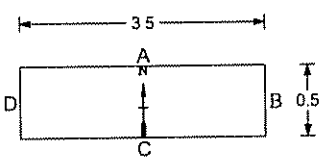
Orientation= 90deg
Plant: Cat 428C Excavator
Backfilled: 24-Aug-05

Groundwater

3.7m depth: No water encountered

Shoring/Support: None

Stability: Trial pit abandoned due to collapse of southern face from 1.5m



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No	Hole ref	Page
69829-00	TP112	1 of 1

Contractor	Soil Mechanics	
Local grid co-ordinates	Ground Level (m OD)	Date
6454.1598 487.2925	28.50	24-Aug-05

Pencoed Technology Park
Issue

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			28.2		(0.30) 0.30	TOPSOIL	1	
			27.5		(0.70) 1.00	Loose brown very silty/clayey SAND with some rounded to subrounded gravel of sandstone	2	
1.70-1.80	B 1				(3.00)	Loose to medium dense clayey very sandy rounded to subrounded GRAVEL and COBBLES of sandstone with occasional small boulders of sandstone exhibiting weak discontinuities, with induced fracturing during excavation forming tabular particles.	3	
3.90-4.00	B 2		24.5		4.00	*Trial pit completed at 4m depth*		

Remarks

Investigation/cluster ref: Main

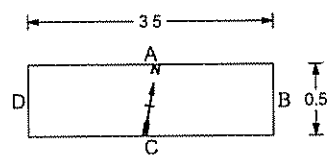
Orientation= 80deg.
Plant: Cat 428C Excavator
Backfilled: 24-Aug-05

Groundwater

4m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP113	1 of 1

Contractor	
	Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6534.7935 583.86	28.90	24-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			28.6		(0.30) 0.30	TOPSOIL	1	
			28.2		(0.40) 0.70	Loose yellow brown fine to medium SAND	2	
			28.0		(0.20) 0.90	Loose to medium dense bright orange slightly clayey fine to medium SAND	3	
			27.6		(0.40) 1.30	Loose to medium dense light grey slightly clayey fine SAND	4	
1.30-2.50	B 1					Loose to medium dense brown with occasional streaks of orange clayey very sandy rounded to subrounded GRAVEL of sandstone with occasional rounded to subrounded cobbles	5	
2.50-4.40	B 3							
2.50-2.55	J 2				(3.10)			
			24.5		4.40			
						Trial pit completed at 4.4m depth		

Remarks

Investigation/cluster ref: Main

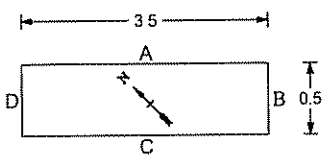
Orientation= 135deg
Plant: Cat 428C Excavalor
Backfilled: 24-Aug-05

Groundwater

4.4m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP	Trial Pit Log	Job No. 69829-00	Hole ref **TP114**	Page 1 of 1
		Contractor	Soil Mechanics	
Pencoed Technology Park Issue		Local grid co-ordinates 6627.447 641.529	Ground Level (m OD) 29.00	Date 24-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thickness)	Description	Stratum	Geology
			28.7		(0.30) 0.30	TOPSOIL	1	
0.70-0.80	B 1		28.0		(0.70) 1.00	Medium dense light brown fine to medium very silty SAND	2	
2.20-2.30	B 2		25.3		(2.70) 3.70	Medium dense light brown silty very gravely fine to coarse SAND with occasional rounded to subrounded cobbles of sandstone	3	
3.70-4.20	D 3		24.8		(0.50) 4.20	Firm to stiff dark brown slightly sandy gravely CLAY with frequent rounded to subrounded cobbles of sandstone. Gravel is fine to coarse rounded to subrounded of sandstone	4	
						Trial pit completed at 4.2m depth		

Remarks

Investigation/cluster ref: Main

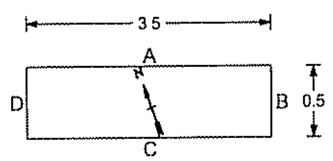
Orientation= 110deg.
Plant: Cat 428C Excavator
Backfilled: 24-Aug-05

Groundwater

4.2m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

ARUP | Trial Pit Log

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69829-00	TP115	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6652.5286 700.3215	29.00	24-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			28.7		(0.30) 0.30	TOPSOIL	1	
0 50 0 70-0 80	J 1 B 2		28.0		(0.70) 1.00	Soft orange brown slightly gravely slightly sandy CLAY Gravel is fine to coarse rounded to subrounded of sandstone	2	
			27.8		(0 20) 1.20	Layer of blackened gravelly rounded cobbles in a matrix of stiff and brittle black charcoal-like substance (indicative of previous fire)	3	
2 70-2 80	B 3		25.8		(2 00) 3.20	Loose to medium dense orange and brown clayey fine to coarse SAND and GRAVEL with frequent rounded to subrounded fine to coarse of sandstone	4	
						Trial pit completed at 3.2m depth		

Remarks

Investigation/cluster ref: Main

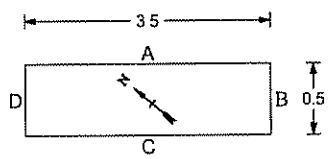
Orientation= 140deg.
Plant: Cat 428C Excavator
Backfilled: 24-Aug-05

Groundwater

3.2m depth: No water encountered

Shoring/Support: None

Stability: Sides collapsing slightly from 2 1 to 3 2m



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No	Hole ref	Page
69829-00	TP116	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6740.502 704.8152	29.40	22-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			29.2		(0.20) 0.20	TOPSOIL	1	
			28.9		(0.30) 0.50	Loose to medium dense grey brown slightly gravely very silty fine SAND. Gravel is rounded to subrounded and fine	2	
0.50-1.10	B 1		28.3		(0.60) 1.10	Loose to medium dense orange silty fine SAND with occasional fine to medium rounded gravel of sandstone	3	
			28.2		(0.10) 1.20	Loose to medium dense black SAND.	4	
1.20-3.60	B 2				(2.40)	Medium dense orange brown slightly clayey sandy rounded to subrounded GRAVEL and COBBLES	5	
			25.8		3.60			
			25.6		(0.20) 3.80	Firm marron brown slightly gravely slightly sandy CLAY. Gravel is rounded to subrounded of sandstone. *Trial pit completed at 3.8m depth*	6	

Remarks

Investigation/cluster ref: Main

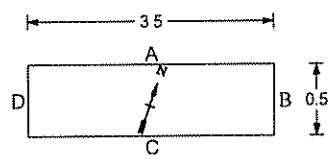
Orientation= 70deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.8m depth: No water encountered

Shoring/Support: None

Stability: Sides collapsing slightly from 2.6m



Client	Logged by: M Cooper	Database check:
Welsh Development Agency		

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP117	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6992.3969 1180.4048	32.65	22-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			32.3		(0.40) 0.40	TOPSOIL	1	
0.40-1.80	LB 1				(1.40)	Loose to medium dense yellow brown slightly gravely slightly clayey fine to coarse SAND with occasional pockets of orange/grey mottled sandy clay. Gravel is rounded to subrounded of sandstone	2	
			30.9		1.80			
2.50-2.70	LB 2				(2.30)	Loose to medium dense brown slightly clayey very sandy rounded to subrounded GRAVEL of sandstone with occasional rounded to subrounded cobbles of sandstone 2.70 - 4.10 Frequent cobbles.	3	
			28.6		4.10			
						Trial pit completed at 4.1m depth		

Remarks

Investigation/cluster ref: Main

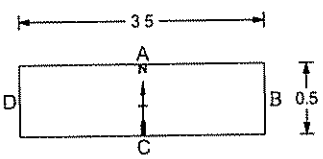
Orientation= 90deg.
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

4.1m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No	Hole ref	Page
69829-00	TP118	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7042.0935 1150.0723	32.60	22-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			32.4		(0.20) 0.20	TOPSOIL	1	
0.20-1.00	LB 1				(0.80)	Medium dense orange brown gravely clayey fine to coarse SAND. Gravel is rounded to subrounded of sandstone	2	
			31.6		1.00			
1.00-4.10	LB 2				(3.10)	Medium dense brown slightly clayey very sandy rounded to subrounded fine to coarse GRAVEL of sandstone with some rounded to subrounded cobbles of sandstone	3	
			28.5		4.10			
						Trial pit completed at 4.1m depth		

Remarks

Investigation/cluster ref: Main

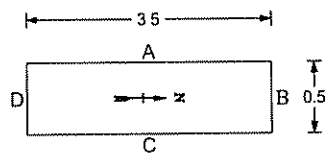
Orientation= 0deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

4.1m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP119	1 of 1

Contractor	Soil Mechanics	
Local grid co-ordinates	Ground Level (m OD)	Date
6923.7015 1177.7834	32.75	22-Aug-05

Pencoed Technology Park
Issue

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			32.5		(0.30) 0.30	TOPSOIL	1	
0.30-1.40	D 1					Loose to medium dense orange brown gravely clayey fine to coarse SAND. Gravel is rounded to subrounded of sandstone	2	
0.70	J 2				(1.10)			
			31.4		1.40			
1.40-3.90	B 3					Medium dense brown slightly clayey sandy rounded to subrounded fine to coarse GRAVEL of sandstone with some rounded to subrounded cobbles of sandstone becoming frequent to abundant with depth	3	
					(2.50)	3.00 - 3.10 Small boulders encountered		
			28.9		3.90			
						Trial pit completed at 3.9m depth		

Remarks

Investigation/cluster ref: Main

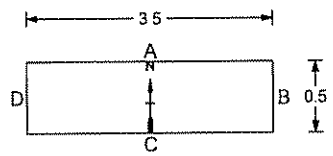
Orientation= 90deg.
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.9m depth: No water encountered

Shoring/Support: None

Stability: Sides collapsing slightly from 3.0m



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	**TP120**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6600.7751 560.4554	29.00	24-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			28.7		(0 30) 0.30	TOPSOIL	1	
0 30-1 50	B 1				(1 20)	Soft orange brown slightly gravely slightly sandy CLAY Gravel is rounded to subrounded of sandstone	2	
			27.5		1.50			
1 50-4 00	B 2				(2 50)	Loose to medium dense brown clayey sandy fine to coarse rounded GRAVEL of sandstone and mudstone with frequent rounded to subrounded cobbles of sandstone	3	
2 50-2 55	J 3					2 50 - 2 55 Black charcoal-like substance encountered (indicative of previous fire).		
						2 90 - 4 00 Abundant cobbles and small boulders		
			25.0		4.00			
						Trial pit completed at 4m depth		

Remarks

Investigation/cluster ref: Main

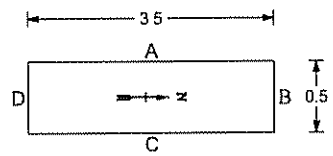
Orientation= 0deg.
Plant: Cat 428C Excavator
Backfilled: 24-Aug-05

Groundwater

4m depth: No water encountered

Shoring/Support: None

Stability: Trail pit abandoned due to instability form 3 0m



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP121	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6697.5458 613.818	29.60	23-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			29.2		(0.40) 0.40	TOPSOIL	1	
			28.5		(0.70) 1.10	Loose to medium dense slightly gravely clayey fine SAND with some rounded to subrounded cobbles of sandstone	2	
1.10-3.70	B 1		25.9		(2.60) 3.70	Medium dense dark brown and orange clayey very sandy rounded to subrounded GRAVEL of sandstone with frequent rounded cobbles of sandstone Sand is fine to coarse ... 2.50 - 2.55 Rounded gravel and sand in an odourless black brittle matrix (indicative of previous fire)	3	
3.70-4.00	B 2		25.6		(0.30) 4.00	Soft light brown slightly sandy CLAY	4	
						Trial pit completed at 4m depth		

Remarks

Investigation/cluster ref: Main

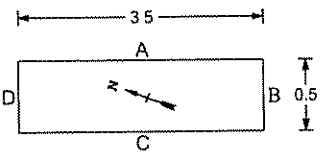
Orientation= 160deg.
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

4m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Logged by: M Cooper	Database check:
Welsh Development Agency		

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP122	1 of 1

Contractor	Soil Mechanics	
Local grid co-ordinates	Ground Level (m OD)	Date
6724.6865 546.5998	30.20	24-Aug-05

Pencoed Technology Park
Issue

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			29.9		(0.30) 0.30	TOPSOIL	1	
0.30-1.30	B 1		28.9		(1.00) 1.30	Soft orange brown slightly sandy slightly gravely CLAY/SILT with some rounded to subrounded gravel of sandstone	2	
1.30-3.80	B 2		26.4		(2.50) 3.80	Loose to medium dense brown clayey fine to coarse SAND and rounded to subrounded GRAVEL of sandstone with some rounded to subrounded cobbles and small boulders of sandstone	3	
						Trial pit completed at 3.8m depth		

Remarks

Investigation/cluster ref: Main

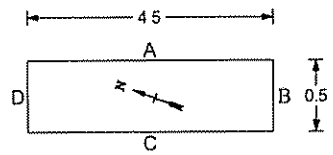
Orientation= 160deg.
Plant: Cat 428C Excavator
Backfilled: 24-Aug-05

Groundwater

3.8m depth: No water encountered

Shoring/Support: None

Stability: Sides collapsing from 2.4m



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP123	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6779.2493 645.2729	31.50	23-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
0 00-0 50	D 1				(0 50)	TOPSOIL: Loose slightly clayey gravely fine to coarse SAND with occasional cobbles.	1	
			31.0		0.50			
0 50-3 10	B 2				(2 60)	Loose red brown gravely fine to coarse SAND with some rounded to subrounded cobbles of sandstone. Gravels are rounded of sandstone	2	
			28.4		3.10	*Trial pit completed at 3.1m depth*		

Remarks

Soil very dry throughout

Investigation/cluster ref: Main

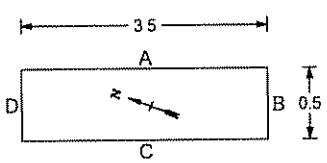
Orientation= 160deg.
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

3 1m depth: No water encountered

Shoring/Support: None

Stability: Sides of pit collapsed. trial pit abandoned



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP124	1 of 1

Contractor	Soil Mechanics	
Local grid co-ordinates	Ground Level (m OD)	Date
6875.2713 671.4861	31.20	23-Aug-05

Pencoed Technology Park
Issue

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			30.9		(0.30) 0.30	TOPSOIL	1	
0.30-1.30	J 2					Loose to medium dense gravely very clayey fine to coarse SAND with occasional cobbles.	2	
0.30-1.30	B 1				(1.00)			
			29.9		1.30			
1.30-3.40	B 3				(2.10)	Medium dense brown clayey very sandy GRAVEL with frequent cobbles. Gravel and cobbles are rounded to subrounded of sandstone	3	
			27.8		3.40	3.30 - 3.40 Occasional subrounded sandstone boulders encountered.		
						Trial pit completed at 3.4m depth		

Remarks

Investigation/cluster ref: Main

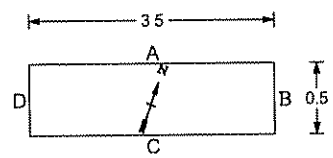
Orientation= 70deg.
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

3.4m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP125	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6900.0722 605.7664	31.40	23-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			30.9		(0.50) 0.50	TOPSOIL	1	
0.50-1.20	D 1		30.2		(0.70) 1.20	Soft orange slightly gravely slightly sandy CLAY. Gravel is rounded to subrounded of sandstone	2	
1.20-3.70	B 2		27.7		(2.50) 3.70	Medium dense brown clayey gravely SAND becoming sandy GRAVEL with some cobbles. Gravel and sand is rounded to subrounded of sandstone. Cobbles becoming abundant with some boulders.	3	
						Trial pit completed at 3.7m depth		

Remarks

Investigation/cluster ref: Main

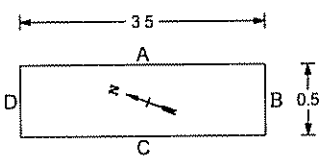
Orientation= 160deg.
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

3.7m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP126	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6965.7715 643.5883	31.80	23-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			31.5		(0.30) 0.30	TOPSOIL	1	
0.30-1.00	J 1		30.8		(0.70) 1.00	Loose to medium dense light brown slightly clayey fine SAND with some rounded gravel of sandstone	2	
1.00-3.60	B 2		28.2		(2.60) 3.60	Loose to medium dense slightly clayey very sandy rounded to subrounded GRAVEL of sandstone with some rounded cobbles of sandstone Becoming more clayey with frequent cobbles from 1.9m	3	
						Trial pit completed at 3.6m depth		

Remarks

Investigation/cluster ref: Main

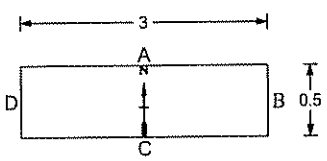
Orientation= 90deg.
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

m depth:

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP127	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
6999.0892 799.9311	31.70	23-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			31.5		(0.20) 0.20	TOPSOIL	1	
0.20-0.90	B 1		30.8		(0.70) 0.90	Medium dense orange brown gravely very clayey fine SAND with occasional rounded to subrounded cobbles of sandstone	2	
0.90-3.40	B 2		28.3		(2.50) 3.40	Medium dense brown slightly clayey gravely fine to coarse SAND and rounded to subrounded COBBLES of sandstone. Cobbles become more frequent with depth with occasional subrounded boulders of sandstone	3	
						Trial pit completed at 3.4m depth		

Remarks

Investigation/cluster ref: Main

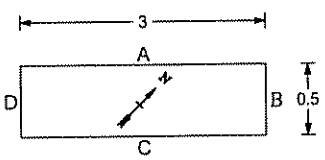
Orientation= 45deg.
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

1.3m depth: Becoming damp

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP128	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7070.1229 800.1187	32.50	23-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			32.3		(0.20) 0.20	TOPSOIL	1	
0.20-1.30	B 1				(1.10)	Loose to medium dense orange slightly gravely fine to coarse SAND with occasional rounded to subrounded cobbles of sandstone. Gravel is rounded	2	
			31.2		1.30			
1.30-3.00	D 2				(1.70)	Medium dense brown slightly gravely clayey fine to coarse SAND with frequent rounded cobbles of sandstone.	3	
			29.5		3.00			
						Trial pit completed at 3m depth		

Remarks

Investigation/cluster ref: Main

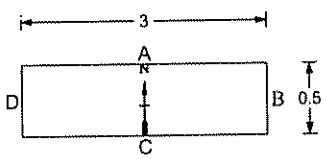
Orientation= 90deg.
Plant: Cat 428C Excavator
Backfilled: 23-Aug-05

Groundwater

1.6m depth: Becoming damp

Shoring/Support: None

Stability: Sides slightly unstable with cobbles falling in below 2.0m



Client	Logged by: M Cooper	Database check:
Welsh Development Agency		

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP129	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7190 3368 915.4582	35.45	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
0.10-2.90	B 1		35.4		(0.10) 0.10	TOPSOIL Medium dense reddish brown slightly gravely slightly silty fine to coarse SAND with occasional rounded cobbles of sandstone. Cobbles become more frequent with depth from 1.4m	1 2	
					(2.80)			
			32.6		2.90	*Trial pit completed at 2.9m depth*		

Remarks

Investigation/cluster ref: Main

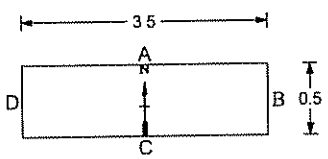
Orientation= 90deg.
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

2.9m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	**TP130**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7219.2105 871.2704	34.10	22-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			34.0		(0.10)	TOPSOIL	1	
					0.10	Loose to medium dense reddish brown slightly silty fine SAND with some rounded gravels of sandstone and rare rounded cobbles of sandstone	2	
					(1.20)			
			32.8		1.30			
1.30-3.10	B 1					Medium dense slightly silty gravely fine SAND and rounded COBBLES of sandstone	3	
					(1.80)			
			31.0		3.10			
						Trial pit completed at 3.1m depth		

Remarks

Investigation/cluster ref: Main

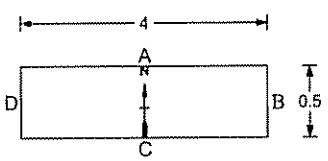
Orientation= 90deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.1m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP131	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7078.0785 601.4588	33.20	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			32.8		(0.40) 0.40	TOPSOIL: Soft dark brown organic SILT/CLAY with many rootlets.	1	
0.40-0 80	D 1		32.4		(0.40) 0.80	Soft orange and grey slightly sandy CLAY Sand is fine	2	
			32.0		(0.40) 1.20	Firm maroon brown sandy CLAY with some subangular to rounded sand and gravel of sandstone and limestone	3	
1.20-3 90	B 2		29.3		(2.70) 3.90	Firm maroon brown CLAY with some subangular to rounded sand and gravel of sandstone and limestone. Becoming stiff with depth with frequent rounded to subrounded cobbles of sandstone	4	
						Trial pit completed at 3 9m depth		

Remarks

Investigation/cluster ref: Main

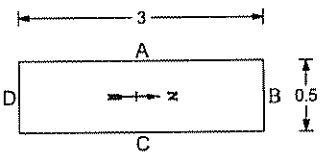
Orientation= 0deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3 9m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	**TP132**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7160.1572 637.4091	33.70	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			33.6		(0.10) 0.10	TOPSOIL	1	
0.10-1.80	B 1				(1.70)	Loose to medium dense slightly gravelly orange brown silty SAND with occasional angular to rounded cobbles of sandstone. Gravel is subrounded of grey sandstone. Some cobbles recovered as angular with clean breaks	2	
			31.9		1.80			
1.80-3.10	B 2				(1.30)	Medium dense reddish orange brown slightly clayey very sandy rounded COBBLES of sandstone	3	
			30.6		3.10			
						Trial pit completed at 3.1m depth		

Remarks

Investigation/cluster ref: Main

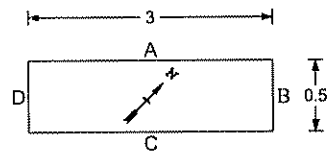
Orientation= 45deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

2m depth: Becoming damp

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP133	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7210.4138 725.2254	34.00	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			33.9		(0.10)	TOPSOIL	1	
					0.10	Soft orange brown slightly sandy CLAY	2	
					(0.60)			
			33.3		0.70			
0.70-3.60	B 1					Medium dense brown slightly silty fine to coarse SAND with occasional rounded gravel and small cobbles of sandstone	3	
					(2.90)			
			30.4		3.60			
						Trial pit completed at 3.6m depth		

Remarks

Investigation/cluster ref: Main

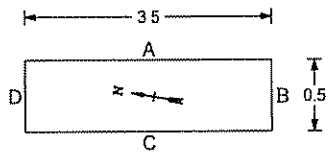
Orientation= 170deg.
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.3m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No	Hole ref	Page
69829-00	**TP134**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7341.2068 661.1875	35.80	22-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			35.7		(0.10)	TOPSOIL	1	
0.10-1.45	D 1				0.10	Uncompact red/orange brown slightly sandy SILT. Boulders of concrete containing reinforcement encountered at 0.1m	2	
					(1.35)			
			34.4		1.45			
1.45-3.85	B 2					Orange brown clayey sandy rounded to subrounded GRAVEL and COBBLES of sandstone	3	
					(2.40)			
			32.0		3.85			
						Trial pit completed at 3.85m depth		

Remarks

Investigation/cluster ref: Main

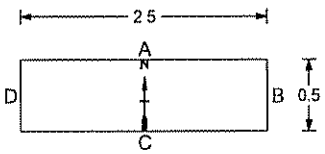
Orientation= 90deg.
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.85m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP135	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7141.8457 987.4906	33.60	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			33.3		(0.30) 0.30	TOPSOIL	1	
0.30-1.90	B 1				(1.60)	Loose to medium dense orange brown slightly gravely silty fine SAND. Gravel is rounded to subangular of sandstone	2	
			31.7		1.90			
1.90-4.00	B 2				(2.10)	Loose to medium dense light brown slightly clayey very gravely fine to coarse SAND with occasional cobbles. Gravel and cobbles are rounded to subrounded of sandstone becoming more frequent with depth	3	
			29.6		4.00			
4.00-4.50	D 3				(0.50)	Firm brown slightly gravely slightly sandy CLAY. Gravel is rounded to subrounded of sandstone.	4	
			29.1		4.50			
						Trial pit completed at 4.5m depth		

Remarks

Investigation/cluster ref: Main

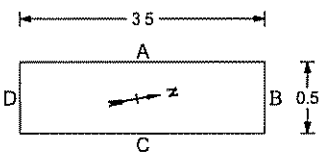
Orientation= 10deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

4.5m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ENCLOSURE B
INSITU TESTING

Insitu Hand Vane Results

Hole ID	Depth (m)	Test No	Result Peak (kN/m2)
TP119	0.7	1	86
TP119	0.7	2	122
TP119	0.7	3	104
TP120	0.7	1	114
TP120	0.7	2	82
TP120	0.7	3	94
TP121	0.2	1	60
TP121	0.2	2	64
TP121	0.2	3	54
TP122	0.7	1	44
TP122	0.7	2	32
TP122	0.7	3	60
TP124	0.7	1	46
TP124	0.7	2	42
TP124	0.7	3	58
TP125	0.7	1	78
TP125	0.7	2	58
TP125	0.7	3	60
TP126	0.5	1	112
TP126	0.5	2	78
TP126	0.5	3	82
TP127	0.5	1	60
TP127	0.5	2	46
TP127	0.5	3	66
TP128	0.5	1	56
TP128	0.5	2	48
TP128	0.5	3	82
TP129	0.5	1	28
TP129	0.5	2	34
TP129	0.5	3	42
TP130	0.5	1	42
TP130	0.5	2	32
TP130	0.5	3	78
TP133	0.4	1	46
TP133	0.4	2	24
TP133	0.4	3	14

Readings and Data supplied by Arup

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4 3				
Trial Pit No	101	Test Position No	1	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0.35 m
Operator	M. Millett	Weather at time of test	Overcast with Showers		
Soil description	Orange brown slightly sandy slightly gravelly SILT with occasional cobbles				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13 6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2 83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0.0237 kN/division

Penet-ration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	10	0.24
0.5	18	0.43
0.75	22	0.52
1	24	0.57
1.25	26	0.62
1.5	28	0.66
1.75	30	0.71
2	33	0.78
2.25	34	0.81
2.5	36	0.85
2.75	37	0.88
3	39	0.92
3.25	40	0.95
3.5	41	0.97
3.75	42	1.00

Penet-ration mm	Load Dial Reading divs	Force kN
4	44	1.04
4.25	45	1.07
4.5	48	1.14
4.75	49	1.16
5	50	1.19
5.25	50	1.19
5.5	51	1.21
5.75	51	1.21
6	52	1.23
6.25	52	1.23
6.5	53	1.26
6.75	53	1.26
7	54	1.28
7.25	54	1.28
7.5	55	1.30

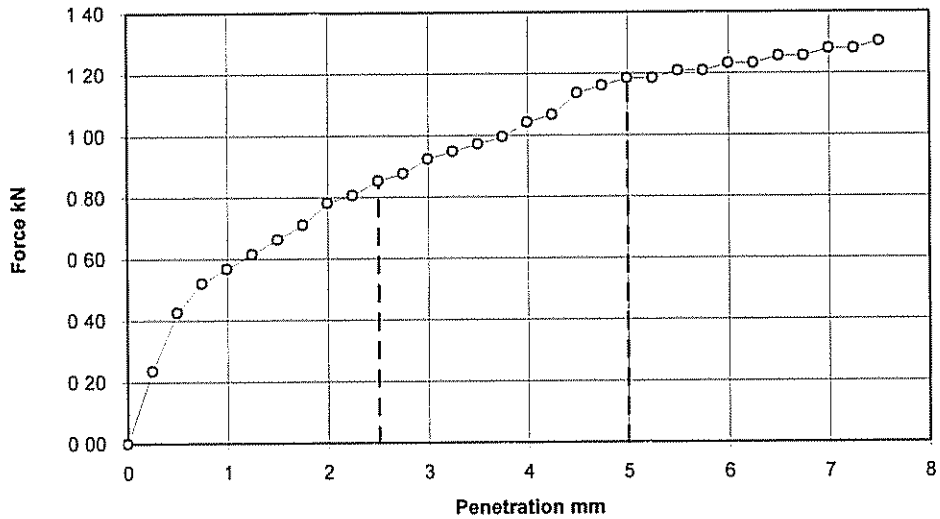
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	0.85	6.5
5.0	1.19	5.9

CBR Value **6.5 %**

Moisture Content **22.6 %**

FORCE / PENETRATION CURVE



Notes:

Project: Pencoed Technology Park
Project No.: H5118
Carried out for: Welsh Development Agency

Test No

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4 3				
Trial Pit No	102	Test Position No.	2	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0 35 m
Operator	M. Millett	Weather at time of test	Overcast with Showers		
Soil description	Brown slightly sandy gravelly SILT				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13.6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2 83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0.0237 kN/division

Penet-ration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	24	0.57
0.5	33	0.78
0.75	39	0.92
1	45	1.07
1.25	49	1.16
1.5	55	1.30
1.75	61	1.45
2	66	1.56
2.25	70	1.66
2.5	75	1.78
2.75	79	1.87
3	84	1.99
3.25	89	2.11
3.5	93	2.20
3.75	98	2.32

Penet-ration mm	Load Dial Reading divs	Force kN
4	103	2.44
4.25	106	2.51
4.5	110	2.61
4.75	114	2.70
5	117	2.77
5.25	122	2.89
5.5	125	2.96
5.75	128	3.03
6	132	3.13
6.25	135	3.20
6.5	138	3.27
6.75	140	3.32
7	143	3.39
7.25	145	3.44
7.5	148	3.51

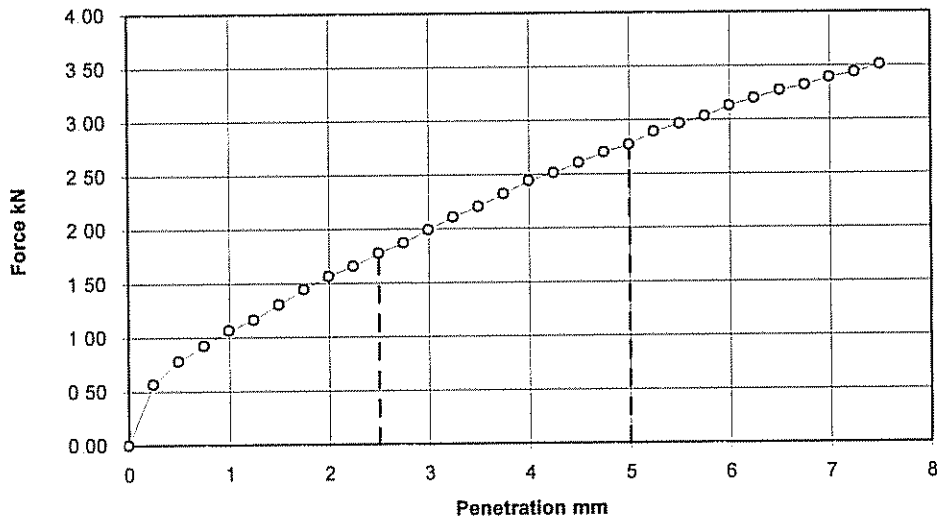
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	1.78	13.5
5.0	2.77	13.9

CBR Value **14 %**

Moisture Content **12.8 %**

FORCE / PENETRATION CURVE



Notes:

Project	Pencoed Technology Park
Project No.	H5118
Carried out for	Welsh Development Agency

Test No

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4 3				
Trial Pit No	103	Test Position No.	3	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0.35 m
Operator	M Millett	Weather at time of test	Overcast with Showers		
Soil description	Brown slightly sandy gravelly SILT				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13 6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2 83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0.0237 kN/division

Penet-ration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	11	0.26
0.5	15	0.36
0.75	20	0.47
1	24	0.57
1.25	28	0.66
1.5	31	0.73
1.75	35	0.83
2	40	0.95
2.25	43	1.02
2.5	46	1.09
2.75	49	1.16
3	52	1.23
3.25	55	1.30
3.5	58	1.37
3.75	62	1.47

Penet-ration mm	Load Dial Reading divs	Force kN
4	65	1.54
4.25	68	1.61
4.5	70	1.66
4.75	73	1.73
5	76	1.80
5.25	79	1.87
5.5	82	1.94
5.75	84	1.99
6	87	2.06
6.25	90	2.13
6.5	92	2.18
6.75	95	2.25
7	98	2.32
7.25	101	2.39
7.5	104	2.46

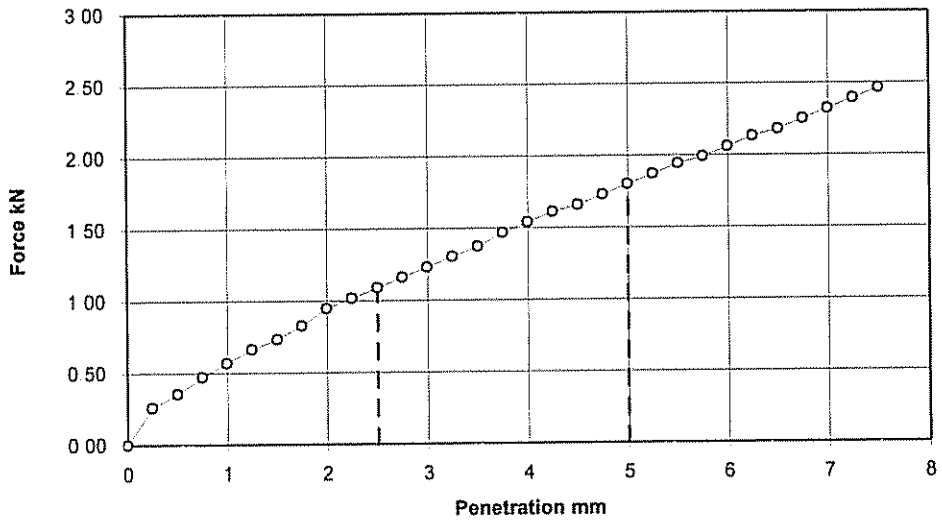
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	1.09	8.3
5.0	1.80	9.0

CBR Value **9.0 %**

Moisture Content **16.8 %**

FORCE / PENETRATION CURVE



Notes:	Project	Pencoed Technology Park	Test No
	Project No.	H5118	
	Carried out for	Welsh Development Agency	

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4 3				
Trial Pit No	104	Test Position No	4	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0.35 m
Operator	M. Millett	Weather at time of test	Overcast with Showers		
Soil description	Brown slightly sandy gravelly SILT				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13.6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2 83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0.0237 kN/division

Penet-ration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	7	0.17
0.5	12	0.28
0.75	15	0.36
1	19	0.45
1.25	22	0.52
1.5	24	0.57
1.75	26	0.62
2	27	0.64
2.25	30	0.71
2.5	32	0.76
2.75	34	0.81
3	35	0.83
3.25	37	0.88
3.5	38	0.90
3.75	39	0.92

Penet-ration mm	Load Dial Reading divs	Force kN
4	41	0.97
4.25	42	1.00
4.5	43	1.02
4.75	44	1.04
5	45	1.07
5.25	46	1.09
5.5	47	1.11
5.75	48	1.14
6	49	1.16
6.25	49	1.16
6.5	50	1.19
6.75	51	1.21
7	51	1.21
7.25	52	1.23
7.5	52	1.23

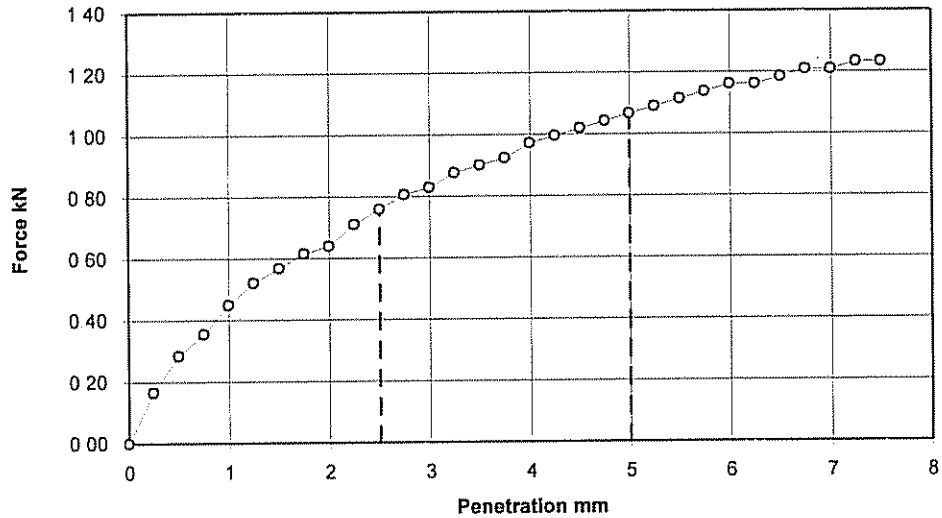
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	0.76	5.7
5.0	1.07	5.3

CBR Value **5.7 %**

Moisture Content **21.8 %**

FORCE / PENETRATION CURVE



Notes:

Project	Pencoed Technology Park	Test No
Project No.	H5118	
Carried out for	Welsh Development Agency	

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4 3				
Trial Pit No	105	Test Position No	5	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0.15 m
Operator	M Millett	Weather at time of test	Overcast with Showers		
Soil description	Brown very gravelly SILT				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13 6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2 83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0.0237 kN/division

Penet-ration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	8	0.19
0.5	18	0.43
0.75	25	0.59
1	35	0.83
1.25	42	1.00
1.5	48	1.14
1.75	54	1.28
2	60	1.42
2.25	65	1.54
2.5	69	1.64
2.75	74	1.75
3	78	1.85
3.25	82	1.94
3.5	86	2.04
3.75	90	2.13

Penet-ration mm	Load Dial Reading divs	Force kN
4	93	2.20
4.25	96	2.28
4.5	99	2.35
4.75	103	2.44
5	106	2.51
5.25	108	2.56
5.5	111	2.63
5.75	114	2.70
6	117	2.77
6.25	119	2.82
6.5	122	2.89
6.75	124	2.94
7	127	3.01
7.25	129	3.06
7.5	131	3.10

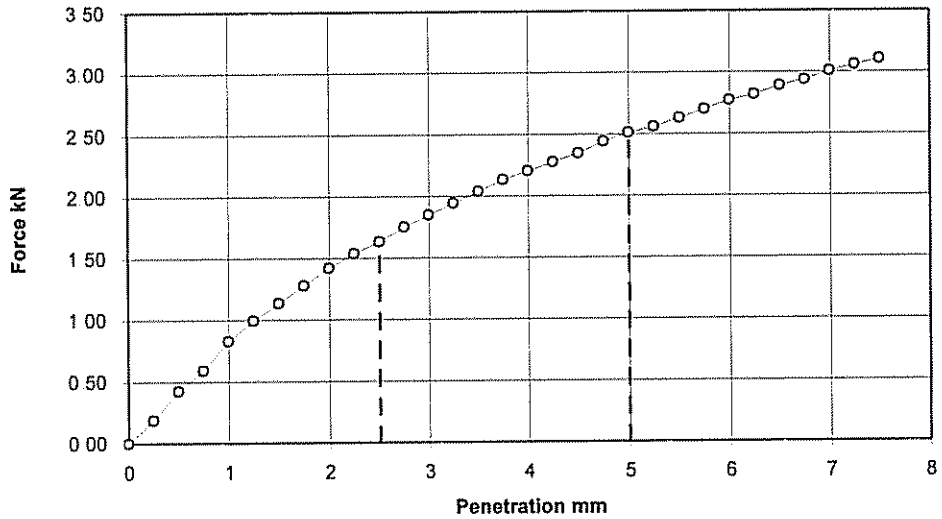
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	1.64	12.4
5.0	2.51	12.6

CBR Value **13 %**

Moisture Content **11.8 %**

FORCE / PENETRATION CURVE



Notes:

Project: Pencoed Technology Park

Project No.: H5118

Carried out for: Welsh Development Agency

Test No

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4 3				
Trial Pit No	106	Test Position No	6	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0 35 m
Operator	M. Millett	Weather at time of test	Sunny and dry		
Soil description	Orange brown slightly sandy slightly gravelly SILT				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13 6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2 83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0.0237	kN/division

Penet-ration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	7	0.17
0.5	10	0.24
0.75	11	0.26
1	13	0.31
1.25	14	0.33
1.5	15	0.36
1.75	16	0.38
2	17	0.40
2.25	18	0.43
2.5	19	0.45
2.75	19	0.45
3	20	0.47
3.25	20	0.47
3.5	21	0.50
3.75	21	0.50

Penet-ration mm	Load Dial Reading divs	Force kN
4	22	0.52
4.25	22	0.52
4.5	23	0.55
4.75	23	0.55
5	24	0.57
5.25	24	0.57
5.5	25	0.59
5.75	25	0.59
6	26	0.62
6.25	26	0.62
6.5	27	0.64
6.75	27	0.64
7	28	0.66
7.25	28	0.66
7.5	28	0.66

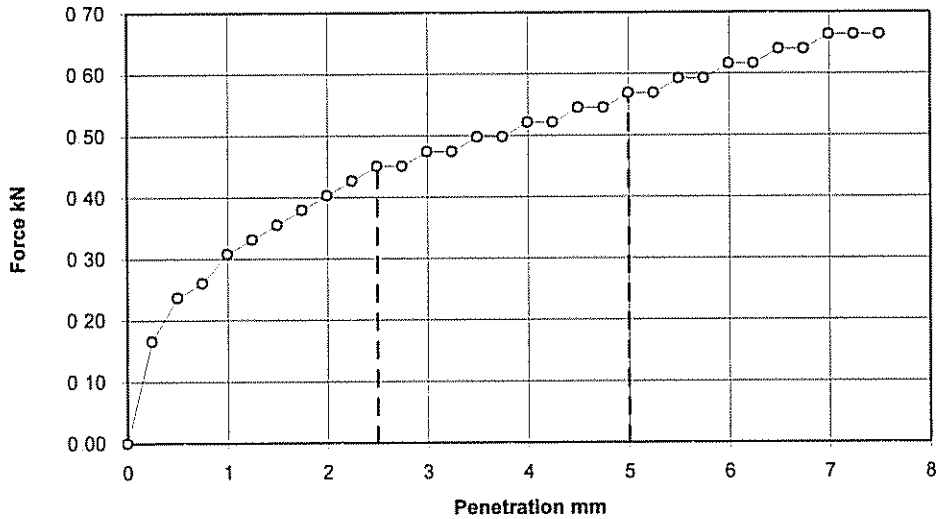
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	0.45	3.4
5.0	0.57	2.8

CBR Value **3.4 %**

Moisture Content **19.2 %**

FORCE / PENETRATION CURVE



Notes:

AGS

Project	Pencoed Technology Park
Project No.	H5118
Carried out for	Welsh Development Agency

Test No

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4.3				
Trial Pit No	107	Test Position No.	7	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0.35 m
Operator	M. Millett	Weather at time of test	Sunny and dry		
Soil description	Orange brown slightly sandy slightly gravelly SILT				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13.6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2.83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0.0237 kN/division

Penetration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	5	0.12
0.5	9	0.21
0.75	12	0.28
1	14	0.33
1.25	15	0.36
1.5	16	0.38
1.75	17	0.40
2	18	0.43
2.25	19	0.45
2.5	20	0.47
2.75	21	0.50
3	22	0.52
3.25	23	0.55
3.5	23	0.55
3.75	24	0.57

Penetration mm	Load Dial Reading divs	Force kN
4	24	0.57
4.25	25	0.59
4.5	25	0.59
4.75	26	0.62
5	26	0.62
5.25	27	0.64
5.5	27	0.64
5.75	28	0.66
6	28	0.66
6.25	29	0.69
6.5	29	0.69
6.75	29	0.69
7	30	0.71
7.25	30	0.71
7.5	30	0.71

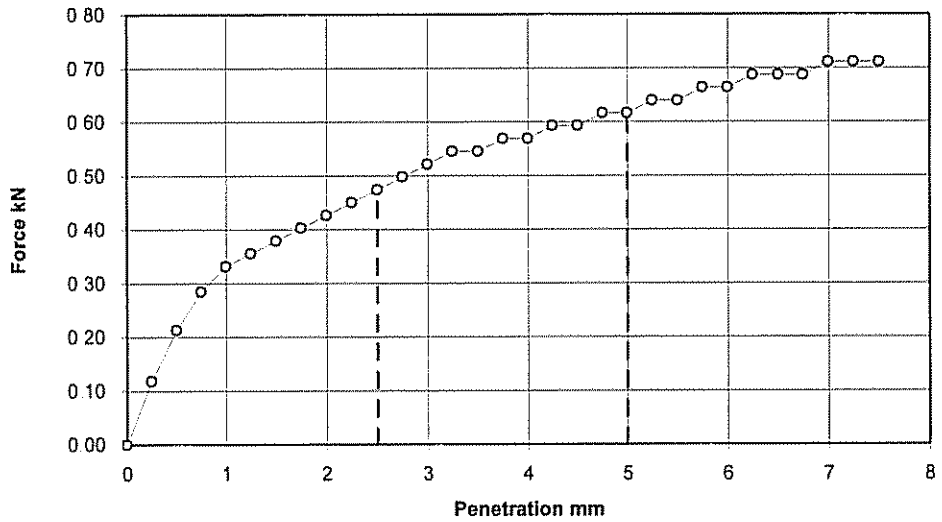
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	0.47	3.6
5.0	0.62	3.1

CBR Value **3.6 %**

Moisture Content **33.9 %**

FORCE / PENETRATION CURVE



Notes:	Project: Pencoed Technology Park Project No.: H5118 Carried out for: Welsh Development Agency	Test No

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4.3				
Trial Pit No	108	Test Position No	8	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0.35 m
Operator	M Millett	Weather at time of test	Sunny and dry		
Soil description	Orange brown slightly sandy slightly gravelly SILT				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13.6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2.83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0.0237 kN/division

Penetration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	12	0.28
0.5	15	0.36
0.75	18	0.43
1	21	0.50
1.25	23	0.55
1.5	24	0.57
1.75	25	0.59
2	26	0.62
2.25	27	0.64
2.5	28	0.66
2.75	29	0.69
3	30	0.71
3.25	31	0.73
3.5	32	0.76
3.75	33	0.78

Penetration mm	Load Dial Reading divs	Force kN
4	34	0.81
4.25	35	0.83
4.5	36	0.85
4.75	37	0.88
5	38	0.90
5.25	39	0.92
5.5	40	0.95
5.75	41	0.97
6	42	1.00
6.25	43	1.02
6.5	44	1.04
6.75	45	1.07
7	46	1.09
7.25	47	1.11
7.5	48	1.14

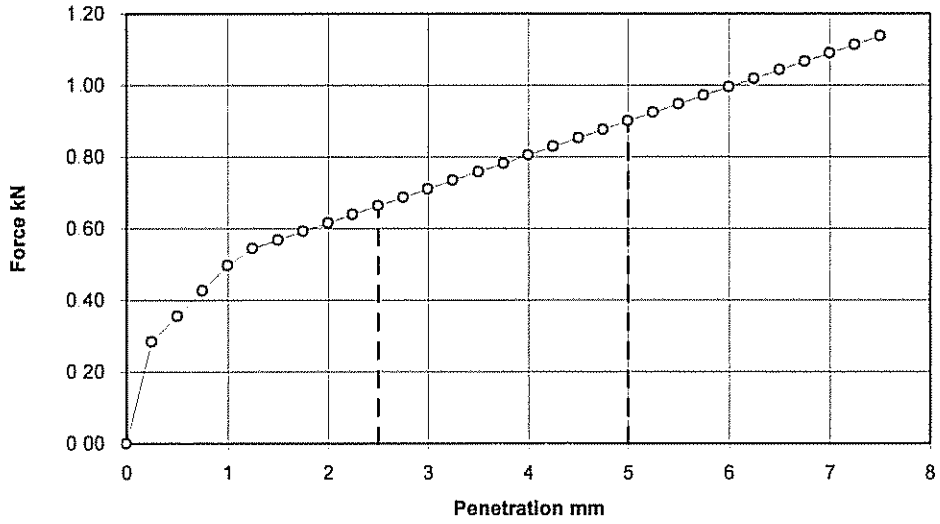
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	0.66	5.0
5.0	0.90	4.5

CBR Value **5.0 %**

Moisture Content **19.8 %**

FORCE / PENETRATION CURVE



Notes:

Project	Pencoed Technology Park	Test No
Project No.	H5118	
Carried out for	Welsh Development Agency	

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4 3				
Trial Pit No	109	Test Position No.	9	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0.35 m
Operator	M. Millett	Weather at time of test	Overcast with showers		
Soil description	Orange brown slightly sandy slightly gravelly SILT				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13 6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2.83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0 0237 kN/division

Penet-ration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	5	0.12
0.5	8	0.19
0.75	11	0.26
1	14	0.33
1.25	17	0.40
1.5	20	0.47
1.75	23	0.55
2	25	0.59
2.25	26	0.62
2.5	28	0.66
2.75	29	0.69
3	31	0.73
3.25	31	0.73
3.5	32	0.76
3.75	32	0.76

Penet-ration mm	Load Dial Reading divs	Force kN
4	33	0.78
4.25	33	0.78
4.5	34	0.81
4.75	35	0.83
5	35	0.83
5.25	36	0.85
5.5	36	0.85
5.75	37	0.88
6	37	0.88
6.25	38	0.90
6.5	39	0.92
6.75	39	0.92
7	40	0.95
7.25	40	0.95
7.5	41	0.97

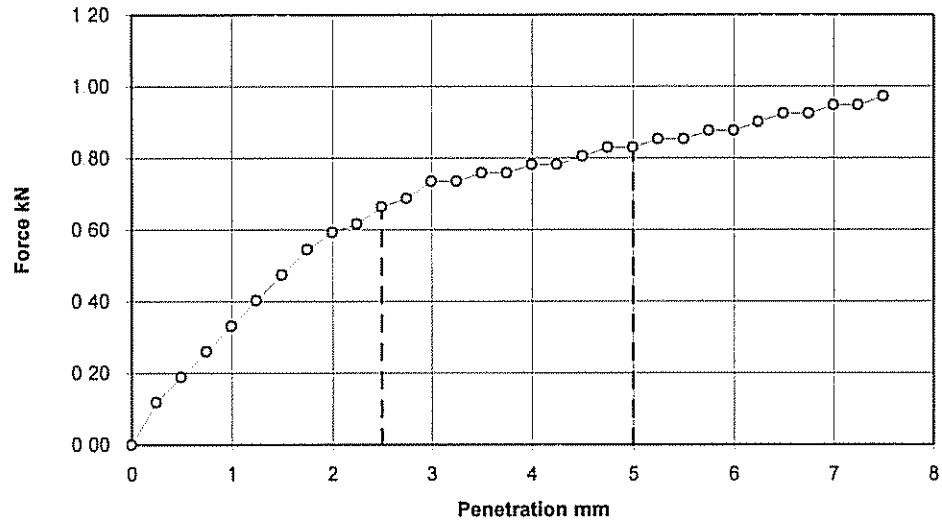
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	0.66	5.0
5.0	0.83	4.1

CBR Value **5.0 %**

Moisture Content **25.2 %**

FORCE / PENETRATION CURVE



Notes:

Project: Pencoed Technology Park
Project No.: H5118
Carried out for: Welsh Development Agency

Test No

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4.3				
Trial Pit No	110	Test Position No	10	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0.45 m
Operator	M. Millett	Weather at time of test	Overcast with showers		
Soil description	Orange brown slightly sandy gravelly SILT with some cobbles				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13.6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2.83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0.0237	kN/division

Penet-ration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	16	0.38
0.5	23	0.55
0.75	26	0.62
1	29	0.69
1.25	32	0.76
1.5	34	0.81
1.75	37	0.88
2	39	0.92
2.25	41	0.97
2.5	43	1.02
2.75	45	1.07
3	47	1.11
3.25	48	1.14
3.5	51	1.21
3.75	54	1.28

Penet-ration mm	Load Dial Reading divs	Force kN
4	56	1.33
4.25	57	1.35
4.5	59	1.40
4.75	61	1.45
5	63	1.49
5.25	64	1.52
5.5	66	1.56
5.75	68	1.61
6	70	1.66
6.25	73	1.73
6.5	74	1.75
6.75	75	1.78
7	77	1.82
7.25	79	1.87
7.5	81	1.92

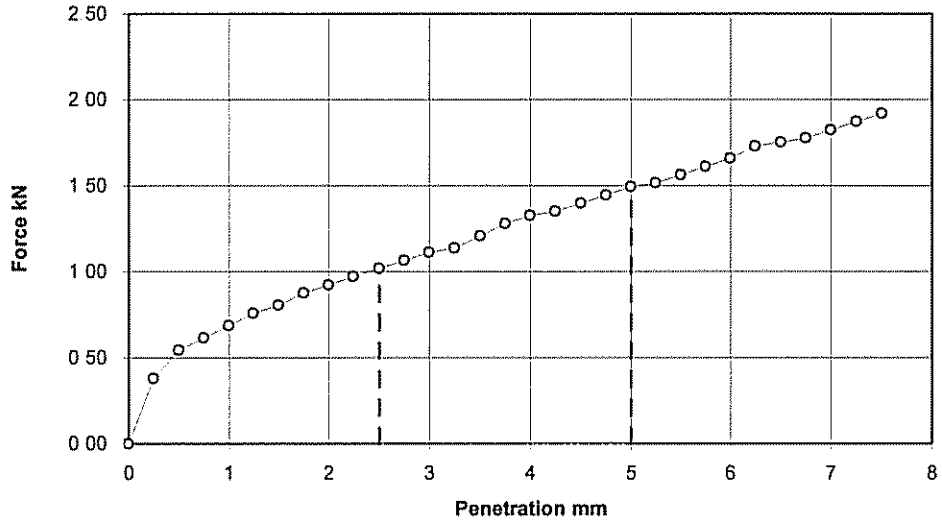
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	1.02	7.7
5.0	1.49	7.5

CBR Value **7.7 %**

Moisture Content **9.1 %**

FORCE / PENETRATION CURVE



Notes:	Project	Pencoed Technology Park	Test No
	Project No.	H5118	
	Carried out for	Welsh Development Agency	

In situ California Bearing Ratio Test

Test Method	BS 1377 : Part 9 : 1990 : Clause 4 3				
Trial Pit No	111	Test Position No.	11	Date of Test	24 Aug 2005
Ground Level	mOD	Chainage		Depth	0.40 m
Operator	M. Millett	Weather at time of test	Overcast with showers		
Soil description	Orange brown slightly sandy gravelly SILT				
Groundwater	None				
Remarks					
Seating Load	50 N	Surcharge mass	13.6 kg	Trial Pit Stratum No	
Diameter of Base Disc	250 mm	Equiv Overburden Pressure *	2.83 kN/m^2		

* includes allowance for nominal area of plunger (1935 mm^2)

Load Ring No.	CBR2	Calibration	0.0237 kN/division

Penet-ration mm	Load Dial Reading divs	Force kN
0	0	0.00
0.25	10	0.24
0.5	17	0.40
0.75	20	0.47
1	22	0.52
1.25	23	0.55
1.5	25	0.59
1.75	27	0.64
2	30	0.71
2.25	32	0.76
2.5	33	0.78
2.75	35	0.83
3	36	0.85
3.25	38	0.90
3.5	39	0.92
3.75	41	0.97

Penet-ration mm	Load Dial Reading divs	Force kN
4	42	1.00
4.25	45	1.07
4.5	47	1.11
4.75	48	1.14
5	49	1.16
5.25	51	1.21
5.5	52	1.23
5.75	53	1.26
6	55	1.30
6.25	56	1.33
6.5	57	1.35
6.75	58	1.37
7	59	1.40
7.25	60	1.42
7.5	61	1.45

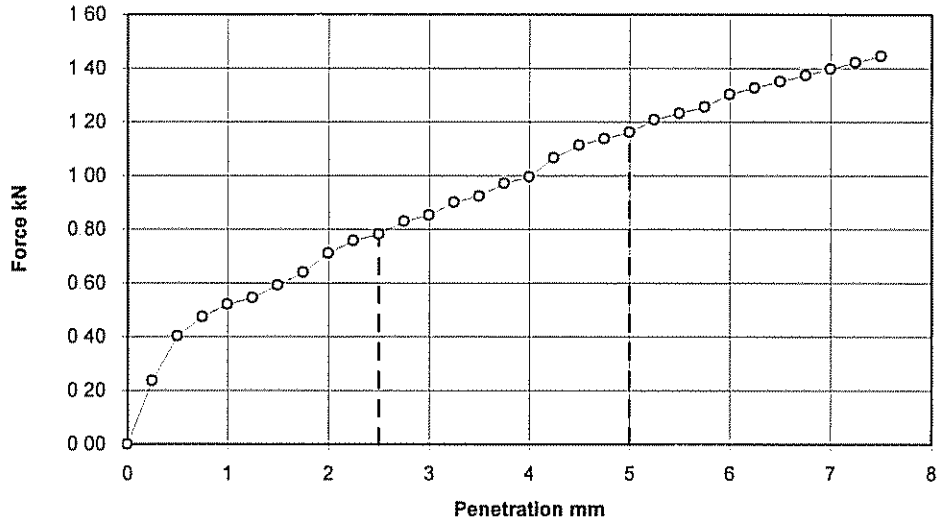
CBR Determination

Penetration mm	Load kN	CBR Value %
2.5	0.78	5.9
5.0	1.16	5.8

CBR Value **5.9 %**

Moisture Content **11.5 %**

FORCE / PENETRATION CURVE



Notes:

Project: Pencoed Technology Park
Project No.: H5118
Carried out for: Welsh Development Agency

Test No

ENCLOSURE C
GEOTECHNICAL RESULTS

INDEX PROPERTIES - SUMMARY OF RESULTS

Project No	Project Name
H5118	Pencoed Techology Park

Hole No	Sample No	Depth (m) from	Depth (m) to	type	Soil Description	ρ Mg/m³	ρ_d Mg/m³	w %	< 425 µm sieve %	W_L %	W_P %	I_P	ρ_s Mg/m³	Remarks
TP102	1	0.10	1.00	D	Brown gravelly sandy SILT/CLAY			12	69	28	21	7		
TP104	2	0.10	1.30	D	Brown silty SAND with rootlets			29	92	52	34	18		
TP108	3	1.90	4.20	ES	Red/brown silty gravelly SAND			20	89	36	24	12		
TP110	1	0.20	0.70	ES	Brown slightly sandy SILT			16	81	24	19	5		
TP112	1	1.70	1.80	B	Brown very sandy clayey GRAVEL with cobbles			13	40	34	22	12		
TP112	2	3.90	4.00	B	Brown very sandy clayey GRAVEL with cobbles			9.2	32	24	18	6		
TP113	1	1.30	2.50	B	Brown very sandy silty GRAVEL with cobbles			10	31	29	25	4		
TP113	2	2.50	2.55	ES	Brown/orange clayey very sandy GRAVEL			9.8	32	36	20	16		
TP114	L1	0.70		B	Brown slightly gravelly sandy SILT			21	95	28	23	5		
TP114	2	2.20	2.30	B	Brown very sandy silty GRAVEL			20	56					Unsuitable for PI
TP115	1	0.50		ES	Brown/orange slightly gravelly slightly sandy SILT			26	90	44	27	17		
TP115	3	2.70	2.80	B	Brown very sandy clayey GRAVEL with cobbles			24	48	30	20	10		
TP116	1	0.50	1.10	B	Brown very silty slightly gravelly SAND			14	87					Unsuitable for PI
TP116	2	1.20	3.60	B	Brown very sandy clayey GRAVEL			14	44	31	21	10		
TP117	1	0.40	1.80	B	Brown very sandy clayey GRAVEL with cobbles			13	67	27	20	7		
TP117	2	2.50	2.70	B	Brown slightly silty sandy GRAVEL with cobbles			9.0	46	37	23	14		
TP118	1	0.20	1.00	B	Brown very gravelly slightly sandy SILT with cobbles			16	45	37	24	13		
TP118	2	1.00	4.00	B	Brown slightly clayey sandy GRAVEL with cobbles			7.2	26	27	19	8		
TP119	2	0.70		ES	Orange/brown gravelly clayey SAND			13	75	23	NP			
TP124	2	0.30	1.30	ES	Brown gravelly clayey SAND with occasional cobbles			11	37	36	22	14		
TP127	1	0.20		B	Brown slightly gravelly sandy CLAY			14	70	28	19	9		
TP132	1	0.10		B	Brown slightly silty gravelly SAND with cobbles			8.2	42	30	24	6		
TP134	1	0.10		D	Dark brown slightly gravelly sandy SILT			22	80	39	26	13		

General notes: Definitive method used in all cases unless annotated otherwise See individual test reports for further details

Key

ρ	bulk density, linear	W_L	Liquid limit	ρ_s	particle density
ρ_d	dry density	W_P	Plastic limit	-g = gas jar	
w	moisture content	I_P	Plasticity Index	-p = small pyknometer	

CHEMICAL TESTS - SUMMARY OF RESULTS

Project No	Project Name
H5118	Pencoed Techology Park

Hole No	Sample No	Depth (m) from	Depth (m) to	type	Soil Description	pH	Org %	LOI %	Sulphate as SO_4 soil %	Sulphate as SO_4 2:1 g/L	Sulphate as SO_4 water g/L	CO_2 %	Chloride. Cl water sol %	Chloride. Cl acid sol %	<2 mm %	Remarks
TP104	2	0.10	1.30	D	Brown silty SAND with rootlets	6.3				0.63					94	
TP108	3	1.90	4.20	ES	Red/brown silty gravelly SAND	6.2				0.70					95	
TP115	1	0.50		ES	Brown/orange slightly gravelly slightly sandy SILT	7.3				0.57					100	
TP119	2	0.70		ES	Orange/brown gravelly clayey SAND	6.6				0.91					83	
TP124	2	0.30	1.30	ES	Brown gravelly clayey SAND with occasional cobbles	6.9				0.76					47	
TP126	1	0.30		ES	Brown slightly sandy SILT	6.9				0.81					98	

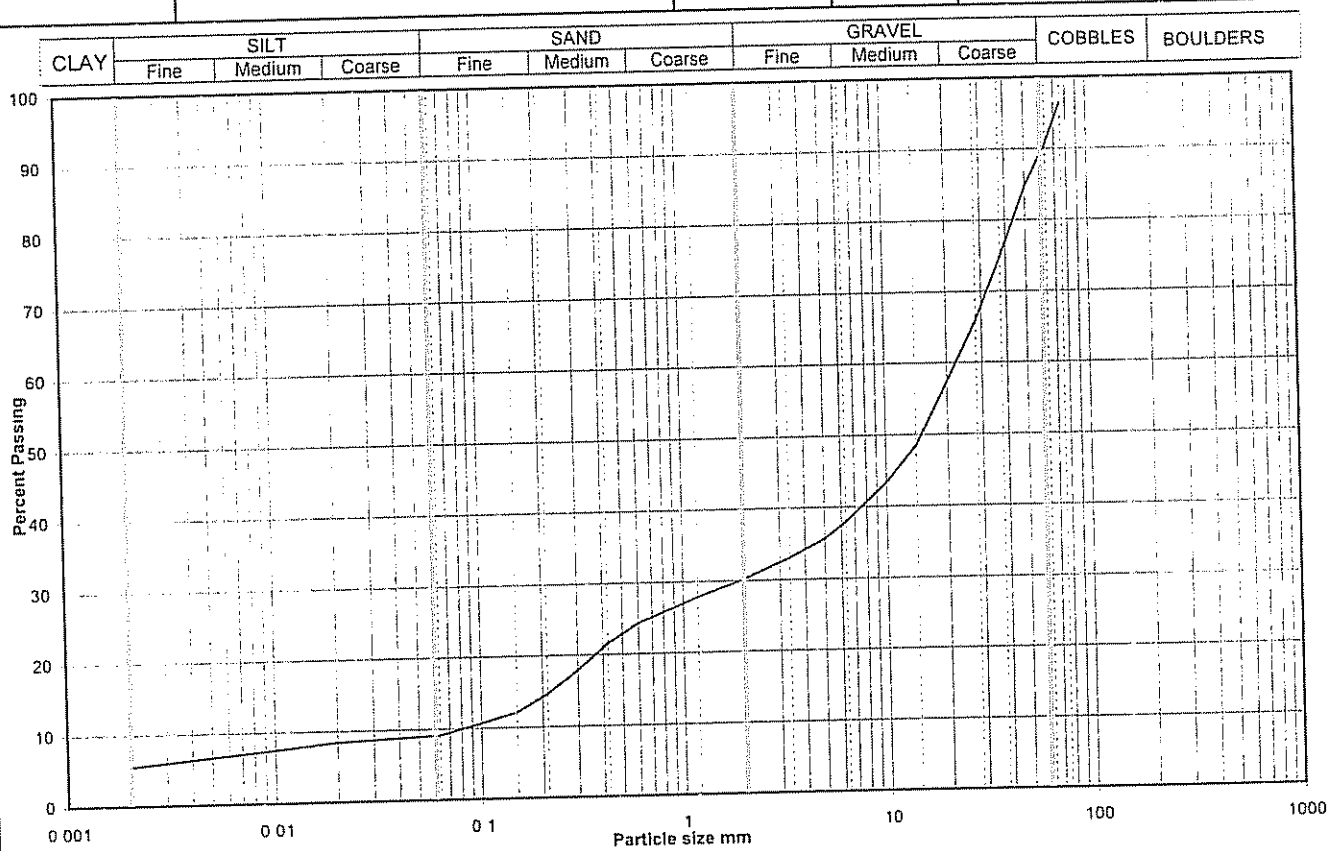
General notes: BS 1377:Part 3:1990 definitive method used in all cases unless annotated otherwise. See individual test reports for further details

Key : 2:1 2:1 water:soil extract from soil Org Organic matter content CO_2 Carbonate content (rapid titration)

< 2 mm material passing 2mm sieve LOI Mass loss on ignition

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP112		
Project Name	Pencoed Techology Park		Depth (m BGL)	1.70		
			Samp No	1	Type	B
			ID	ESGH511820050919380337		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	96	0.0201	8
63	91	0.0060	7
50	85	0.0020	5
37.5	75		
28	66		
20	57		
14	48		
10	43		
6.3	38		
5.0	36		
3.35	33		
2.00	30		
1.18	28		
0.600	24		
0.425	22	Particle density, Mg/m3	
0.300	18	2.65 assumed	
0.212	15	Dry mass of sample, kg	
0.150	12	32 2	
0.063	9		

Soil description	Brown very sandy clayey GRAVEL with cobbles	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	11
	Gravel	59
	Sand	21
	Silt	4
	Clay	5

Uniformity Coefficient	D_{60} / D_{10}	270

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

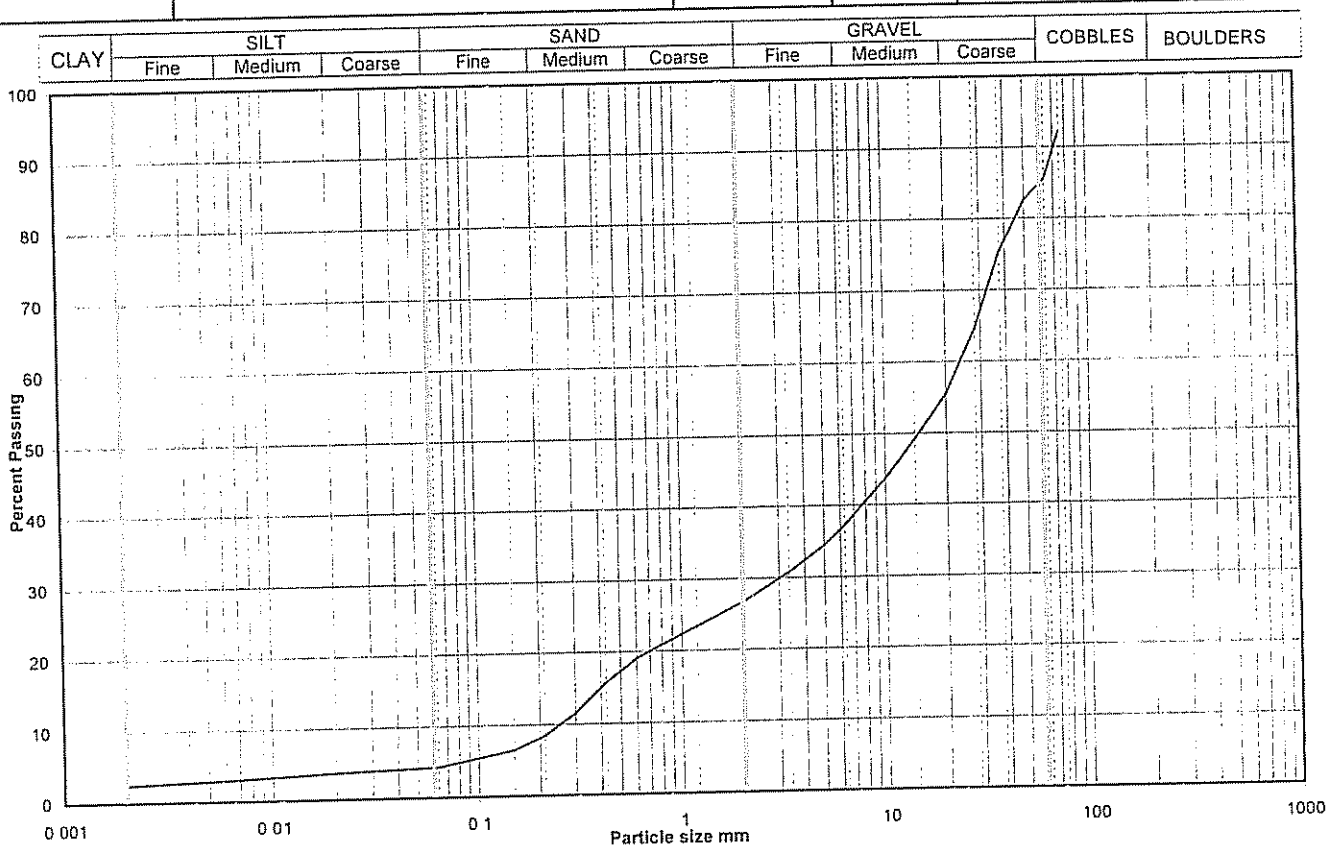
QA Ref
SLR 2 9
Rev 0
Nov 04

Soil Mechanics

Approved		Figure
Date		PSD 1

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP112		
Project Name	Pencoed Techology Park		Depth (m BGL)	3.90		
			Samp No	2	Type	B
			ID	ESGH511820050919194709		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	92	0.0201	4
63	85	0.0060	3
50	83	0.0020	3
37.5	75		
28	64		
20	55		
14	49		
10	44		
6.3	37		
5.0	34		
3.35	31		
2.00	27		
1.18	23		
0.600	19		
0.425	16	Particle density. Mg/m3	
0.300	11	2.65 assumed	
0.212	8	Dry mass of sample, kg	
0.150	6	31 5	
0.063	4		

Soil description	Brown very sandy clayey GRAVEL with cobbles	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	15
	Gravel	58
	Sand	22
	Silt	2
	Clay	3

Uniformity Coefficient	D_{60} / D_{10}	93

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

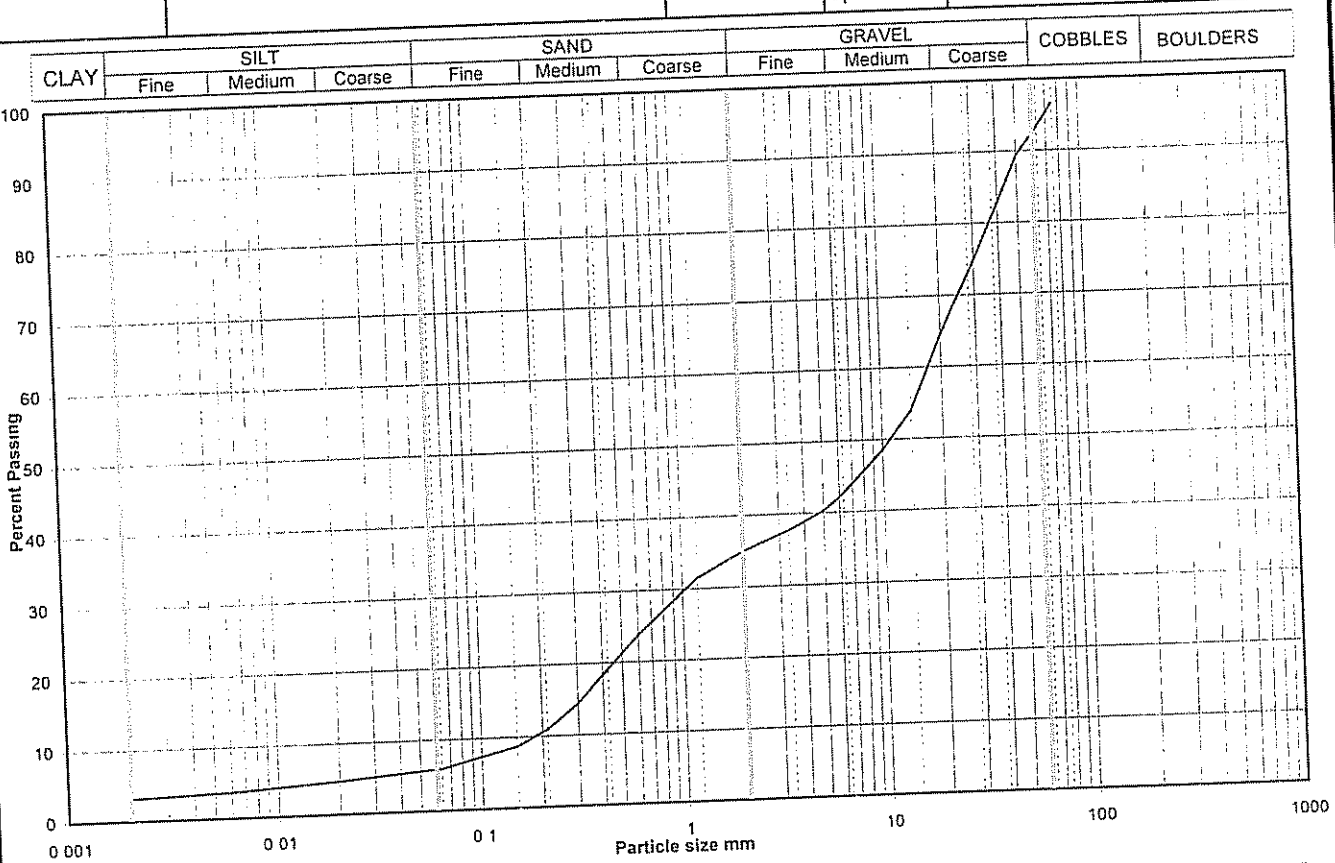
QA Ref SLR 2 9 Rev 0 Nov 04

Soil Mechanics

Approved		Figure
Date		PSD 2

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP113		
Project Name	Pencoed Techology Park		Depth (m BGL)	1.30		
			Samp No	1	Type	B
			ID	ESGH511820050919017172		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	97	0.0201	5
63	93	0.0060	4
50	89	0.0020	3
37.5	81		
28	73		
20	64		
14	54		
10	49		
6.3	43		
5.0	40		
3.35	38		
2.00	35		
1.18	31		
0.600	24		
0.425	19	Particle density, Mg/m3	
0.300	14	2.65 assumed	
0.212	11	Dry mass of sample. kg	
0.150	9	36 1	
0.063	6		

Soil description	Brown very sandy silty GRAVEL with cobbles	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	8
	Gravel	57
	Sand	29
	Silt	3
	Clay	3

Uniformity Coefficient	D_{60} / D_{10}	93

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

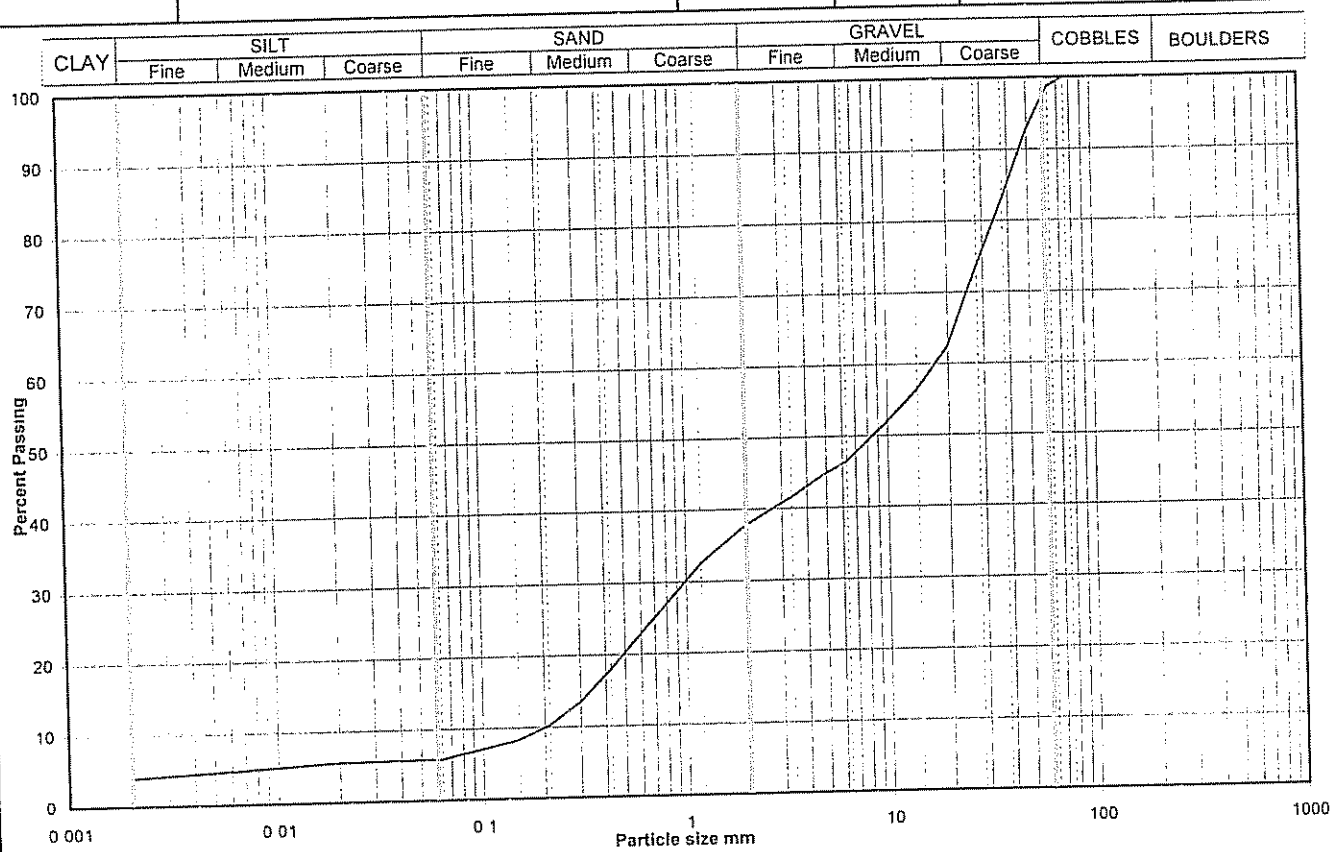
QA Ref
SLR 2 9
Rev 0
Nov 04

Soil Mechanics

Approved		Figure
Date		PSD 3

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP113		
Project Name	Pencoed Techology Park		Depth (m BGL)	2 50		
			Samp No	3	Type	B
			ID	ESGH511820050919483105		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100	0.0201	6
63	99	0.0060	5
50	93	0.0020	4
37.5	83		
28	74		
20	63		
14	56		
10	52		
6.3	46		
5.0	45		
3.35	42		
2.00	38		
1.18	33		
0.600	23		
0.425	18	Particle density. Mg/m3	
0.300	13	2.65 assumed	
0.212	10	Dry mass of sample, kg	
0.150	8	31 7	
0.063	6		

Soil description	Brown very sandy clayey GRAVEL	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	3
	Gravel	59
	Sand	32
	Silt	2
	Clay	4

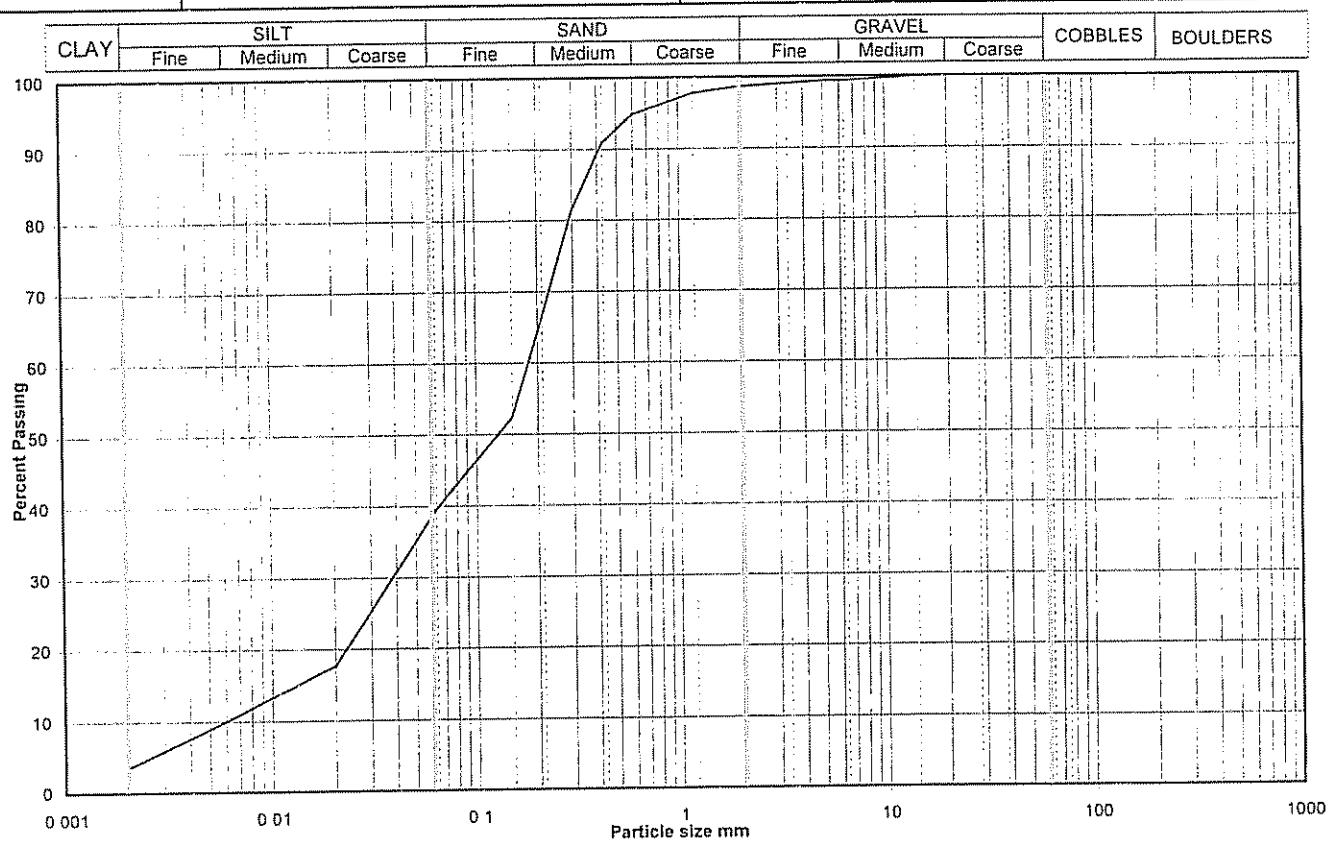
Uniformity Coefficient	D_{60} / D_{10}	85

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref SLR 2 9 Rev 0 Nov 04	Soil Mechanics	Approved	Figure PSD 4
		Date	

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP114		
Project Name	Pencoed Techology Park		Depth (m BGL)	0.70		
			Samp No	L1	Type	B
			ID	ESGR41510		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100	0.0201	18
63	100	0.0060	10
50	100	0.0020	3
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5.0	99		
3.35	99		
2.00	99		
1.18	98		
0.600	95		
0.425	91	Particle density Mg/m3	
0.300	81	2.65 assumed	
0.212	67	Dry mass of sample. kg	
0.150	52	2 2	
0.063	40		

Soil description		
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	0
	Gravel	1
	Sand	60
	Silt	36
	Clay	3

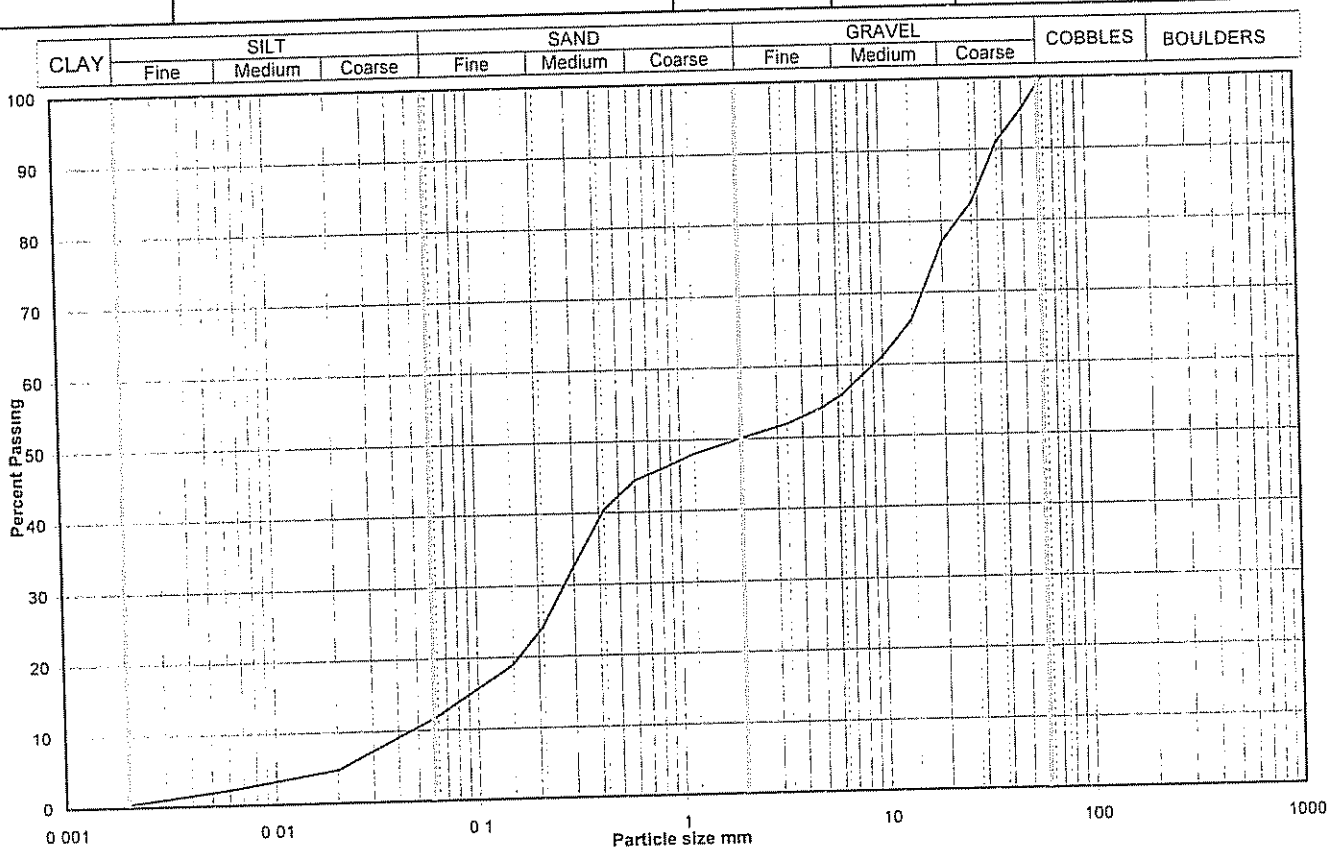
Uniformity Coefficient	D_{60} / D_{10}	30

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref SLR 2 9 Rev 0 Nov 04	Soil Mechanics	Approved	Figure PSD 5
		Date	

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP114		
Project Name	Pencoed Techology Park		Depth (m BGL)	2.20		
			Samp No	2	Type	B
			ID	ESGH511820050919151984		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100	0.0201	5
63	100	0.0060	2
50	96	0.0020	0
37.5	91		
28	83		
20	77		
14	66		
10	61		
6.3	56		
5.0	54		
3.35	52		
2.00	50		
1.18	48		
0.600	44		
0.425	40	Particle density, Mg/m3	
0.300	33	2.65 assumed	
0.212	24	Dry mass of sample, kg	
0.150	19	33.3	
0.063	12		

Soil description	Brown very sandy silty GRAVEL	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	1
	Gravel	49
	Sand	38
	Silt	12
	Clay	0

Uniformity Coefficient	D_{60} / D_{10}	194

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref
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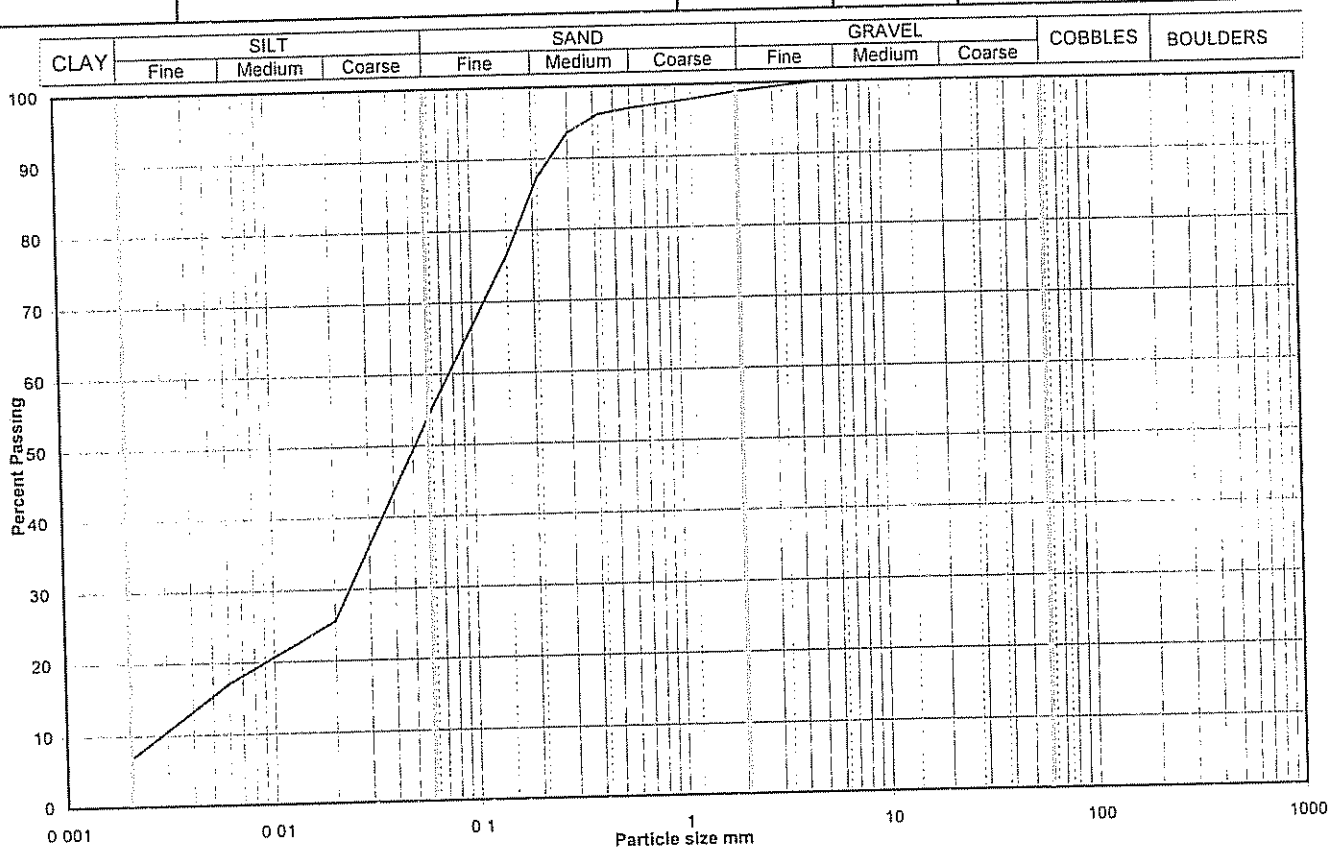
Approved		Figure
Date		PSD 6

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP115	
Project Name	Pencoed Techology Park		Depth (m BGL)	0.70	
			Samp No	2	Type B
			ID	ESGH511820050919837360	
			Spec Ref		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100	0.0201	26
63	100	0.0060	17
50	100	0.0020	7
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5.0	100		
3.35	100		
2.00	99		
1.18	98		
0.600	97		
0.425	96	Particle density, Mg/m3	
0.300	94	2.65 assumed	
0.212	87	Dry mass of sample. kg	
0.150	77	2 4	
0.063	55		

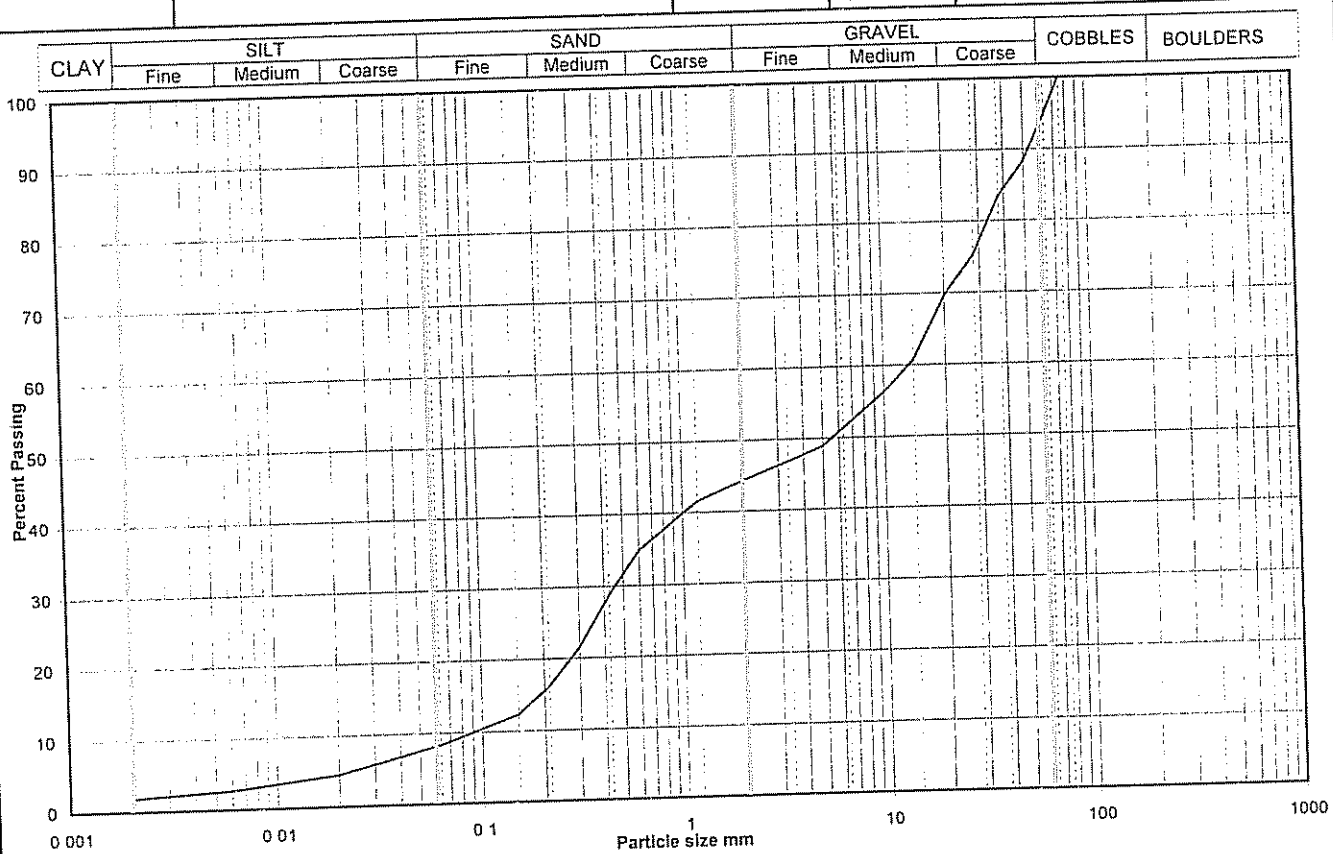
Soil description	Brown slightly gravelly sandy SILT	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	0
	Gravel	1
	Sand	45
	Silt	47
	Clay	7

Uniformity Coefficient	D_{60} / D_{10}	27

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP115	
Project Name	Pencoed Techology Park		Depth (m BGL)	2 70	
			Samp No	3	Type B
			ID	ESGH511820050919574372	
			Spec Ref		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100	0.0201	4
63	95	0.0060	3
50	88	0.0020	2
37.5	83		
28	75		
20	70		
14	61		
10	56		
6.3	51		
5.0	49		
3.35	47		
2.00	44		
1.18	42		
0.600	35		
0.425	29	Particle density, Mg/m3	
0.300	22	2.65 assumed	
0.212	16	Dry mass of sample, kg	
0.150	12	29 3	
0.063	8		

Soil description	Brown very sandy clayey GRAVEL with cobbles	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	7
	Gravel	49
	Sand	36
	Silt	6
	Clay	2

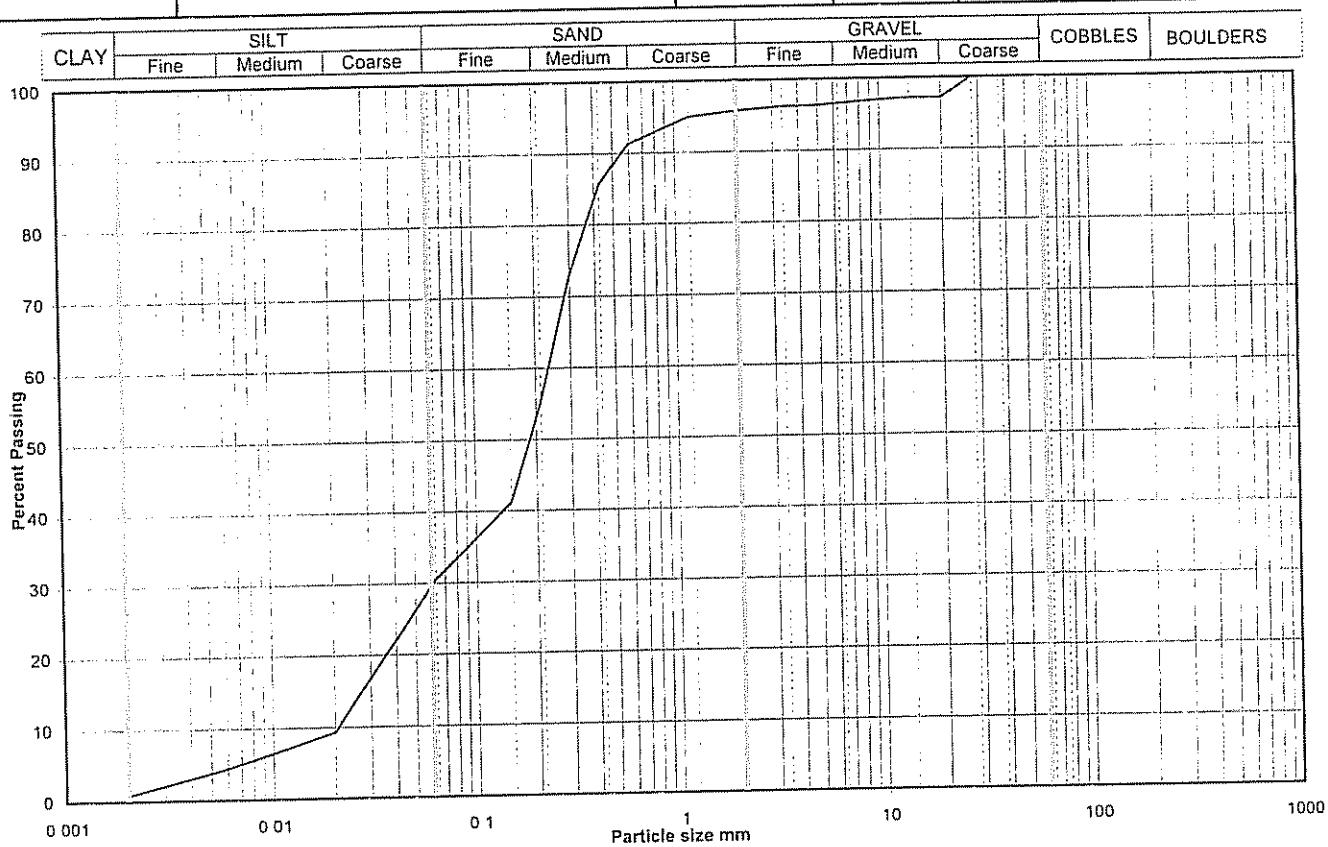
Uniformity Coefficient	D_{60} / D_{10}	146

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref SLR 2 9 Rev 0 Nov 04	Soil Mechanics	Approved	Figure PSD 8
		Date	

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP116		
Project Name	Pencoed Techology Park		Depth (m BGL)	0 50		
			Samp No	1	Type	B
			ID	ESGH511820050919097757		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100	0.0201	9
63	100	0.0060	4
50	100	0.0020	1
37.5	100		
28	100		
20	97		
14	97		
10	97		
6.3	97		
5.0	96		
3.35	96		
2.00	96		
1.18	95		
0.600	91		
0.425	86	Particle density, Mg/m3	
0.300	73	2.65 assumed	
0.212	55	Dry mass of sample, kg	
0.150	41	2 1	
0.063	30		

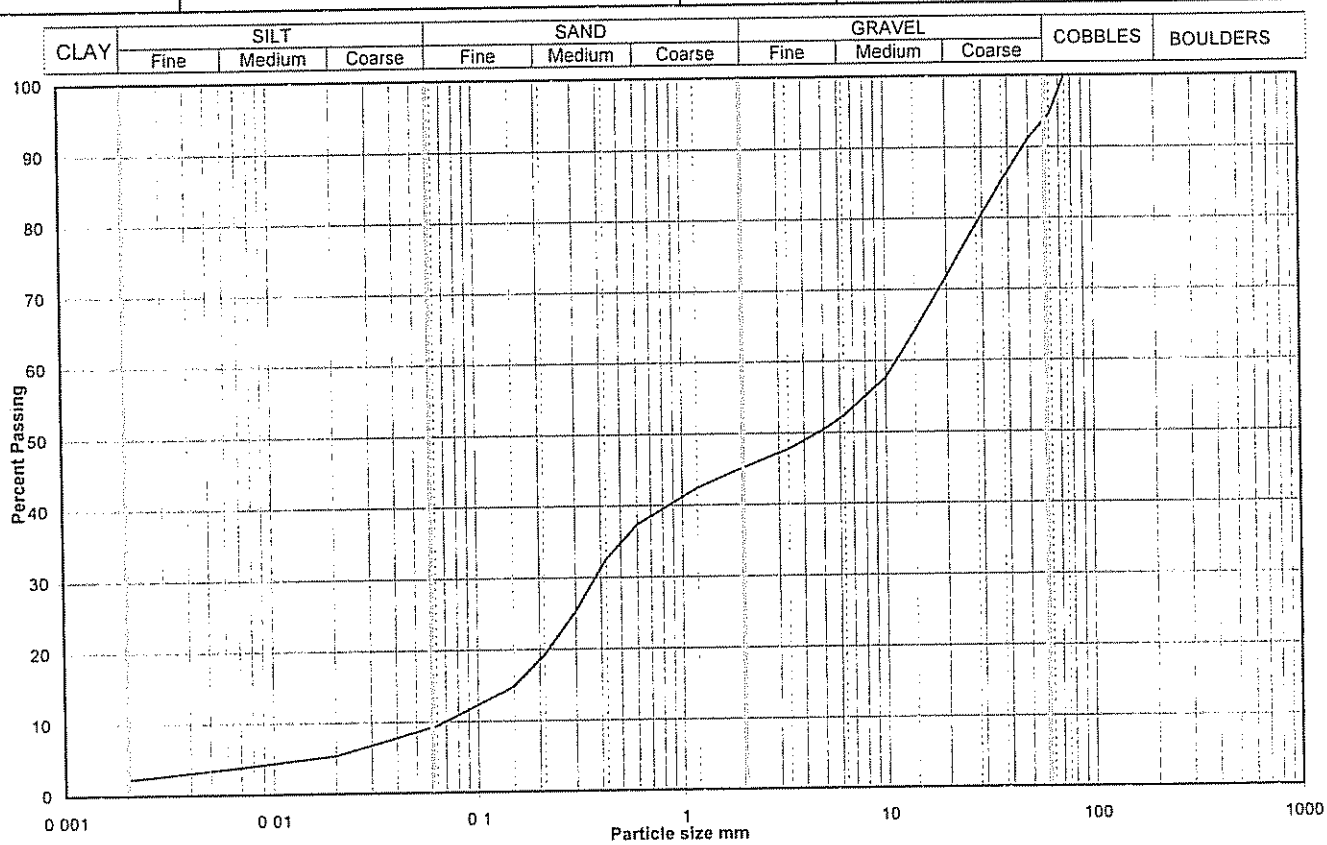
Soil description	Brown very silty slightly gravelly SAND	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	0
	Gravel	4
	Sand	66
	Silt	29
	Clay	1

Uniformity Coefficient	D_{60} / D_{10}	11

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP116		
Project Name	Pencoed Techology Park		Depth (m BGL)	1.20		
			Samp No	2	Type	B
			ID	ESGH511820050919527602		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100	0.0201	5
63	95	0.0060	4
50	91	0.0020	2
37.5	85		
28	79		
20	72		
14	64		
10	58		
6.3	52		
5.0	50		
3.35	48		
2.00	45		
1.18	42		
0.600	37		
0.425	32	Particle density. Mg/m3	
0.300	25	2.65 assumed	
0.212	19	Dry mass of sample, kg	
0.150	15	31 0	
0.063	9		

Soil description	Brown very sandy clayey GRAVEL	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	6
	Gravel	49
	Sand	36
	Silt	7
	Clay	2

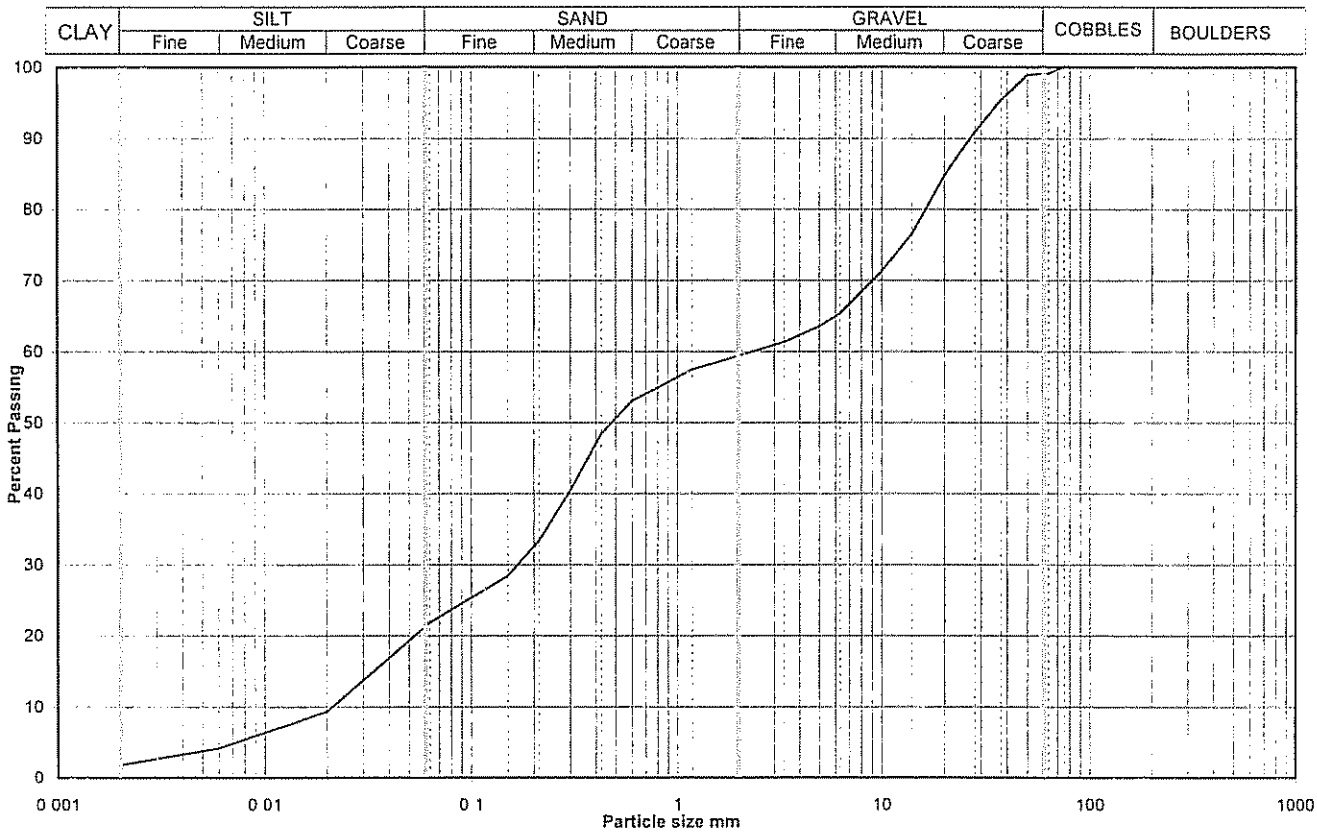
Uniformity Coefficient	D_{60} / D_{10}	163

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref SLR 2 9 Rev 0 Nov 04	Soil Mechanics	Approved	Figure PSD 10
		Date	

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP117		
Project Name	Pencoed Techology Park		Depth (m BGL)	0.40		
			Samp No	1	Type	B
			ID	ESGH511820050919769227		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100	0.0201	9
63	99	0.0060	4
50	99	0.0020	2
37.5	95		
28	91		
20	85		
14	77		
10	71		
6.3	65		
5.0	64		
3.35	61		
2.00	59		
1.18	57		
0.600	53		
0.425	48	Particle density, Mg/m3	
0.300	40	2.65 assumed	
0.212	33	Dry mass of sample. kg	
0.150	28	41 4	
0.063	22		

Soil description	Brown very sandy clayey GRAVEL with cobbles	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks		
Sample Proportions	Cobbles / boulders	1
	Gravel	40
	Sand	38
	Silt	19
	Clay	2

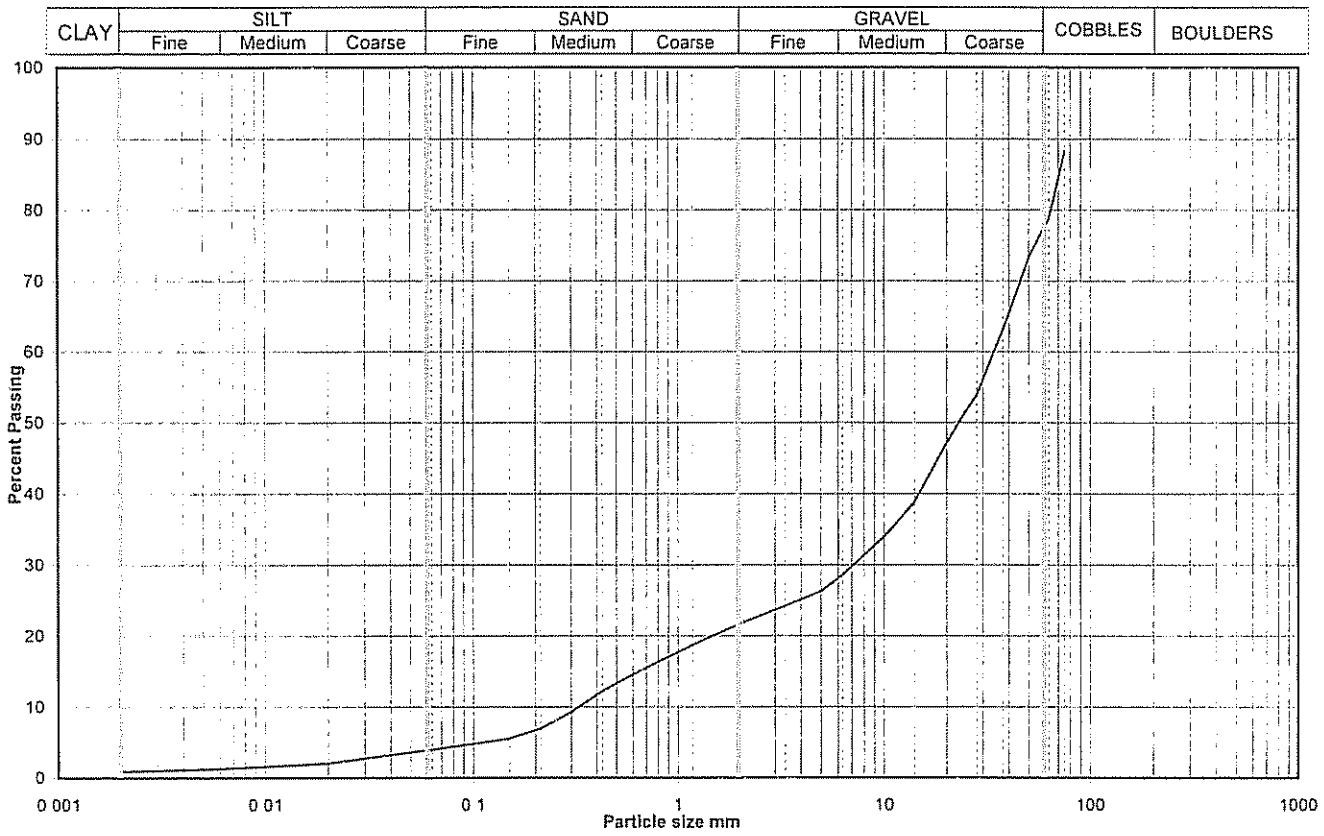
Uniformity Coefficient	D_{60} / D_{10}	109

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref SLR 2 9 Rev 0 Nov 04	Soil Mechanics	Approved	Figure PSD 11
		Date	

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP117		
Project Name	Pencoed Techology Park		Depth (m BGL)	2.50		
			Samp No	2	Type	B
			ID	ESGH511820050919044351		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	88	0.0201	2
63	79	0.0060	1
50	73	0.0020	1
37.5	63		
28	54		
20	47		
14	39		
10	34		
6.3	29		
5.0	26		
3.35	24		
2.00	22		
1.18	19		
0.600	15		
0.425	12	Particle density, Mg/m3	
0.300	9	2.65 assumed	
0.212	7	Dry mass of sample. kg	
0.150	6	49 0	
0.063	4		

Soil description	Brown slightly silty sandy GRAVEL with cobbles	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks	Sieve: 2156 70g retained at 90mm	
Sample Proportions	Cobbles / boulders	22
	Gravel	56
	Sand	18
	Silt	3
	Clay	1

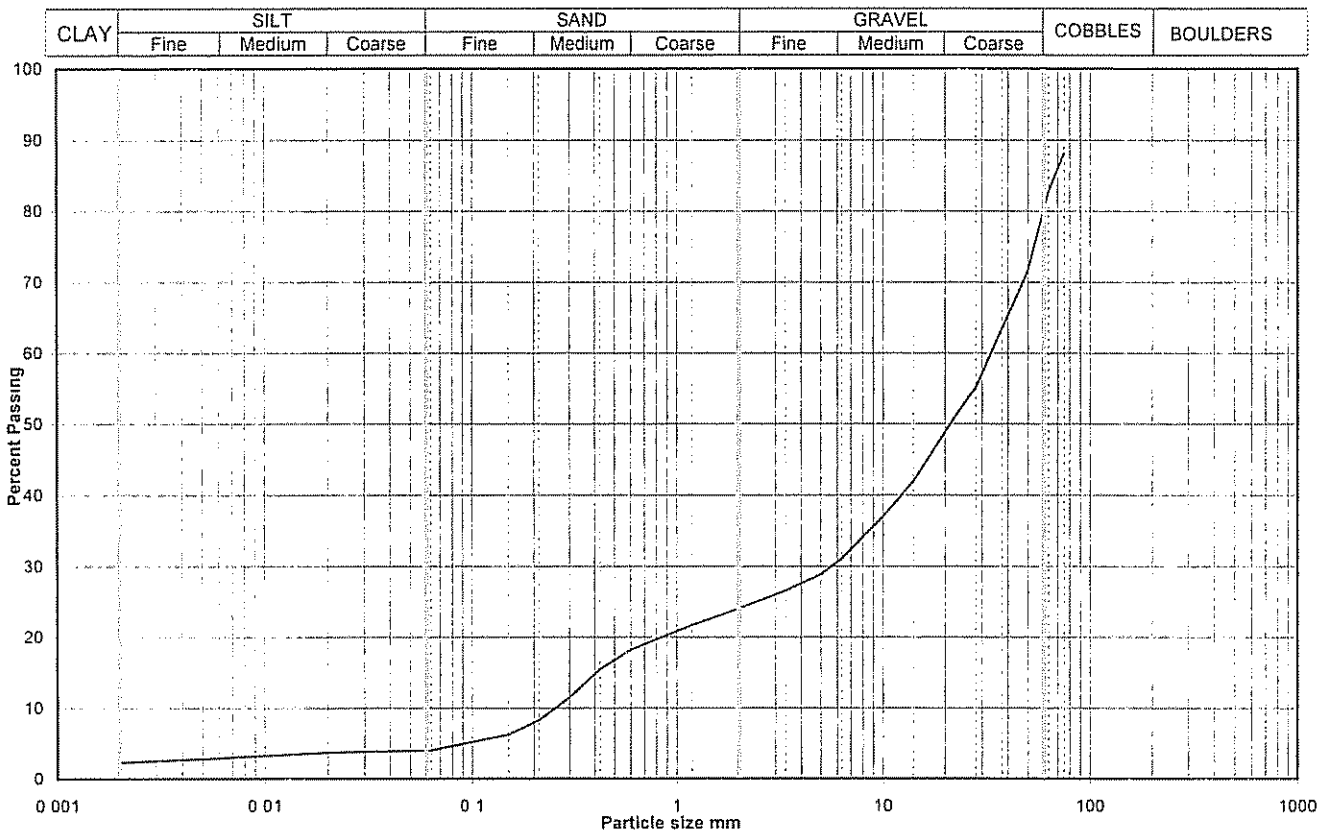
Uniformity Coefficient	D_{60} / D_{10}	104

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref SLR 2 9 Rev 0 Nov 04	Soil Mechanics	Approved		Figure PSD 12
		Date		

Particle Size Distribution Analysis

Project No	H5118	Sample Details:	Hole No	TP118		
Project Name	Pencoed Techology Park		Depth (m BGL)	1 00		
			Samp No	2	Type	B
			ID	ESGH511820050919960671		
			Spec Ref			



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	88	0.0201	4
63	83	0.0060	3
50	72	0.0020	2
37.5	63		
28	55		
20	49		
14	42		
10	37		
6.3	31		
5.0	29		
3.35	27		
2.00	24		
1.18	22		
0.600	18		
0.425	15	Particle density, Mg/m3	
0.300	11	2.65 assumed	
0.212	8	Dry mass of sample, kg	
0.150	6	50 0	
0.063	4		

Soil description	Brown slightly clayey sandy GRAVEL with cobbles	
Preparation / Pretreatment	Sieve: natural material Pipette: as BS1377	
Remarks	Sieve: 1731 70g retained at 90mm	
Sample Proportions	Cobbles / boulders	20
	Gravel	56
	Sand	20
	Silt	2
	Clay	2

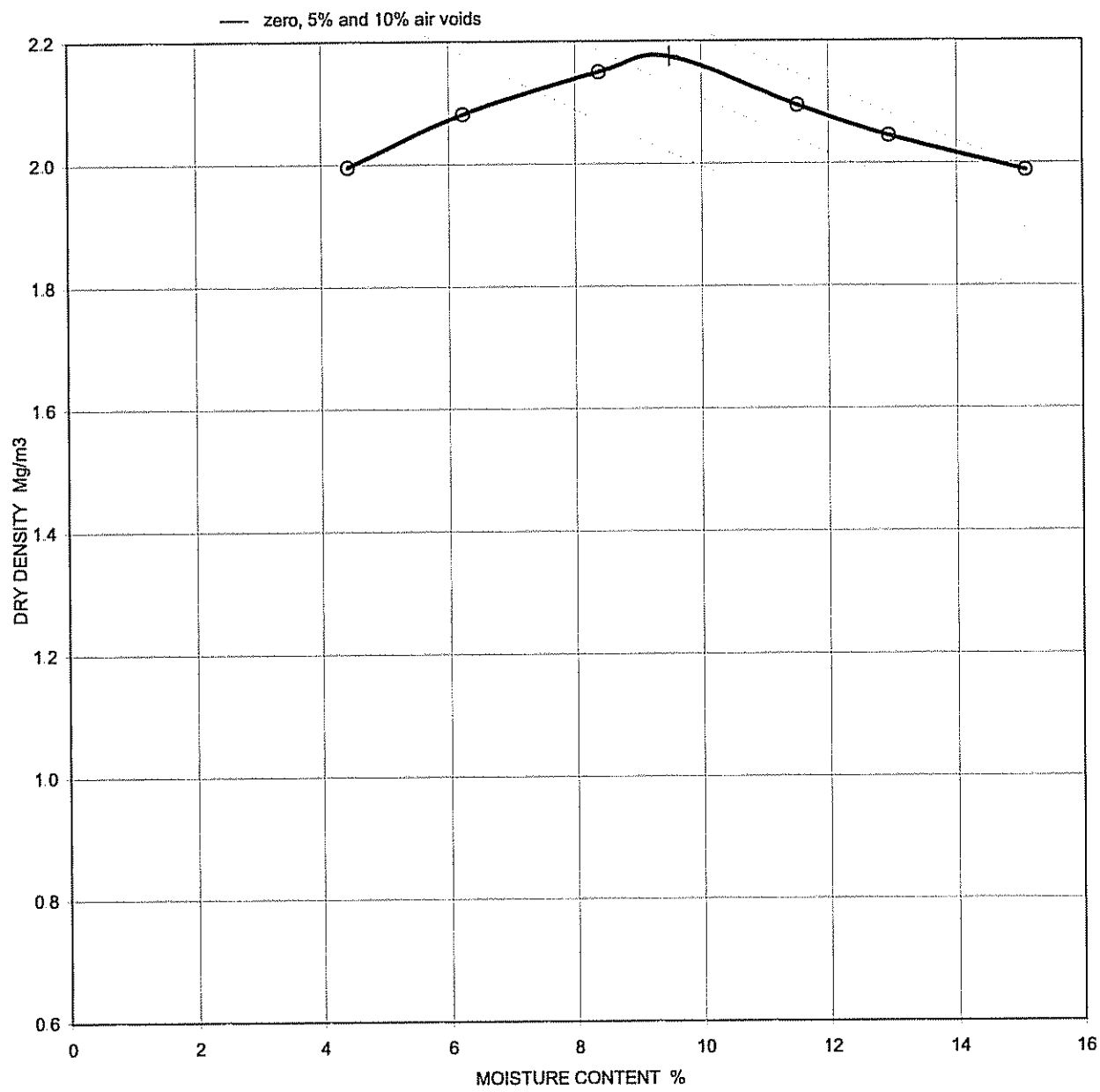
Uniformity Coefficient	D_{60} / D_{10}	130

Test Method	BS 1377 : Part 2 : 1990	
	Sieving	9.2 wet sieve
	Sedimentation	9.4 pipette

QA Ref SLR 2 9 Rev 0 Nov 04	Soil Mechanics	Approved	Figure PSD 14
		Date	

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP112		
Project Name	Pencoed Techology Park		Depth (m BGL)	1.70		
			Samp No	1	Type	B
			ID	ESGH511820050919380337		
			Spec Ref			



Soil description	Brown very sandy clayey GRAVEL with cobbles		
Test method	BS 1377:part 4:1990: clause 3 6, 4.5 kg rammer in a CBR mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	24	%	
Material < 37.5mm > 20mm	18	%	
Particle density	2.85	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

2.175

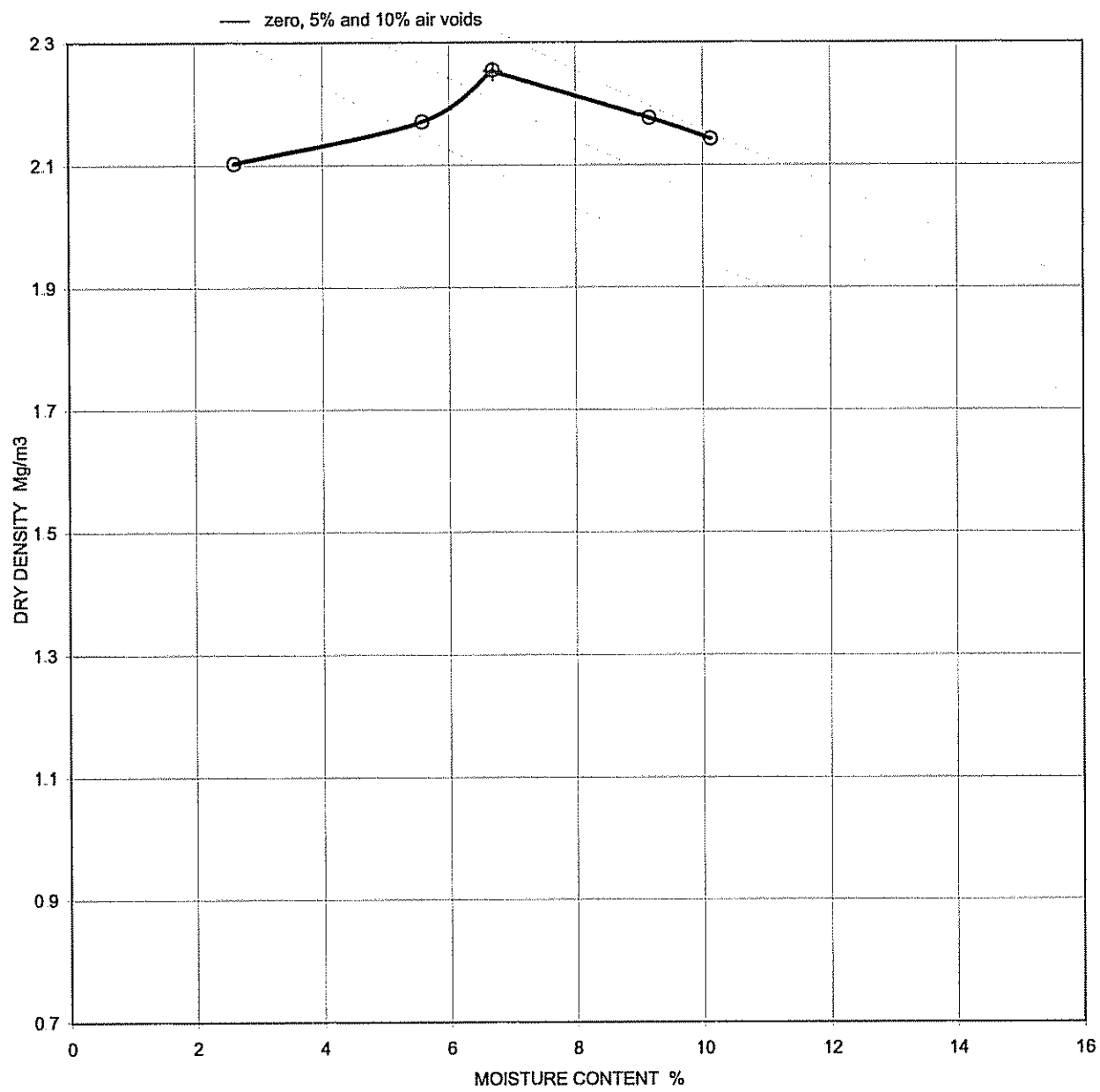
Optimum moisture content, %

9.5

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		Figure **COMPH 1**
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP112		
Project Name	Pencoed Techology Park		Depth (m BGL)	3.90		
			Samp No	2	Type	B
			ID	ESGH511820050919194709		
			Spec Ref			



Soil description	Brown very sandy clayey GRAVEL with cobbles		
Test method	BS 1377:part 4:1990: clause 3.6, 4.5 kg rammer in a CBR mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	25	%	
Material < 37.5mm > 20mm	19	%	
Particle density	2.75	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

2.253

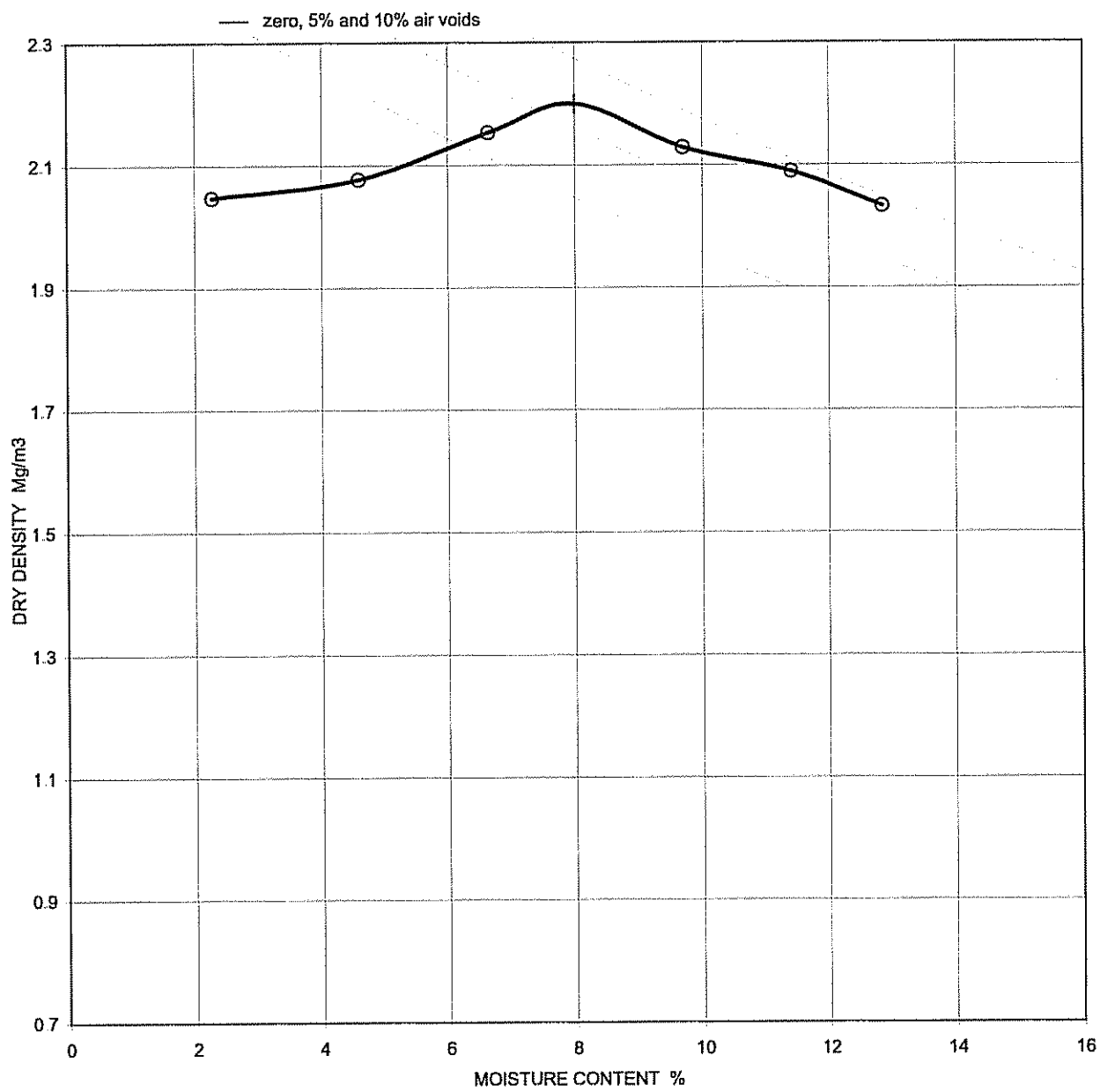
Optimum moisture content, %

6.7

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		**Figure** COMPH 2
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP113		
Project Name	Pencoed Techology Park		Depth (m BGL)	1.30		
			Samp No	1	Type	B
			ID	ESGH5118200509190171 72		
			Spec Ref			



Soil description	Brown very sandy silty GRAVEL with cobbles		
Test method	BS 1377:part 4:1990: clause 3.6, 4.5 kg rammer in a CBR mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	18	%	
Material < 37.5mm > 20mm	16	%	
Particle density	2.78	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

2.2

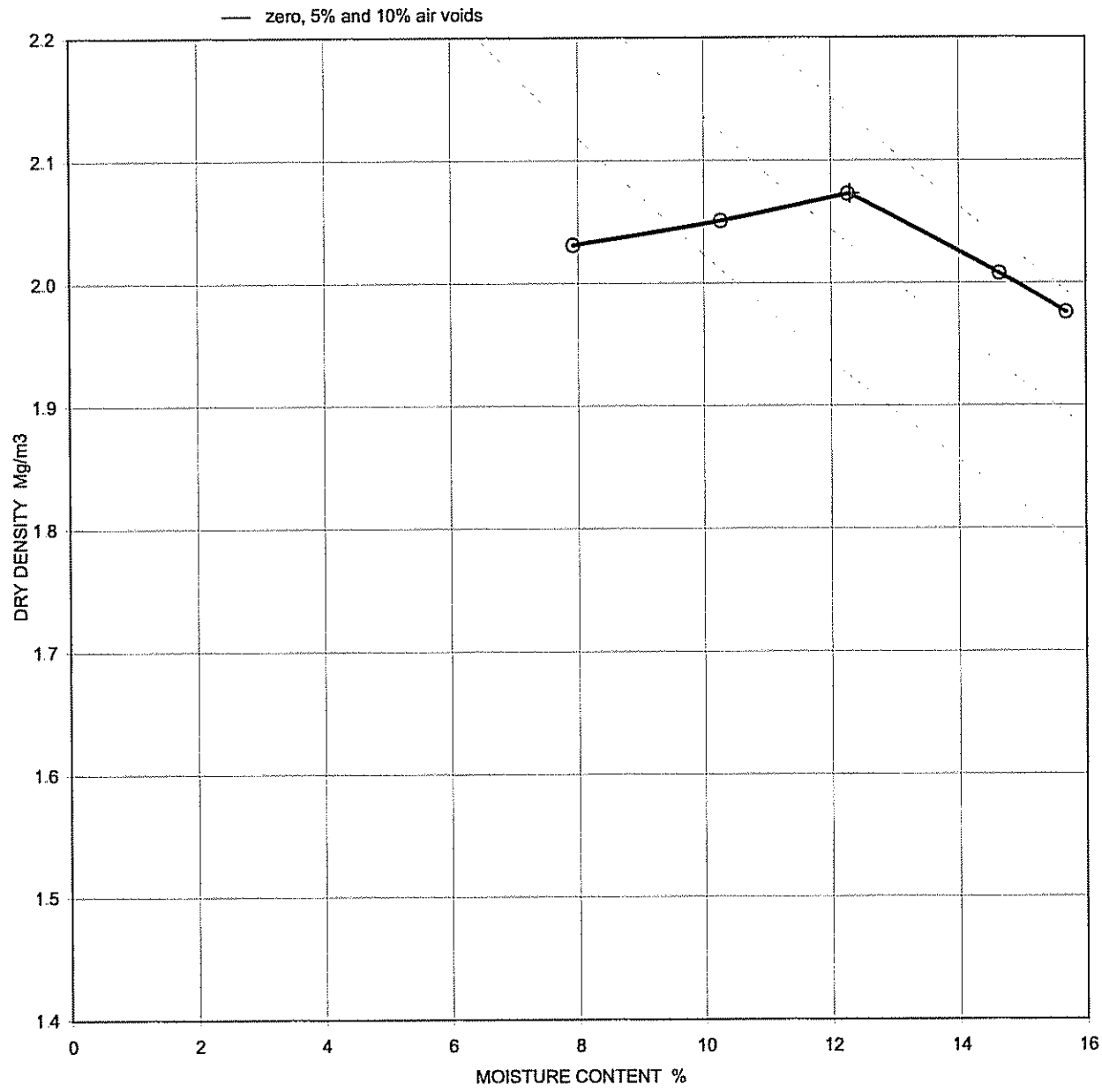
Optimum moisture content, %

8

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		**Figure** COMPH 3
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP113		
Project Name	Pencoed Techology Park		Depth (m BGL)	2.50		
			Samp No	3	Type	B
			ID	ESGH511820050919483105		
			Spec Ref			



Soil description	Brown very sandy clayey GRAVEL		
Test method	BS 1377:part 4:1990: clause 3.6, 4.5 kg rammer in a CBR mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	18	%	
Material < 37.5mm > 20mm	18	%	
Particle density	2.9	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

2.073

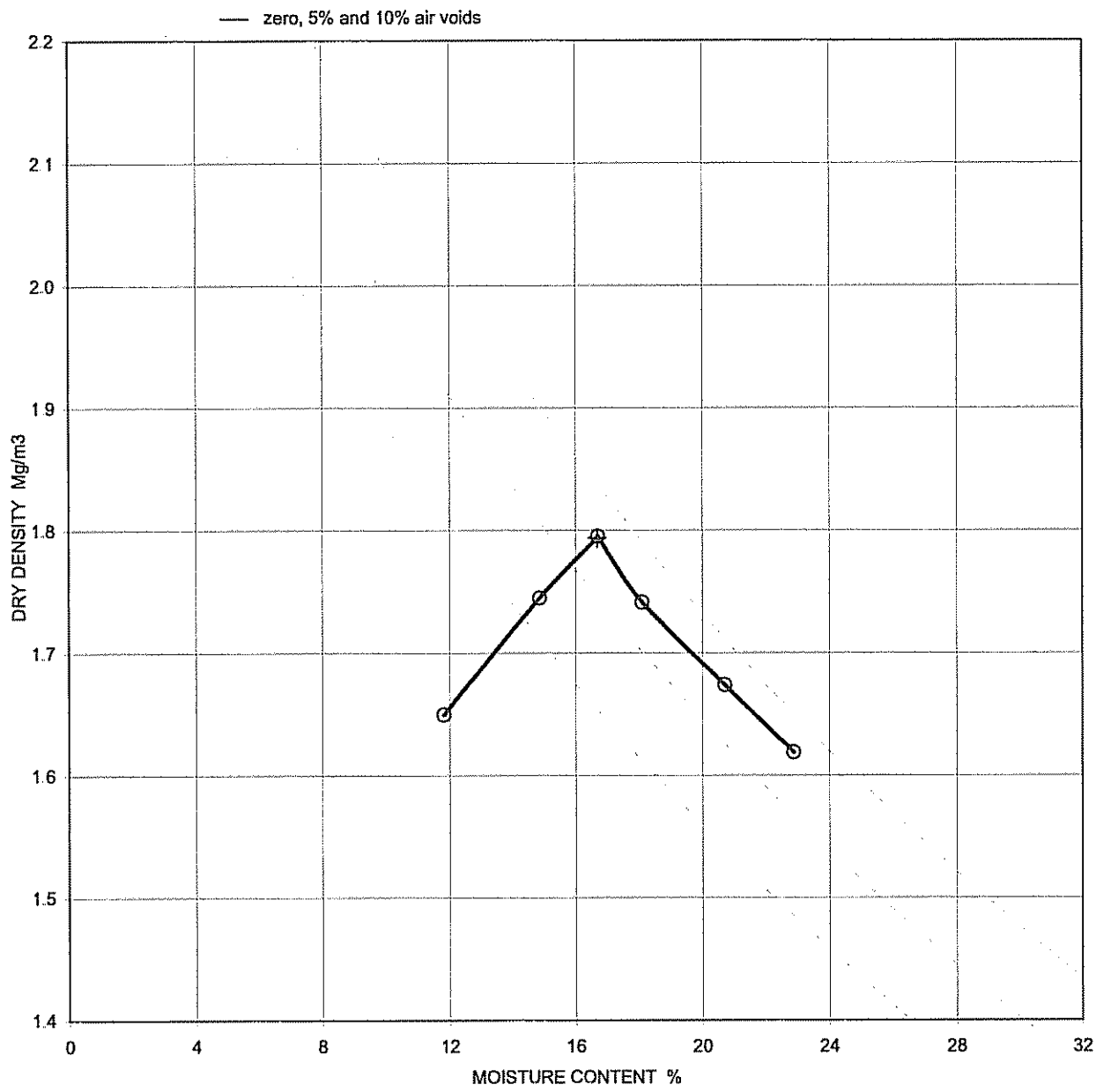
Optimum moisture content, %

12.3

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		**Figure** COMPH 4
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP114		
Project Name	Pencoed Techology Park		Depth (m BGL)	0.70		
			Samp No	L1	Type	B
			ID	ESGR41510		
			Spec Ref			



Soil description	Brown slightly gravelly sandy SILT	
Test method	BS 1377:part 4:1990: clause 3 5, 4.5 kg rammer in a 1 litre mould	
Preparation	Original material was natural, separate specimens tested	
Material > 37.5mm	0 %	
Material < 37.5mm > 20mm	0 %	
Particle density	2.65 assumed	
Remarks		

Derived Parameters +

Maximum dry density, Mg/m3

1.794

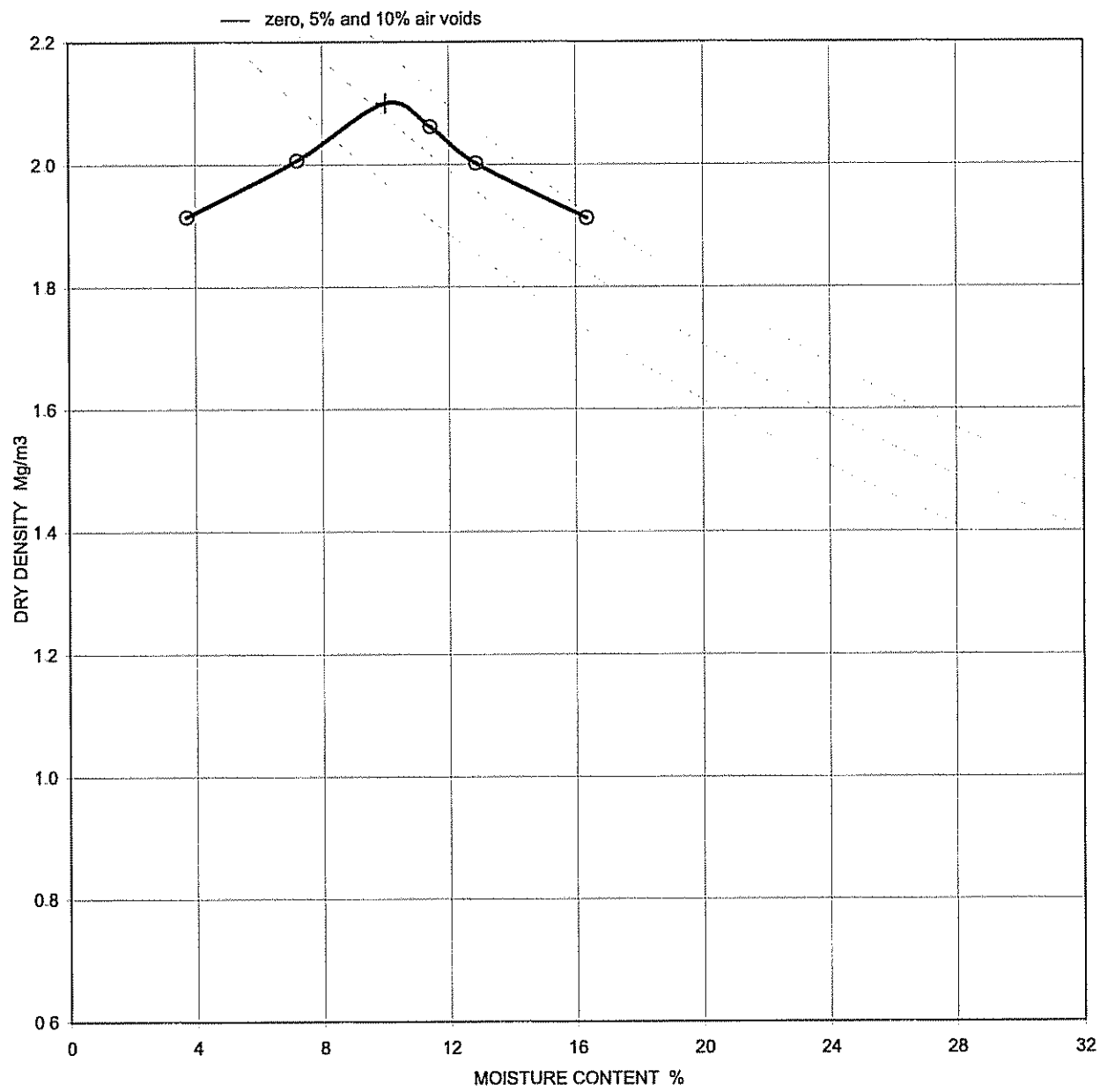
Optimum moisture content, %

16.7

QA Ref SLD 4, 3 5/6 Rev 0 Nov 04	Soil Mechanics	Approved	Figure **COMPH 5**
		Date	

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP114		
Project Name	Pencoed Techology Park		Depth (m BGL)	2.20		
			Samp No	2	Type	B
			ID	ESGH511820050919151984		
			Spec Ref			



Soil description	Brown very sandy silty GRAVEL		
Test method	BS 1377:part 4:1990: clause 3.6, 4.5 kg rammer in a CBR mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	9	%	
Material < 37.5mm > 20mm	13	%	
Particle density	2.8	assumed	
Remarks			

Derived Parameters +

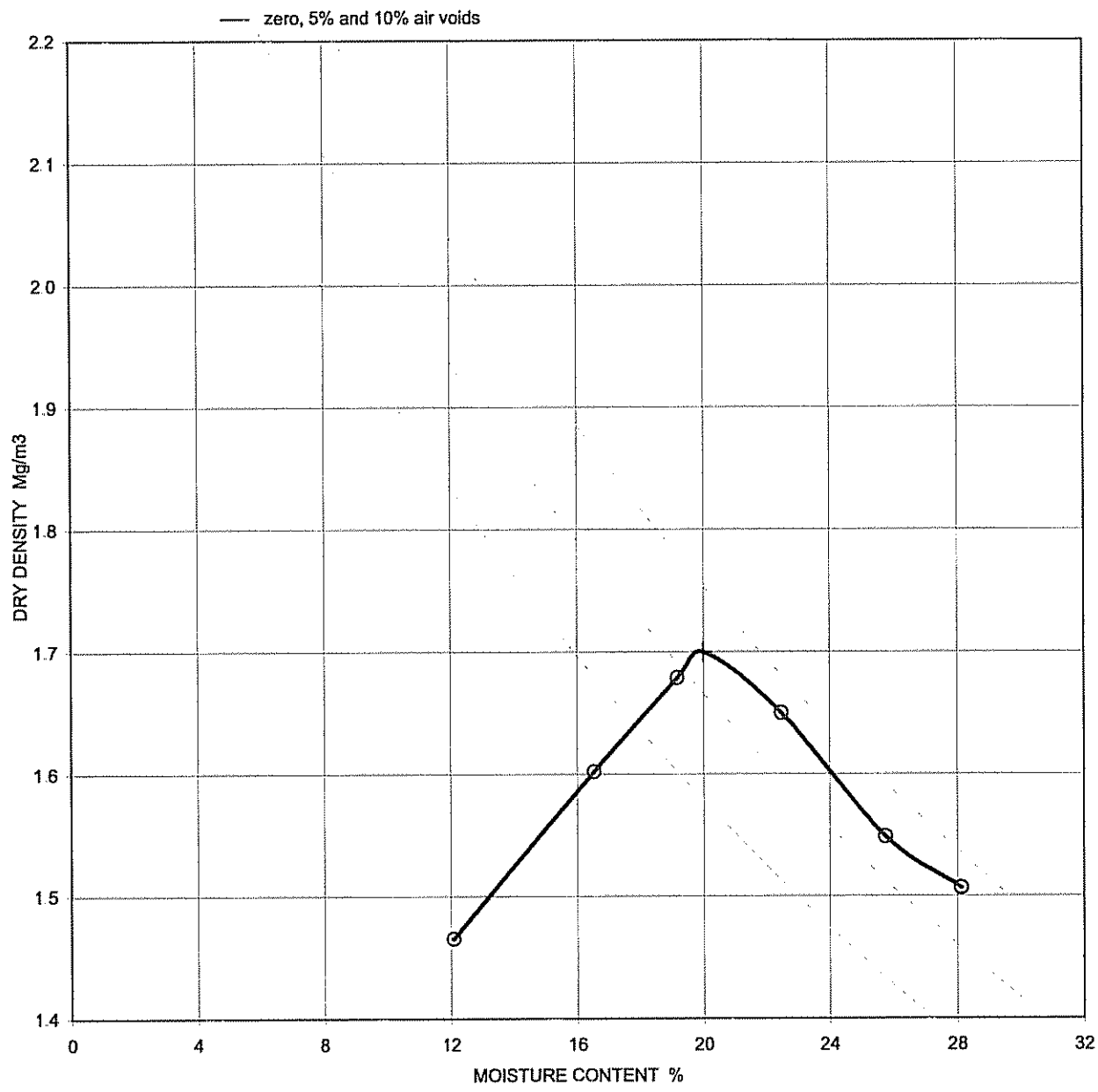
Maximum dry density, Mg/m3 **2.1**

Optimum moisture content, % **10**

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		Figure **COMPH 6**
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP115		
Project Name	Pencoed Techology Park		Depth (m BGL)	0.70		
			Samp No	2	Type	B
			ID	ESGH5118200509198373 60		
			Spec Ref			



Soil description	Brown slightly gravelly sandy SILT		
Test method	BS 1377:part 4:1990: clause 3.5, 4.5 kg rammer in a 1 litre mould		
Preparation	Original material was natural ..separate specimens tested		
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	0	%	
Particle density	2.7	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

1.7

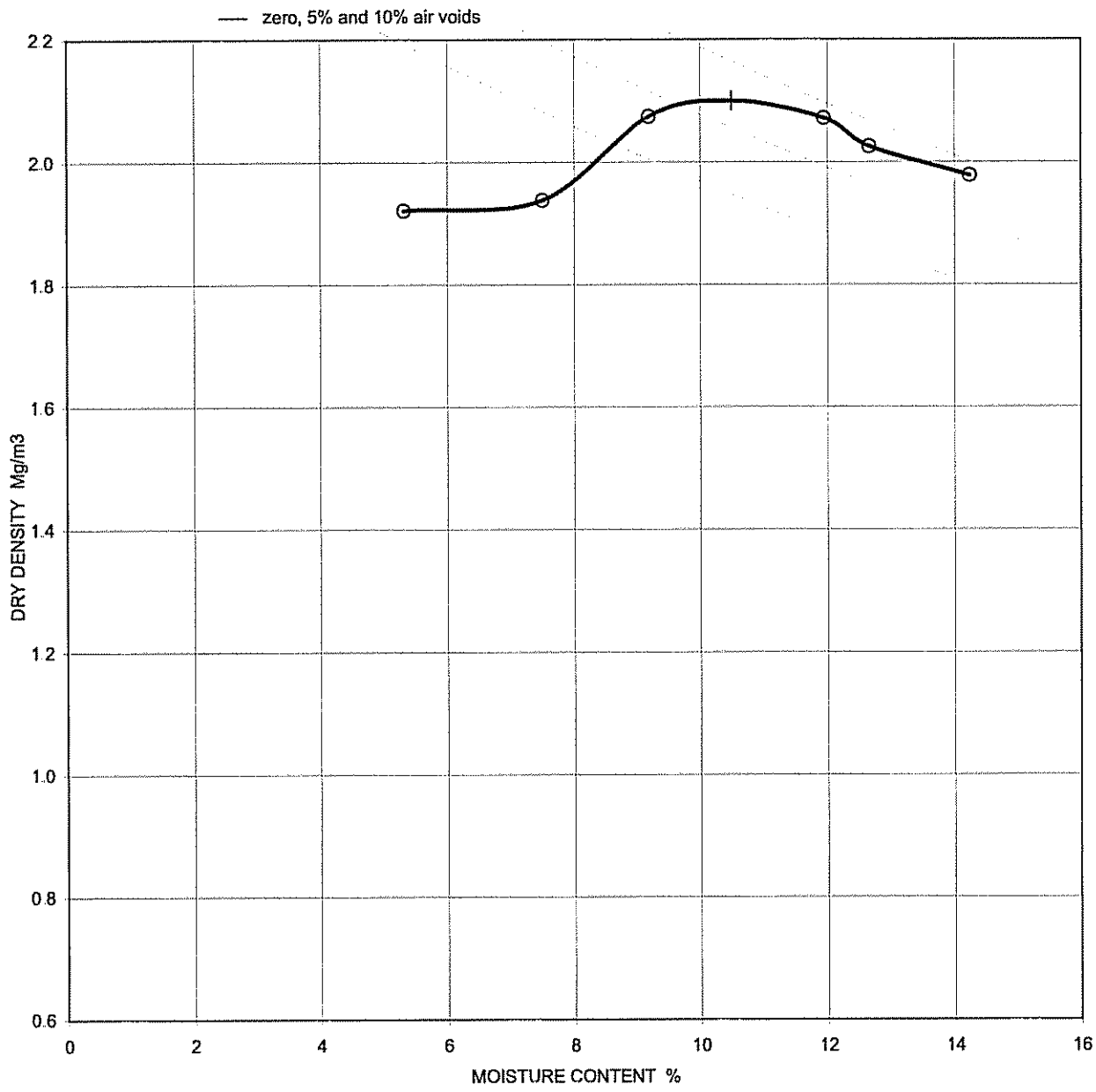
Optimum moisture content, %

20

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		**Figure** COMPH 7
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP115		
Project Name	Pencoed Techology Park		Depth (m BGL)	2.70		
			Samp No	3	Type	B
			ID	ESGH511820050919574372		
			Spec Ref			



Soil description	Brown very sandy clayey GRAVEL with cobbles		
Test method	BS 1377:part 4:1990: clause 3.6, 4.5 kg rammer in a CBR mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	16	%	
Material < 37.5mm > 20mm	14	%	
Particle density	2.8	assumed	
Remarks			

Derived Parameters +

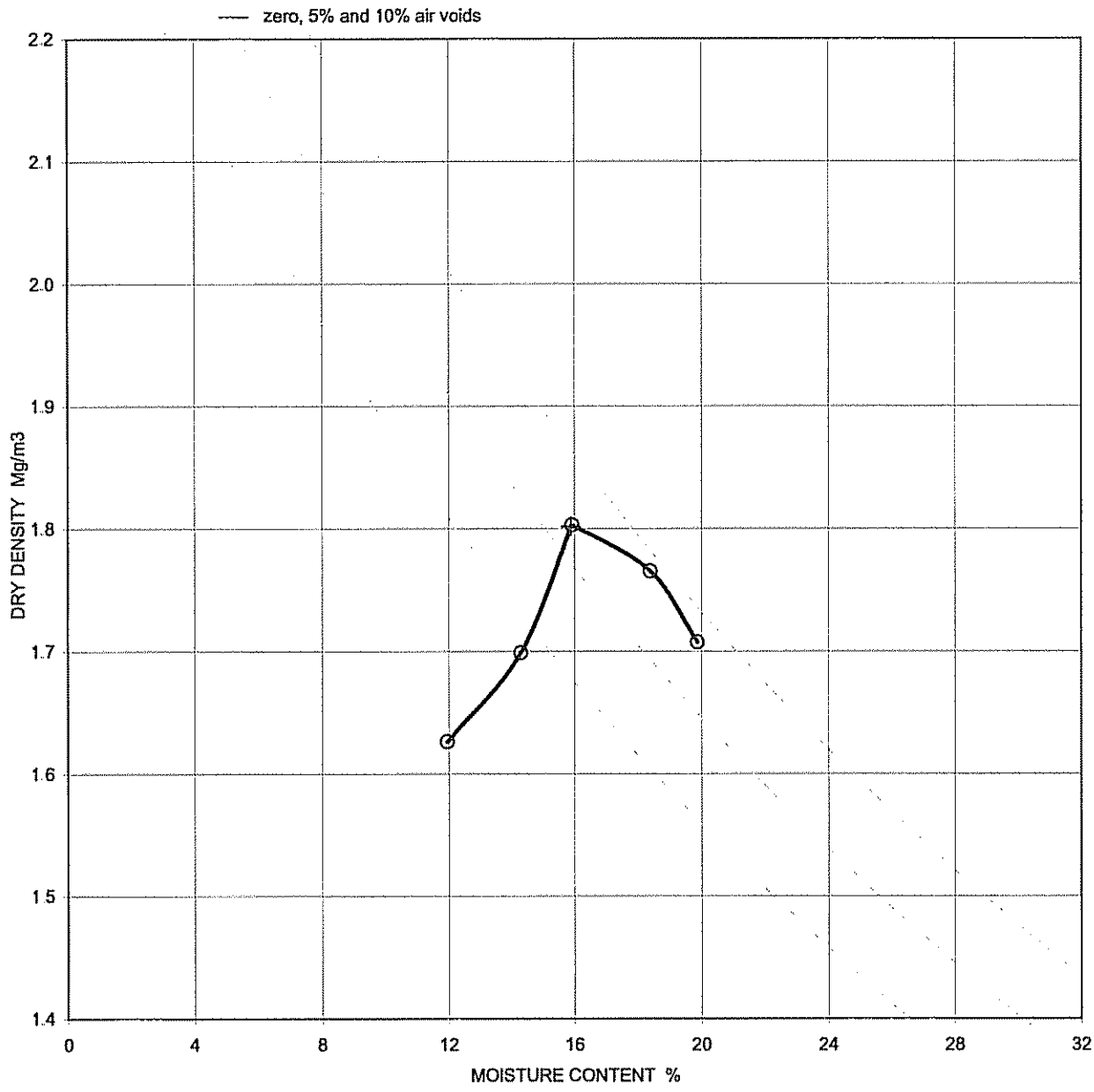
Maximum dry density, Mg/m3 **2.1**

Optimum moisture content, % **10.5**

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		Figure **COMPH 8**
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP116		
Project Name	Pencoed Techology Park		Depth (m BGL)	0.50		
			Samp No	1	Type	B
			ID	ESGH511820050919097757		
			Spec Ref			



Soil description	Brown very silty slightly gravelly SAND		
Test method	BS 1377:part 4:1990: clause 3.5, 4 5 kg rammer in a 1 litre mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	0	%	
Particle density	2.65	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

1.802

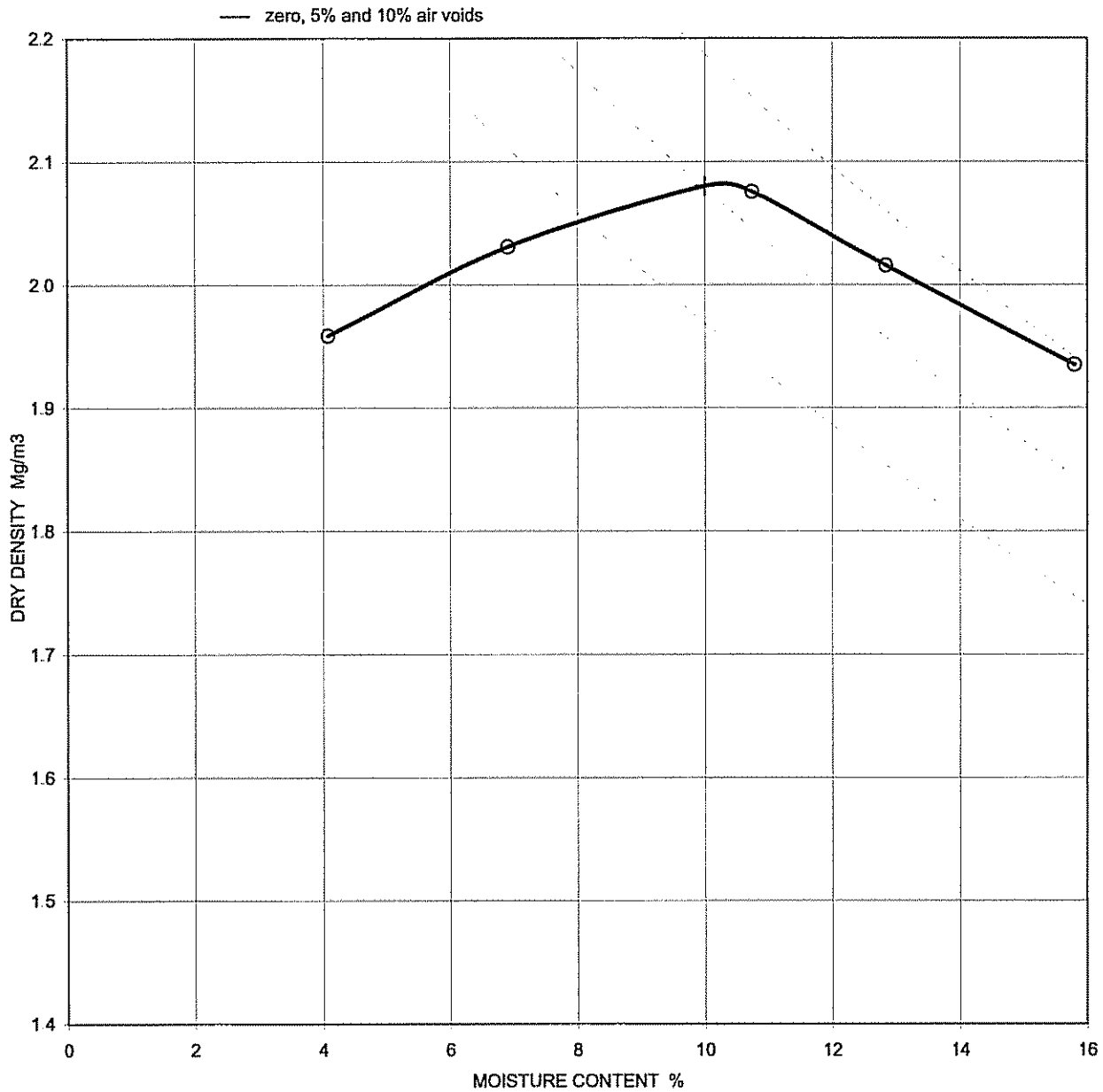
Optimum moisture content, %

15.9

QA Ref SLD 4, 3 5/6 Rev 0 Nov 04	Soil Mechanics	Approved		Figure **COMPH 9**
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP116		
Project Name	Pencoed Techology Park		Depth (m BGL)	1.20		
			Samp No	2	Type	B
			ID	ESGH511820050919527602		
			Spec Ref			



Soil description	Brown very sandy clayey GRAVEL		
Test method	BS 1377:part 4:1990: clause 3.6, 4.5 kg rammer in a CBR mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	14	%	
Material < 37.5mm > 20mm	14	%	
Particle density	2.8	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

2.08

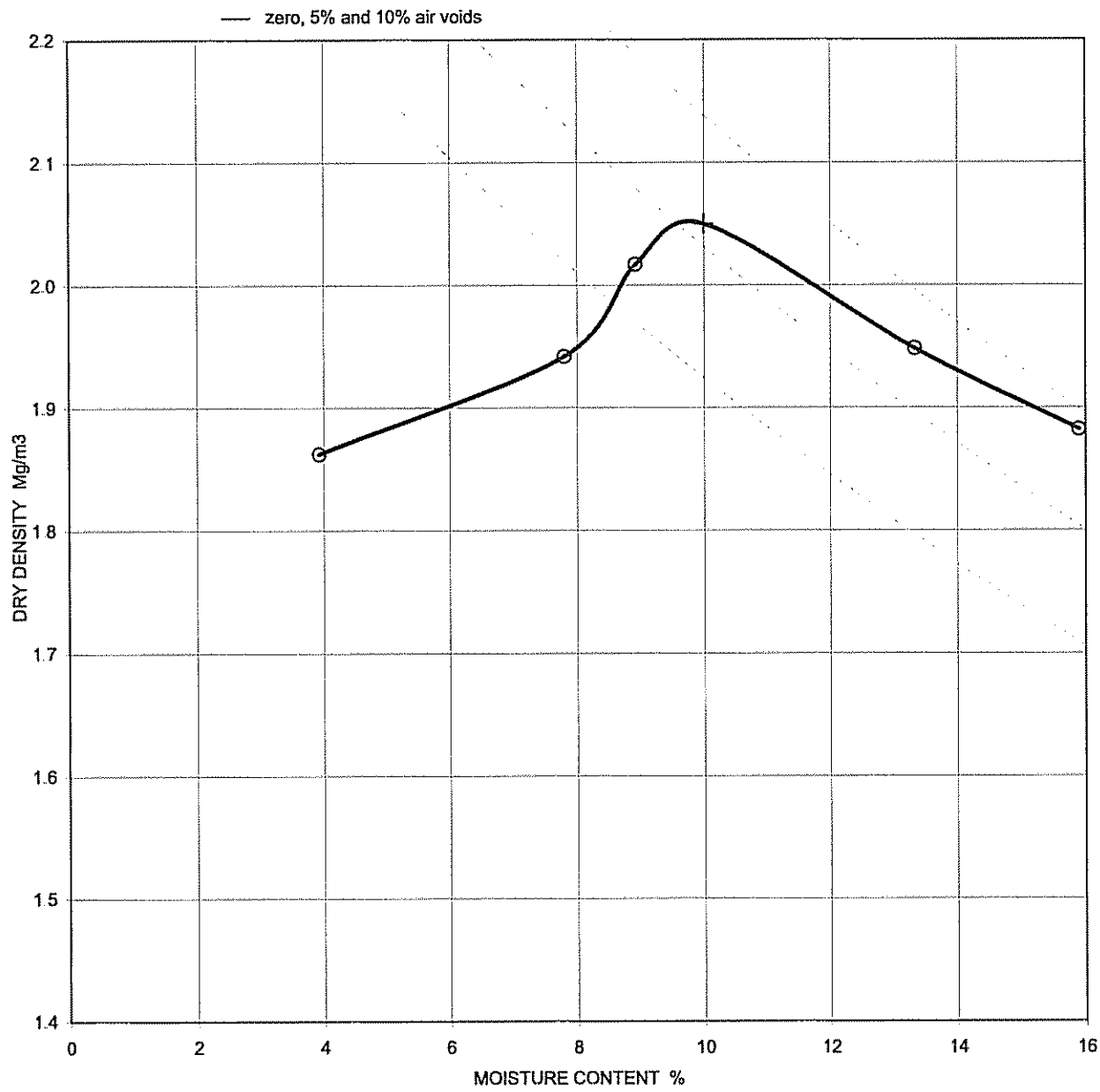
Optimum moisture content, %

10

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		Figure **COMPH 10**
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP117		
Project Name	Pencoed Techology Park		Depth (m BGL)	0.40		
			Samp No	1	Type	B
			ID	ESGH511820050919769227		
			Spec Ref			



Soil description	Brown very sandy clayey GRAVEL with cobbles		
Test method	BS 1377:part 4:1990: clause 3.6, 4.5 kg rammer in a CBR mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	5	%	
Material < 37.5mm > 20mm	10	%	
Particle density	2.72	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

2.05

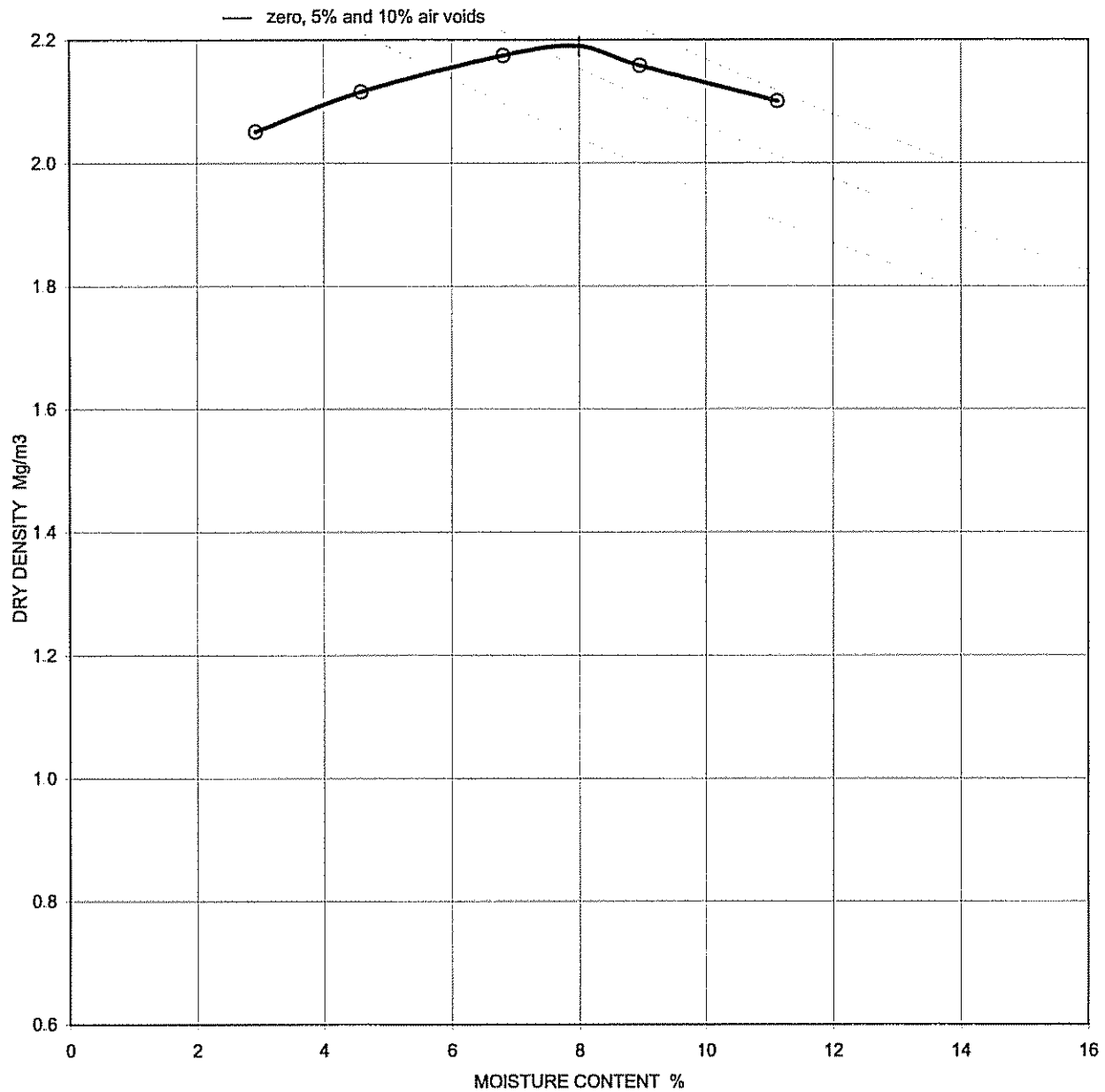
Optimum moisture content, %

10

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		Figure **COMPH 11**
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP117		
Project Name	Pencoed Techology Park		Depth (m BGL)	2.50		
			Samp No	2	Type	B
			ID	ESGH511820050919044351		
			Spec Ref			



Soil description	Brown slightly silty sandy GRAVEL with cobbles	
Test method	BS 1377:part 4:1990: clause 3.6, 4.5 kg rammer in a CBR mould	
Preparation	Original material was natural, separate specimens tested	
Material > 37.5mm	35	%
Material < 37.5mm > 20mm	17	%
Particle density	2.77	assumed
Remarks		

Derived Parameters +

Maximum dry density, Mg/m3

2.19

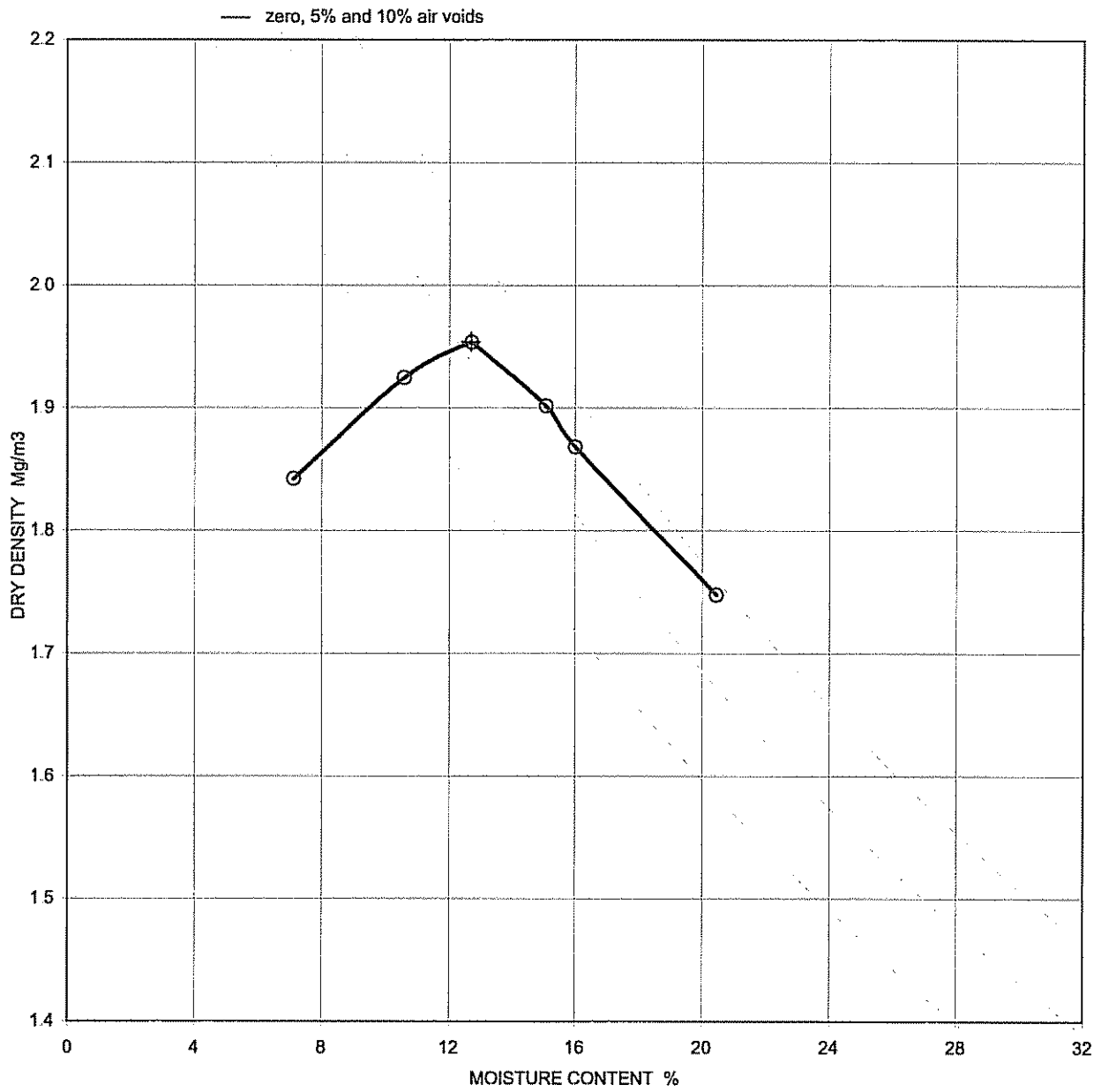
Optimum moisture content, %

8

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved	Figure **COMPH 12**
		Date	

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP118		
Project Name	Pencoed Techology Park		Depth (m BGL)	0.20		
			Samp No	1	Type	B
			ID	ESGH511820050919625505		
			Spec Ref			



Soil description	Brown very gravelly slightly sandy SILT with cobbles		
Test method	BS 1377:part 4:1990: clause 3.6, 4.5 kg rammer in a CBR mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	9	%	
Material < 37.5mm > 20mm	16	%	
Particle density	2.75	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

1.954

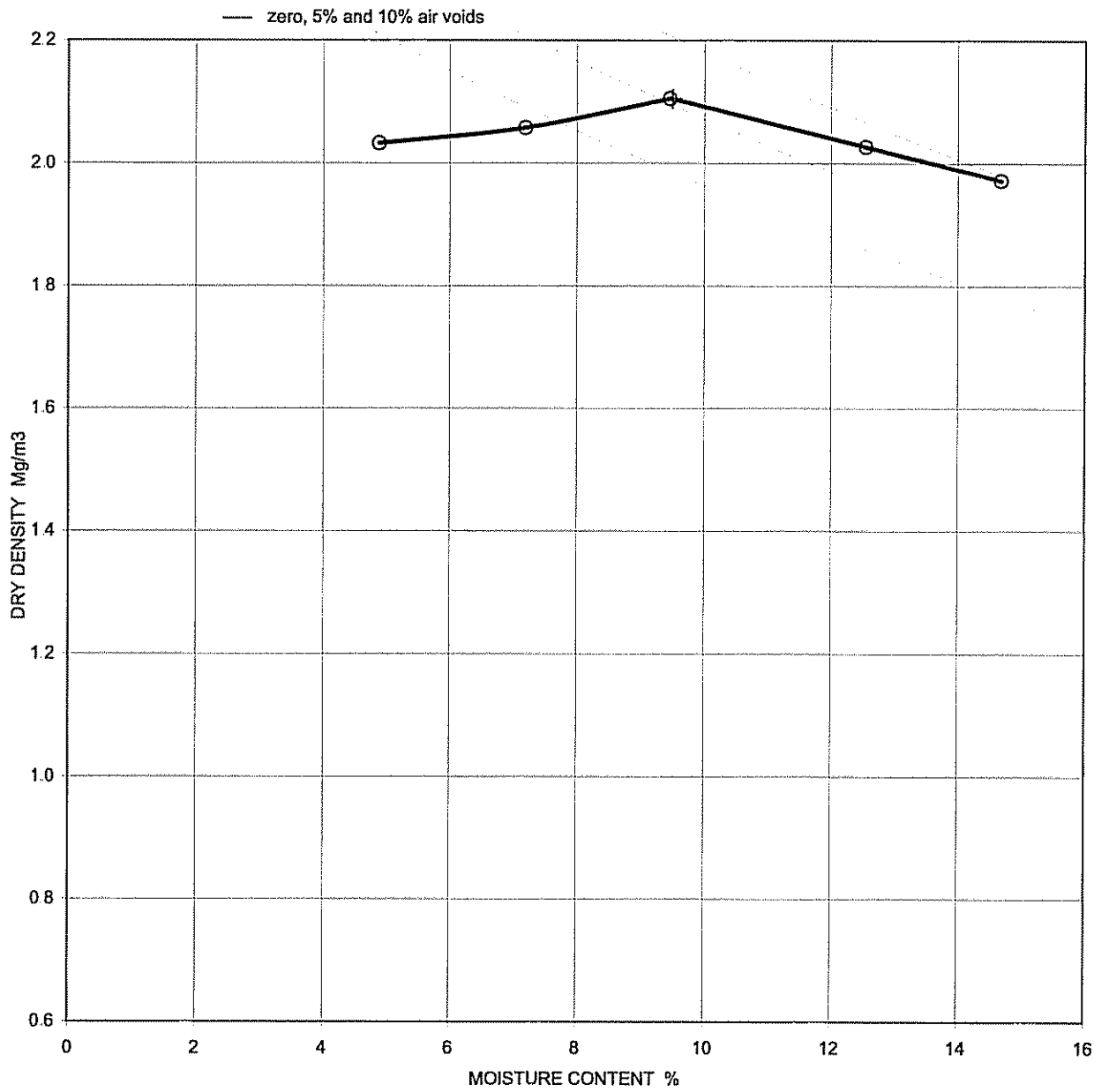
Optimum moisture content, %

12.7

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		Figure **COMPH 13**
		Date		

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP
BS1377 : PART 4 : 1990 : HEAVY COMPACTION, 4.5 kg rammer

Project No	H5118	Sample Details:	Hole No	TP118		
Project Name	Pencoed Techology Park		Depth (m BGL)	1.00		
			Samp No	2	Type	B
			ID	ESGH511820050919960671		
			Spec Ref			



Soil description	Brown slightly clayey sandy GRAVEL with cobbles		
Test method	BS 1377:part 4:1990: clause 3.6, 4.5 kg rammer in a CBR mould		
Preparation	Original material was natural, separate specimens tested		
Material > 37.5mm	0	%	
Material < 37.5mm > 20mm	14	%	
Particle density	2.79	assumed	
Remarks			

Derived Parameters +

Maximum dry density, Mg/m3

2.105

Optimum moisture content, %

9.5

QA Ref SLD 4, 3.5/6 Rev 0 Nov 04	Soil Mechanics	Approved		Figure **COMPH 14**
		Date		

ENCLOSURE D
DRAWINGS

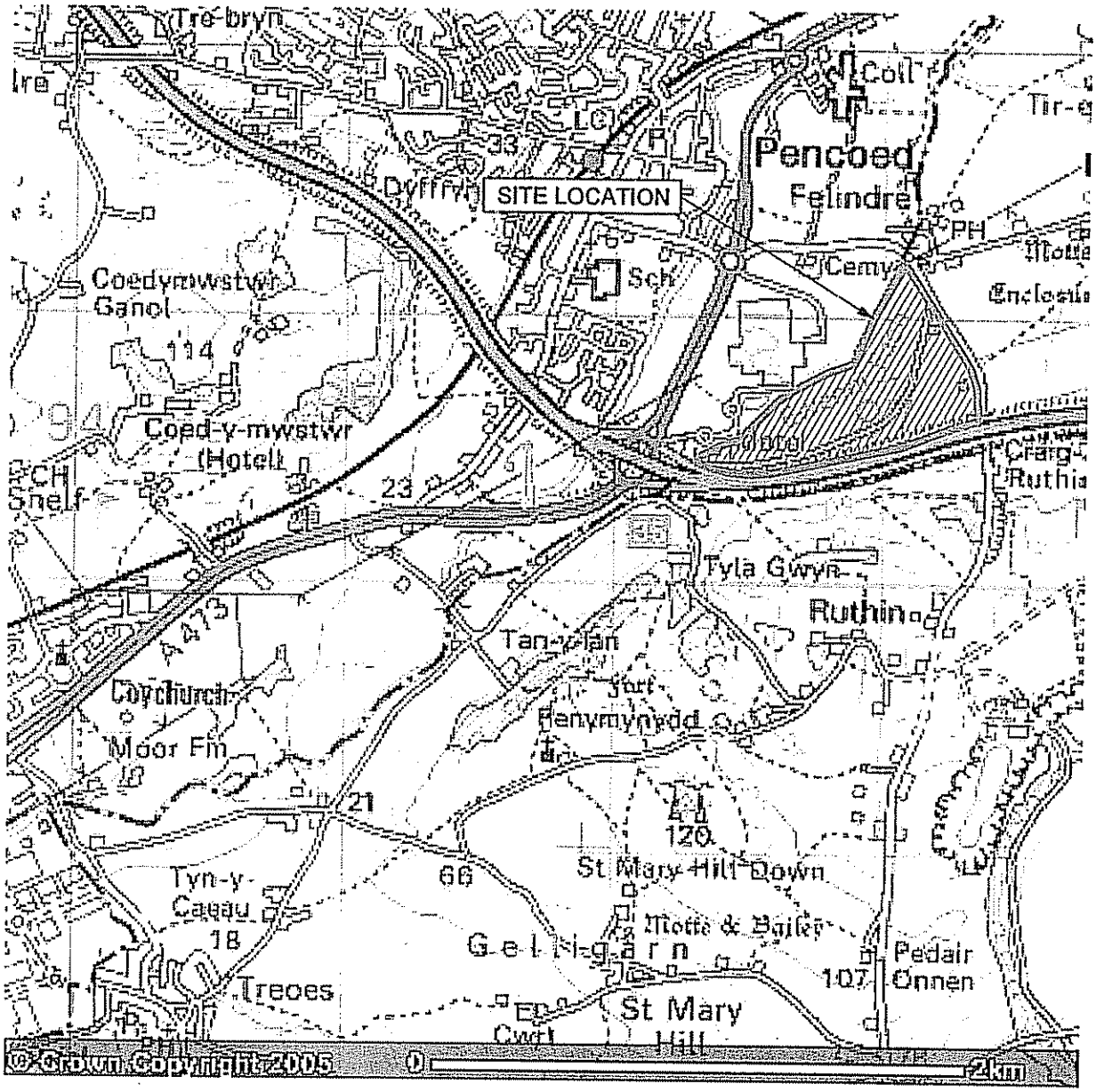
Site Location Plan	D1
Exploratory Borehole Location Plan	D2

Hole

ENCLOSURE D
DRAWINGS

Site Location Plan

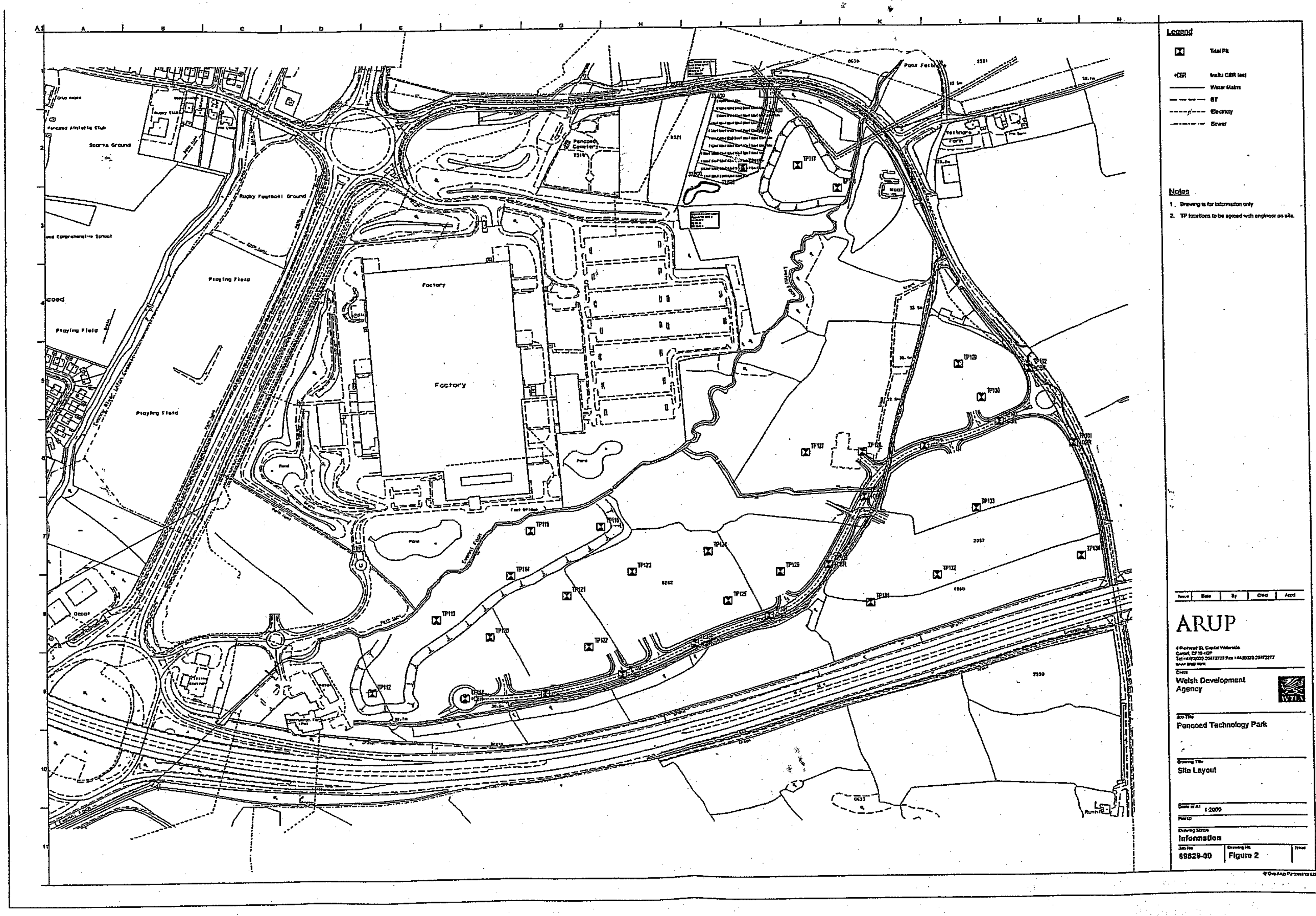
Soil Mechanics



Not to Scale

Reproduced from the 1991 Ordnance Survey 1:50 000 scale Landranger map No 170 with the permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. © Crown copyright. Environmental Services Group Limited, Licence Number AL100006060

Notes	Project	Pencoed Technology Park	Drawing
Not to scale	Project No	H5118	D1
	Carried out for	Welsh Development Agency	Sheet 1 of 1



Approximate Exploratory Trial Pit Positions

D2 - EXPLORATORY HOLE LOCATION PLAN

Pencoed Technology Park **H5118**

Soil Mechanics

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP102	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7278.9386 909.151	34.50	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			34.4		(0.10)	TOPSOIL	1	
0.10-1.00	D 1				0.10	Loose to medium dense yellow brown very silty fine SAND with some subrounded gravel of sandstone	2	
					(0.90)			
			33.5		1.00			
						Medium dense brown slightly gravely silty fine SAND. Gravel is rounded to subrounded of sandstone and mudstone	3	
					(0.90)			
			32.6		1.90			
1.90-3.80	B 2					Medium dense brown clayey SAND with frequent rounded to subrounded gravel and occasional cobbles of sandstone and occasional pockets of yellow sand.	4	
					(1.90)			
			30.7		3.80			
						Trial pit completed at 3.8m depth		

Remarks

Investigation/cluster ref: Main

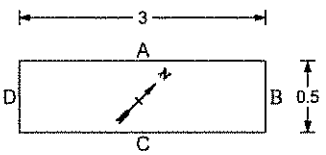
Orientation= 45deg.
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.8m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	**TP103**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7241.206 839.378	33.90	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
0.00-0.50	D 1		33.8		(0.10)	TOPSOIL	1	
					0.10	Soft to firm red brown sandy CLAY with many rootlets at the surface.	2	
					(0.40)			
			33.4		0.50			
0.50-3.10	B 2					Loose to medium dense yellow brown slightly clayey fine to coarse SAND with frequent rounded to subrounded gravel and cobbles of sandstone	3	
					(2.60)			
						2.50 - 2.60 Flat rounded cobbles and small boulders of sandstone encountered		
			30.8		3.10			
						Trial pit completed at 3.1m depth		

Remarks

investigation/cluster ref: Main

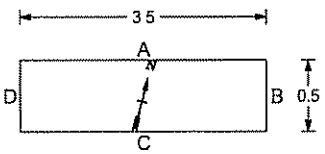
Orientation= 75deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.1m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No	Hole ref	Page
69829-00	**TP104**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7146.3762 807.6398	32.70	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			32.6		(0 10)	TOPSOIL	1	
0 10-1 30	J 2				0.10	Medium dense to dense brown clayey fine to coarse SAND with some rounded gravel of sandstone	2	
0 10-1 30	B 1				(1 20)			
			31.4		1.30			
					(1 00)	Medium dense red brown clayey gravely SAND and COBBLES of sandstone Many cobbles sheared to thin slabs when excavated	3	
			30.4		2.30			
					(0 90)	Frim red brown sandy CLAY with frequent rounded cobbles of sandstone and some pockets of yellow brown clay	4	
			29.5		3.20			
						Trial pit completed at 3 2m depth		

Remarks

Investigation/cluster ref: Main

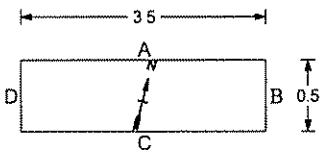
Orientation= 75deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3 2m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	TP129	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7190 3368 915.4582	35.45	22-Aug-05

Samples & tests			Strata log					
Depth	Sample Type Ref	Test Result	Red. Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
0.10-2.90	B 1		35.4		(0.10) 0.10	TOPSOIL Medium dense reddish brown slightly gravely slightly silty fine to coarse SAND with occasional rounded cobbles of sandstone. Cobbles become more frequent with depth from 1.4m	1 2	
					(2.80)			
			32.6		2.90	*Trial pit completed at 2.9m depth*		

Remarks

Investigation/cluster ref: Main

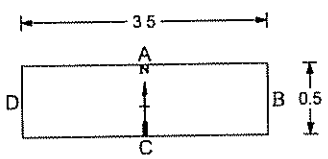
Orientation= 90deg.
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

2.9m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Holetest made by Contractor but logged by Arup.
<<DrawingFileSpec>>

ARUP | Trial Pit Log

Job No.	Hole ref	Page
69829-00	**TP130**	1 of 1

Contractor: Soil Mechanics

Pencoed Technology Park
Issue

Local grid co-ordinates	Ground Level (m OD)	Date
7219.2105 871.2704	34.10	22-Aug-05

Samples & tests			Strata log						
Depth	Sample Type Ref	Test Result	Red Level	Legend	Depth (Thick-ness)	Description	Stratum	Geology
			34.0		(0.10)	TOPSOIL	1	
					0.10	Loose to medium dense reddish brown slightly silty fine SAND with some rounded gravels of sandstone and rare rounded cobbles of sandstone	2	
					(1.20)			
			32.8		1.30			
1.30-3.10	B 1					Medium dense slightly silty gravely fine SAND and rounded COBBLES of sandstone	3	
					(1.80)			
			31.0		3.10			
						Trial pit completed at 3.1m depth		

Remarks

Investigation/cluster ref: Main

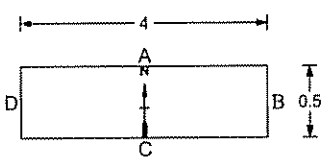
Orientation= 90deg
Plant: Cat 428C Excavator
Backfilled: 22-Aug-05

Groundwater

3.1m depth: No water encountered

Shoring/Support: None

Stability: Sides stable throughout



Client	Welsh Development Agency	Logged by: M Cooper	Database check:

Hole/test made by Contractor but logged by Arup.
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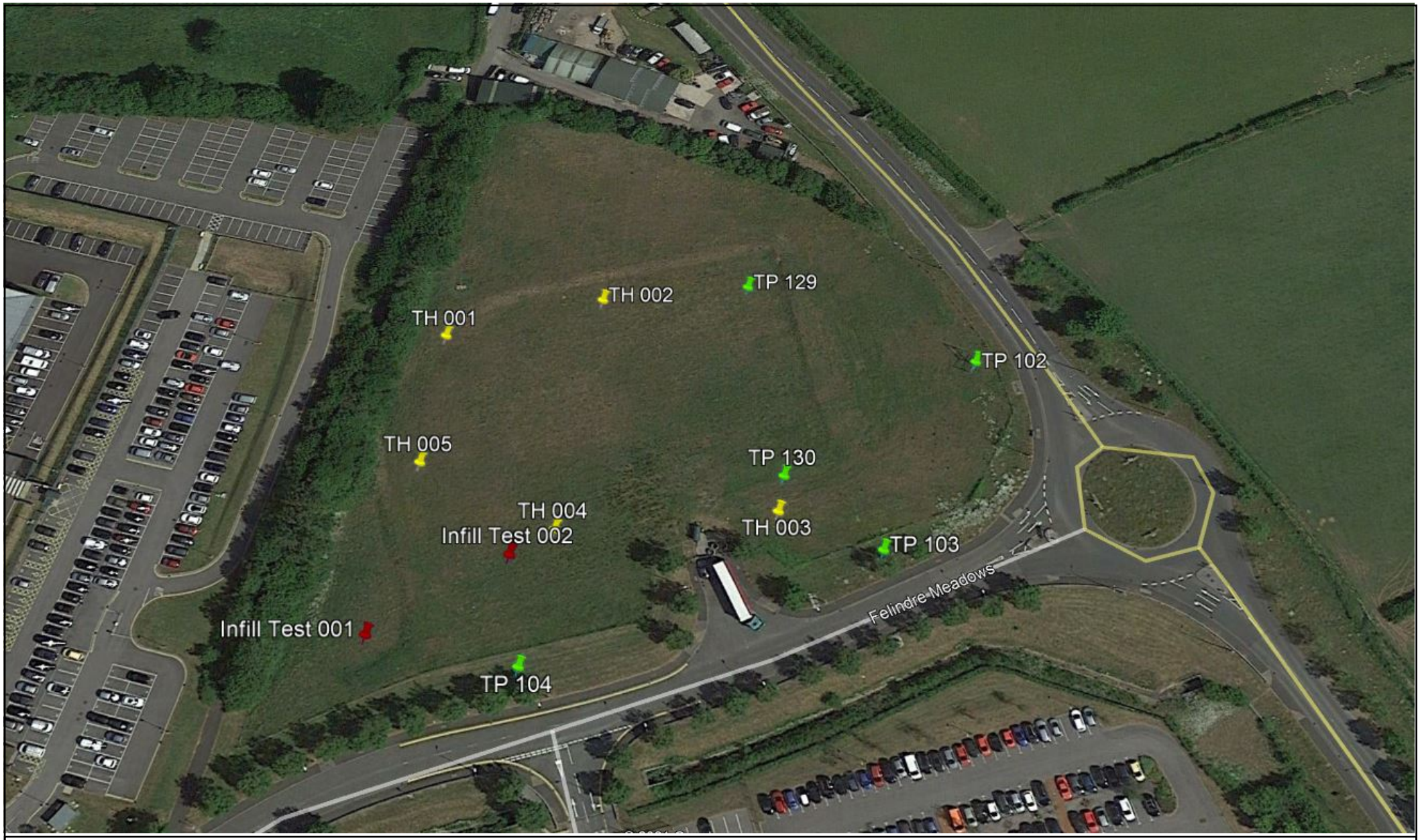


Location plan of Trial Holes
Plot F Felindre Meadows

J G FRANCIS
Civil Engineering

Trial Pit Log	**Contract:** F210706	**Hole Ref:** **TH 001**	**Page:** 1 of 1
Plot F, Felindre Meadows, Pencoed	**Location (OS):** SS 97150 80901	**Ground Level:** 34.600 AOD	Date: 2nd July 2021

Samples and Tests			Strata Log				Stratum	Geology
Depth	**Sample Type - Ref**	**Test Result**	**Level**	**Legend**	**Depth**	**Description**		
0.6-0.8	A		34.4		(0.1) 0.1	Topsoil	1	
			- - - - - 31.4		- - (3.0) - - - 3.1	Medium dense reddish brown slightly gravely slightly silty fine to coarse SAND with occasional rounded cobbles of sandstone. Cobbles become more frequent with depth from 1.5m	2	
			- - 31.0		- - 3.6	Medium dense slightly silty gravely fine SAND and rounded cobbles of sandstone. (Soil becoming damp at 3.4m depth)		
						Trial pit complete at 3.9m depth		

Remarks:
Excavator: JCB 3CX Contractor (Extra Reach)
Backfilled: 2nd July 2021

Groundwater:
3.9m depth – damp / slight seepage after 30 mins

Dimensions:
3m x 0.6m

Client: Fabco Holdings Ltd		Logged by: G Francis	210706

J G FRANCIS
Civil Engineering

Trial Pit Log	Contract: F210706	Hole Ref: TH 002	Page: 1 of 1
Plot F, Felindre Meadows, Pencoed	Location (OS): SS 97188 80913	Ground Level: 34.600 AOD	Date: 2nd July 2021

Samples and Tests			Strata Log					
Depth	Sample Type - Ref	Test Result	Level	Legend	Depth	Description	Stratum	Geology
0.6-0.8	B		34.5		(0.1) 0.1	Topsoil	1	
			- - - - 31.7		- - (2.8) - - 2.9	Medium dense red brown clayey SAND and COBBLES of sandstone. Many cobbles sheering in thin slabs during excavation.	2	
			- - - 31.0		- - - 3.6	Medium dense reddish brown slightly gravely slightly silty fine to coarse SAND with occasional rounded cobbles of sandstone.	3	
						Trial pit complete at 3.6m depth		

Remarks:
Excavator: JCB 3CX Contractor (Extra Reach)
Backfilled: 2nd July 2021

Groundwater:
3.6m depth - No water encountered.

Dimensions:
3m x 0.6m

Client: Fabco Holdings Ltd		Logged by: G Francis	210706

J G FRANCIS
Civil Engineering

Trial Pit Log	Contract: F210706	Hole Ref: TH 003	Page: 1 of 1
Plot F, Felindre Meadows, Pencoed	Location (OS): SS 97220 80873	Ground Level: 34.60 AOD	Date: 2nd July 2021

Samples and Tests			Strata Log					
Depth	Sample Type - Ref	Test Result	Level	Legend	Depth	Description	Stratum	Geology
			34.4		(0.1) 0.1	Topsoil	1	
			- - - 33.0		- - - 1.6	Lose to medium dense reddish brown slightly silty fine SAND with some rounded gravels of sandstone and rounded COBBLES of sandstone.	2	
			- - - - - 30.8		- - - - - 3.8	Medium dense slightly silty gravely fine SAND and rounded cobbles of sandstone.	3	
						Trial pit complete at 3.8m depth		

Remarks:
Excavator: JCB 3CX Contractor (Extra Reach)
Backfilled: 2nd July 2021

Groundwater:
No water encountered.

Dimensions:
3m x 0.6m

Client: Fabco Holdings Ltd		Logged by: G Francis	210706

J G FRANCIS
Civil Engineering

Trial Pit Log	Contract: F210706	Hole Ref: TH 004	Page: 1 of 1
Plot F, Felindre Meadows, Pencoed	Location (OS): SS 97179 80861	Ground Level: 34.60 AOD	Date: 2nd July 2021

Samples and Tests			Strata Log					
Depth	Sample Type - Ref	Test Result	Level	Legend	Depth	Description	Stratum	Geology
			34.5		(0.1) 0.1	Topsoil	1	
			- - - 33.2		- - - 1.4	Firm red brown sandy clay with occasional rounded cobbles of sandstone and pockets of yellow brown clay.	2	
			- - - - 30.8		- - - - 3.8	Medium dense reddish brown slightly silty fine SAND with some rounded gravels of sandstone and rounded COBBLES of sandstone.	3	
						Trial pit complete at 3.8m depth		

Remarks:
Excavator: JCB 3CX Contractor (Extra Reach)
Backfilled: 2nd July 2021

Groundwater:
No water encountered.

Dimensions:
3m x 0.6m

Client: Fabco Holdings Ltd		Logged by: G Francis	210706

J G FRANCIS
Civil Engineering

Trial Pit Log	**Contract:** F210706	**Hole Ref:** **TH 005**	**Page:** 1 of 1
Plot F, Felindre Meadows, Pencoed	**Location (OS):** SS 97145 80873	**Ground Level:** 34.600 AOD	Date: 2nd July 2021

Samples and Tests			Strata Log					
Depth	**Sample Type - Ref**	**Test Result**	**Level**	**Legend**	**Depth**	**Description**	**Stratum**	**Geology**
			34.5		(0.1) 0.1	Topsoil	1	
			- - - - - 31.7		- - - - - 2.9	Medium dense reddish brown slightly gravely slightly silty fine to course SAND rounded cobbles of sandstone. Cobbles become more frequent with depth from 1.4m	2	
			- - 31.0		- - 3.6	Medium dense slightly silty gravely fine SAND and rounded COBBLES of sandstone. (Soil becoming damp at 3.5m depth)	3	
						Trial pit complete at 3.6m depth		

Remarks:
Excavator: JCB 3CX Contractor
Backfilled: 2nd July 2021

Groundwater:
3.5m depth becoming damp

Dimensions:
3m x 0.6m

Client: Fabco Holdings Ltd		Logged by: G Francis	210706

J G FRANCIS
Civil Engineering

Trial Hole - TH 001

J G FRANCIS
Civil Engineering

Trial Hole - TH 002

J G FRANCIS
Civil Engineering

Trial Hole TH – 003

J G FRANCIS
Civil Engineering

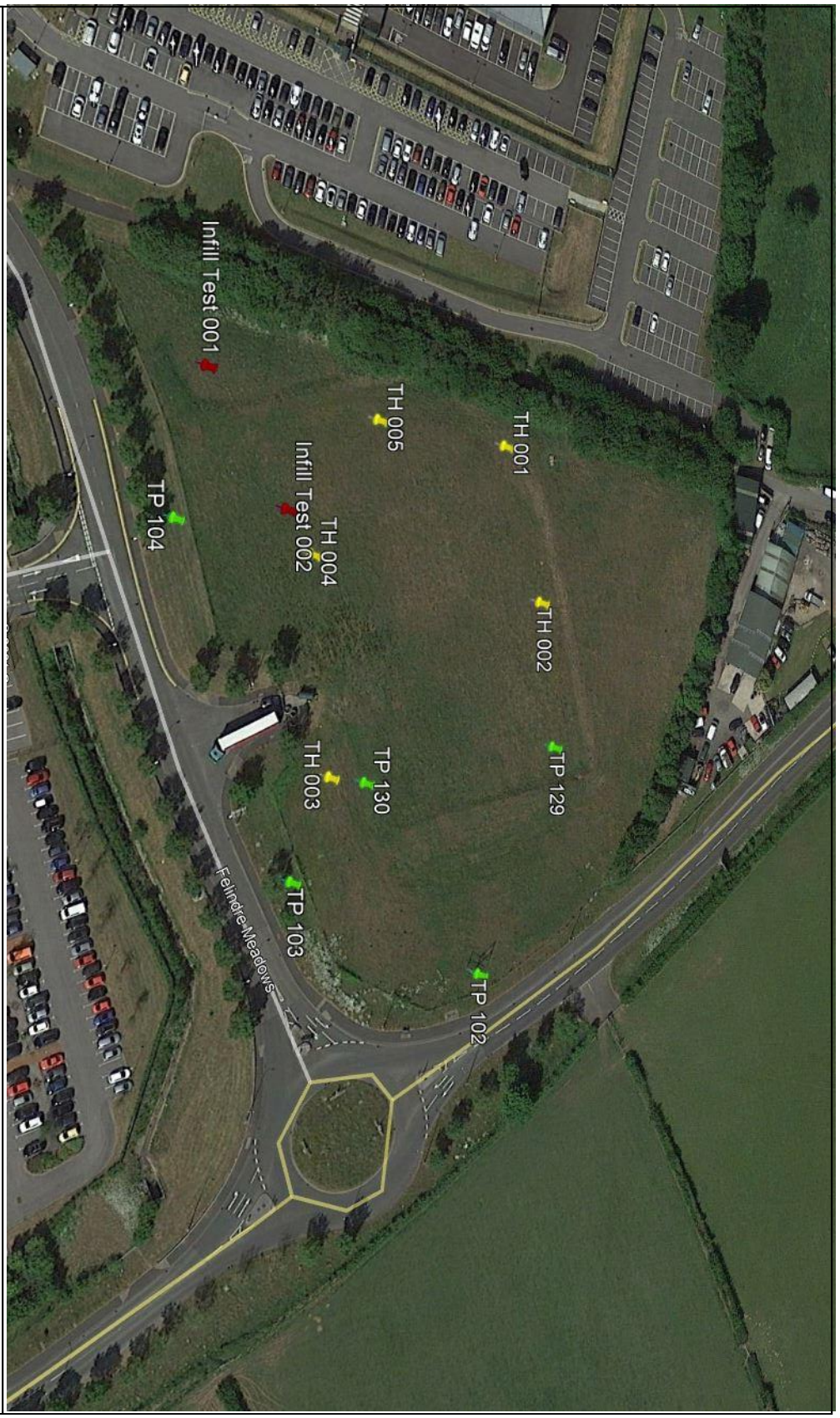
Trial Hole – TH 004

J G FRANCIS
Civil Engineering

Trial Hole – TH 005

J G FRANCIS
Civil Engineering

Location plan of Trial Holes Plot F Felindre Meadows



Laboratory Report

2788

GEO Site & Testing Services Ltd

Contract Number: 54534

Client Ref:
Client PO:

Report Date: **01-07-2021**

Client **JG Francis Civil Engineering LTD**
Building 544, Bro Tathan Aerospace,
Business Park,
St Athan
CF62 4AF

Contract Title: **Pencoed**
For the attention of: **Glyn Francis**

Date Received: **17-06-2021**
Date Completed: **01-07-2021**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	2
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	2
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	2
BRE Reduced Suite **includes pH, water & acid soluble sulphate and total sulphur** Sub-contracted Test - @ Non Accredited Test	2
Metals, PAH & Phenol Suite	2
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Emma Sharp (Office Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)
Shaun Jones (Laboratory manager) - Wayne Honey (Administrative Assistant / Health and Safety)

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

GSTL

NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX
(BS 1377 : Part 2 : 1990 Method 5)

Contract Number	54534	
Project Location	Pencoed	
Date Tested	25/06/2021	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
Sample A		B		-		5.0		NP		17	
Sample B		B		-		6.0		NP		19	
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
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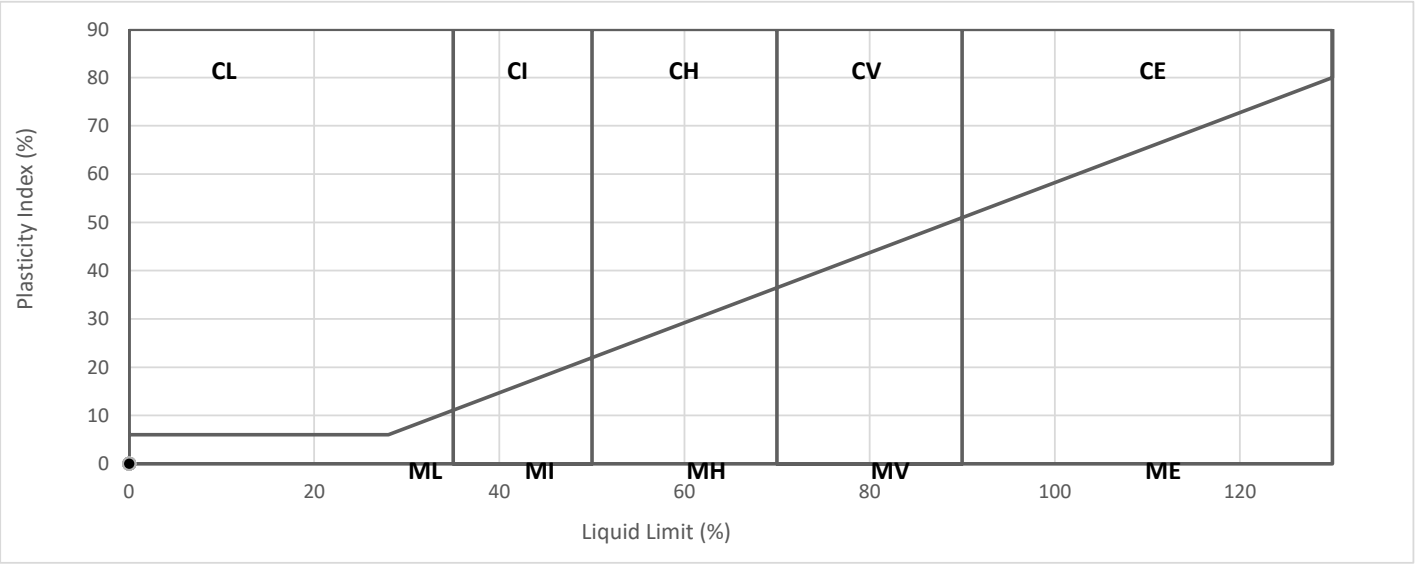
Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

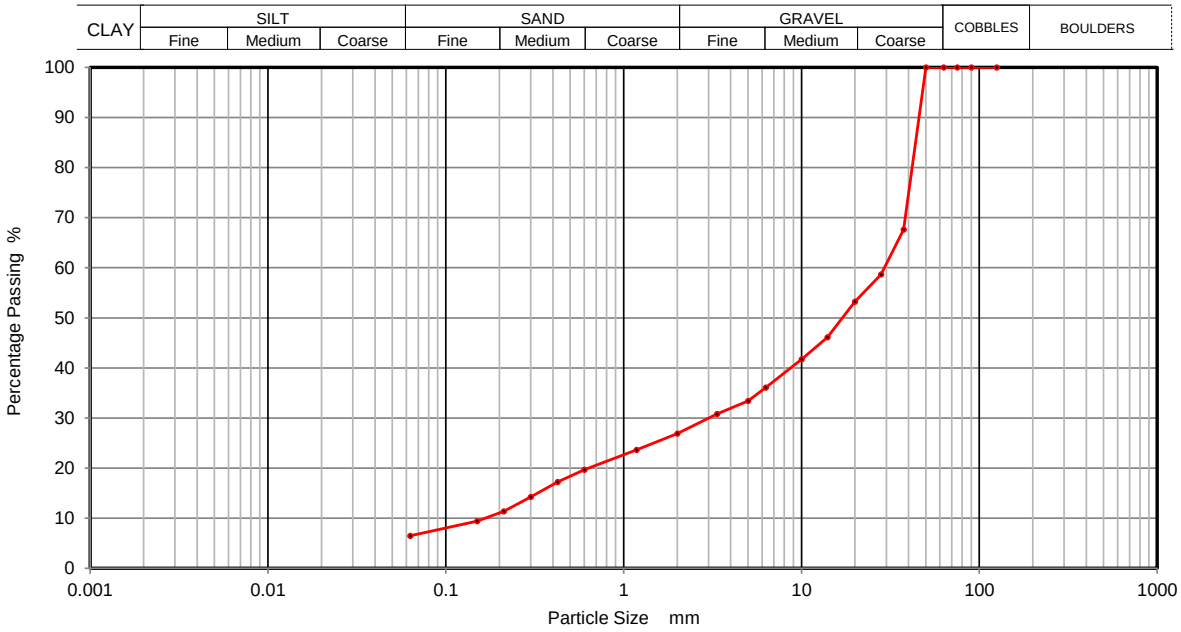
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators	Checked	01/07/2021	Richard John (Advanced Testing Manager)
Gavin Jenkins	Approved	01/07/2021	Paul Evans (Quality/Technical Manager)

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	54534
		Borehole/Pit No.	Sample A
Site Name	Pencoed	Sample No.	
Soil Description	Brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	
		Depth Base	
Date Tested	29/06/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	68		
28	59		
20	53		
14	46		
10	42		
6.3	36		
5	33		
3.35	31		
2	27		
1.18	24		
0.6	20		
0.425	17		
0.3	14		
0.212	11		
0.15	9		
0.063	6		

Sample Proportions	% dry mass
Cobbles	0
Gravel	73
Sand	21
Silt and Clay	6

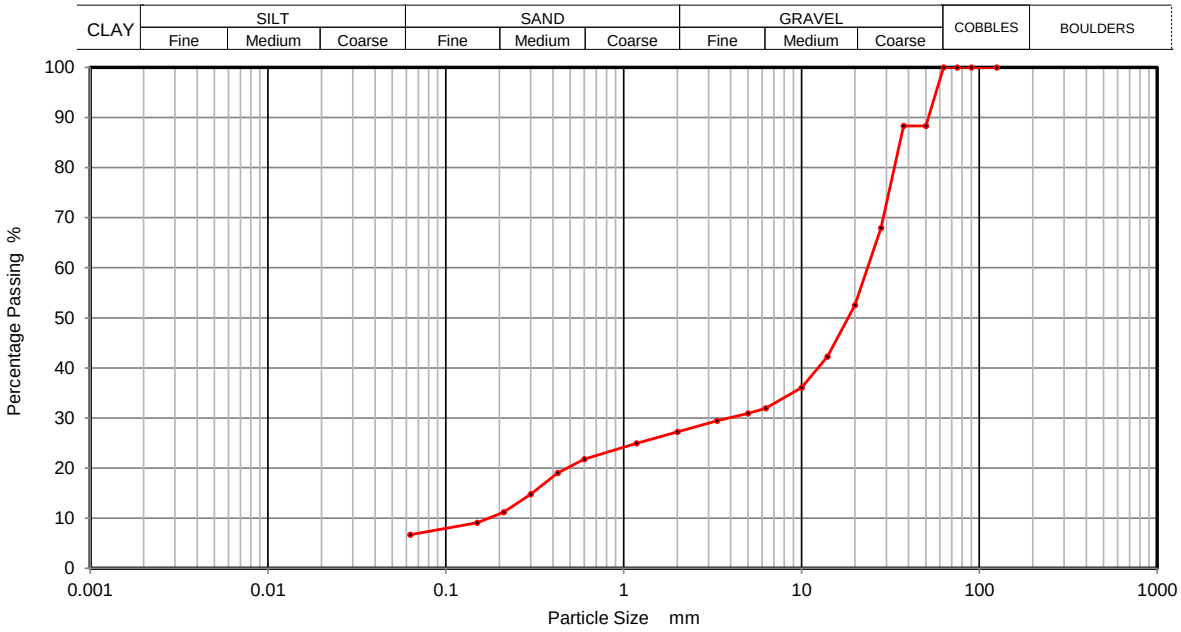
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/06/2021	Richard John	
David	Approved	01/07/2021	Paul Evans	D P Evans

UKAS TESTING
2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	54534
		Borehole/Pit No.	Sample B
Site Name	Pencoed	Sample No.	
Soil Description	Brown slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	
		Depth Base	
Date Tested	29/06/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	88		
37.5	88		
28	68		
20	53		
14	42		
10	36		
6.3	32		
5	31		
3.35	29		
2	27		
1.18	25		
0.6	22		
0.425	19		
0.3	15		
0.212	11		
0.15	9		
0.063	7		

Sample Proportions	% dry mass
Cobbles	0
Gravel	73
Sand	20
Silt and Clay	7

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/06/2021	Richard John	
David	Approved	01/07/2021	Paul Evans	D P Evans

UKAS TESTING
2788

Certificate of Analysis

Certificate Number	21-13021	*Issued:*	25-Jun-21
Client	GEO Site and Testing Services Ltd Unit 4 Heol Aur Dafen Ind Est Dafen Carmarthenshire SA14 8QN		
Our Reference	21-13021		
Client Reference	(not supplied)		
Order No	(not supplied)		
Contract Title	JG FRANCIS CIVIL ENGINEERING LTD		
Description	2 Soil samples.		
Date Received	21-Jun-21		
Date Started	21-Jun-21		
Date Completed	25-Jun-21		
Test Procedures	Identified by prefix DETSn (details on request).		
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.		

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 21-13021
Client Ref
Contract Title JG FRANCIS CIVIL ENGINEERING LTD

			Lab No	1864868	1864869
			.Sample ID	A	B
			Depth		
			Other ID	1	1
			Sample Type	B	B
			Sampling Date	n/s	n/s
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	14	12
Barium	DETSC 2301#	1.5	mg/kg	55	77
Beryllium	DETSC 2301#	0.2	mg/kg	0.6	0.5
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	< 0.2	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.3
Chromium	DETSC 2301#	0.15	mg/kg	13	13
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	15	15
Lead	DETSC 2301#	0.3	mg/kg	44	49
Mercury	DETSC 2325#	0.05	mg/kg	0.16	< 0.05
Nickel	DETSC 2301#	1	mg/kg	22	22
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	16	17
Zinc	DETSC 2301#	1	mg/kg	110	100
Inorganics					
pH	DETSC 2008#		pH	7.8	7.8
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1
Organic matter	DETSC 2002#	0.1	%	0.2	0.6
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	< 10	< 10
Sulphur as S, Total	DETSC 2320	0.01	%	< 0.01	< 0.01
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.03	0.03
PAHs					
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Asbestos Analysis
Soil Samples

Our Ref 21-13021
Client Ref
Contract Title JG FRANCIS CIVIL ENGINEERING LTD

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1864868	A 1	SOIL	NAD	none	Lee Kerridge
1864869	B 1	SOIL	NAD	none	Lee Kerridge

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * - not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 21-13021
Client Ref
Contract JG FRANCIS CIVIL ENGINEERING LTD

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1864868	A SOIL		PT 1L	Sample date not supplied, Anions 2:1 (30 days), Boron (365 days), Chromium, Hexavalent (365 days), Mercury (28 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), ICP WS Boron (182 days), Metals ICP (182 days), Metals ICP Prep (182 days), Kone Cr6 (30 days), Naphthalene (14 days), Organic Matter (Manual) (28 days), PAH MS (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14	Naphthalene, PAH MS
1864869	B SOIL		PT 1L	Sample date not supplied, Anions 2:1 (30 days), Boron (365 days), Chromium, Hexavalent (365 days), Mercury (28 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), ICP WS Boron (182 days), Metals ICP (182 days), Metals ICP Prep (182 days), Kone Cr6 (30 days), Naphthalene (14 days), Organic Matter (Manual) (28 days), PAH MS (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14	Naphthalene, PAH MS

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

Infiltration Test Report

Location: Plot E, Felindre Meadows Pencoed
Client: Fabco Phi 1 Ltd

Date:
12th September 2023

Weather:
Dry

Ground water table level:
Not encountered

Soil Conditions:
0.6m BGL - Medium dense reddish brown silty fine to course sand with occasional rounded cobbles of sandstone.

Comments:
All excavations carried out using JCB 3CX and 1500ltr water bowser.
Testing was carried out over a two day period to allow for saturation of each test hole.

J G FRANCIS CONSTRUCTION

Soakaway Test Results - BRE 365 Digest standards

Site: Plot E, Felindre Meadows, Pencoed
Client: Fabco Phi 1 Ltd

Test Pit 1		**Date:**	12/09/2023
		Performed by:	M Watkins
Dimensions	(m)	**Weather:**	Dry. Overcast
Width	1	**Topsoil:**	n/e 150mm
Length	2	**Superficial soil:**	N/A
Effective storage depth	0.4	**Comments:**	
Total depth of hole	1.32		

Test No.	Time (min)	Depth (m)			
1	0	0.86			
	5	0.75	**Vp75-25 =**	0.27	m
	8	0.7	**As50 =**	2.04	m²
	15	0.53	**tp75-25 =**	4140	s
	32	0.5			
	55	0.32	**f =**	**4.20E-04**	**m/s**
	74	0.25			
2	0	0.86			
	8	0.75	**Vp75-25 =**	0.27	m
	21	0.71	**Ap50 =**	2.04	m²
	44	0.56	**tp75-25 =**	4560	s
	59	0.52			
	71	0.34	**f =**	**4.01E-04**	**m/s**
	84	0.25			
3	0	0.86			
	10	0.75	**Vp75-25 =**	0.27	m
	28	0.71	**Ap50 =**	2.04	m²
	46	0.57	**tp75-25 =**	5220	s
	62	0.53			
	79	0.37	**f =**	**4.09E-04**	**m/s**
	97	0.25			

Soakaway Test Results - BRE 365 Digest standards

Site: Plot E, Felindre Meadows, Pencoed
Client: Fabco Phi 1 Ltd

Trial Pit 2		**Date:**	12/09/2023
		Performed by:	M Watkins
Dimensions	(m)	**Weather:**	Dry. Overcast
Width	1	**Topsoil:**	n/e 150mm
Length	2	**Superficial soil:**	N/A
Effective storage depth	0.4	**Comments:**	
Total depth of hole	1.2		

Test No.	Time (min)	Depth (m)			
1	0	0.98			
	12	0.75	**Vp75-25 =**	0.27	m
	28	0.69	**As50 =**	2.04	m²
	49	0.42	**tp75-25 =**	5400	S
	102	0.25	**f =**	**7.55E-04**	**m/s**
2	0	0.98			
	18	0.75	**Vp75-25 =**	0.27	m
	22	0.7	**Ap50 =**	2.04	m²
	58	0.45	**tp75-25 =**	5880	s
	71	0.35			
	116	0.25	**f =**	**6.02E-04**	**m/s**
3	0	0.98			
	20	0.75	**Vp75-25 =**	0.27	m
	32	0.71	**Ap50 =**	2.04	m²
	77	0.46	**tp75-25 =**	11580	s
	95	0.36			
	121	0.25	**f =**	**6.08E-04**	**m/s**

UNEXPLODED BOMB RISK MAP

SITE LOCATION

Map Centre: 297177,180891

LEGEND

- **High:** Areas indicated as having a bombing density of 50 bombs per 1000acre or higher.
- **Moderate:** Areas indicated as having a bombing density of 15 to 49 bombs per 1000acre.
- **Low:** Areas indicated as having 15 bombs per 1000acre or less.

miltary | **industry** | **UXO find**
transport | **dock** | **Luftwaffe targets**
utilities | **Bombing decoy** | **other**

How to use your Unexploded Bomb (UXB) risk map?

The map indicates the potential for Unexploded Bombs (UXB) to be present as a result of World War Two (WWII) bombing.

You can incorporate the map into your preliminary risk assessment* for potential Unexploded Ordnance (UXO) for a site. Using this map, you can make an informed decision as to whether more in-depth detailed risk assessment* is necessary.

What do I do if my site is in a moderate or high risk area?

Generally, we recommend that a detailed UXO desk study and risk assessment is undertaken for sites in a moderate or high UXB risk area.

Similarly, if your site is near to a designated Luftwaffe target or bombing decoy then additional detailed research is recommended.

More often than not, this further detailed research will conclude that the potential for a significant UXO hazard to be present on your site is actually low.

Never plan site work or undertake a risk assessment using these maps alone. More detail is required, particularly where there may be a source of UXO from other military operations which are not reflected on these maps.

If my site is in a low risk area, do I need to do anything?

If both the map and other research confirms that there is a low potential for UXO to be present on your site then, subject to your own comfort and risk tolerance, works can proceed with no special precautions.

A low risk really means that there is no greater probability of encountering UXO than anywhere else in the UK.

If you are unsure whether other sources of UXO may be present, you can ask for one of our **pre-desk study assessments (PDSA)**

If I have any questions, who do I contact?

tel: **+44 (0) 1993 886682**

email: **uxo@zetica.com**

web: **www.zeticauxo.com**

The information in this UXB risk map is derived from a number of sources and should be used in conjunction with the accompanying notes on our website: **(https://zeticauxo.com/downloads-and-resources/risk-maps/)**

It is important to note that this map is not a UXO risk assessment and should not be reported as such when reproduced.

*Preliminary and detailed UXO risk assessments are advocated as good practice by industry guidance such as CIRIA C681 'Unexploded Ordnance (UXO), a guide for the construction industry'.