REPORT ON A GEOTECHNICAL INVESTIGATION

at

45 – 49 ST MARGARETS GROVE, TWICKENHAM, MIDDLESEX

for

GLOBAL IFA LIMITED

CONSULTING ENGINEERS:

CJD

Report No 04/7014/KJC **September 2004**

ALBURY S.I. LTD

Miltons Yard Petworth Road
Witley Godalming Surrey GU8 5LH

Telephone: 01428 684836
Facsimile: 01428 685261

info@alburysi.co.uk
www.alburysi.co.uk

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FOREWORD

The following notes should be read in conjunction with the report Any variations on the general procedures outlined below are indicated in the text.

General

The recommendations made and opinions expressed in the report are based on the strata conditions revealed by the fieldworks as indicated on the boring and trialpit records, together with an assessment of the data from insitu and laboratory tests. No responsibility can be accepted for conditions, which have not been revealed by the fieldworks, for example, between borehole and/or trialpit positions. While the report may offer opinions on the possible configuration of strata, both between the excavations and below the maximum depth achieved by the investigation, these comments are for guidance only and no liability can be accepted for their accuracy.

Boring Techniques

Unless otherwise stated, the light cable percussion technique of soft ground boring has been used. This method generally enables the maximum information to be obtained in respect of strata conditions, but a degree of mixing if some layered soils, for example, thin bands of coarse and fine granular soils, is inevitable. Specific attention is drawn to this occurrence where evidence of such a condition is available.

Insitu Dynamic Penetration Tests

The penetration resistances quoted on the boring records have been determined generally in accordance with the procedure given in BS1377 : 1990. The suffix '+' donates that the results has been extrapolated from less than 0.3m penetration into undisturbed soil.

Routine Sampling

During the constriction of boreholes, relatively undisturbed samples of predominantly cohesive soils are obtained in 100mm diameter open drive tube samplers, complying with the requirement of BS5930 : 1981. Large disturbed samples of granular soils, or of soils in which undisturbed sampling is impractical or inappropriate, are taken from boring tools and sealed in polythene bags. Small disturbed samples are taken at frequent intervals of depth and placed in sealed containers; similarly, where encountered in sufficient quantity, samples of groundwater are taken as indicated above.

Groundwater

The groundwater observations entered on boring and trialpit records are those noted at the time of the investigation. The normal rate of progress does not usually permit the recording of any equilibrium water level for any one water strike. Moreover, groundwater levels are prone to seasonal variation and to changes in local drainage conditions. The table on each boring record shows the groundwater level at the quoted borehole and casing depths usually at the start and finish of a day's work. The word 'none' indicates that groundwater was sealed off by the borehole casing, or that no water was observed in the borehole.

Trialpits

The method of construction employed to form the trialpits in entered in their records. In general, it is not possible to extend machine excavated trialpits to depths significantly below the water table, especially in predominantly granular soils. Except for manually excavated pits, and unless otherwise stated, the trialpits have not been provided with temporary side support during their construction, hence personnel have note entered them and examined insitu the strata so exposed.

Laboratory Testing

Unless stated in the tests, all laboratory test have been performed in accordance with the requirements detailed in BS1377 Part 9 1990, or other standards or specifications that may by appropriate.

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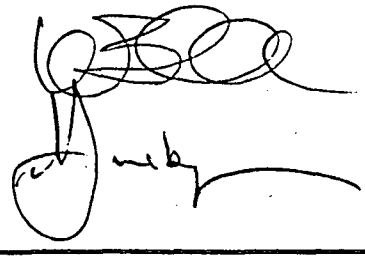
Prepared by	**K J Clark BSc Hons** **Geotechnical Engineer**	
Reviewed by	**C V Sweby CEng MICE** **Technical Director**	

I SYNOPSIS

This investigation has demonstrated that made ground overlies Kempton Park Gravel of Recent or Pleistocene age, which in turn overlies London Clay of late Eocene age. It is considered that foundations located at a minimum depth of 1m within the Kempton Park Gravel can be designed to apply a maximum increase in load of 200kPa. Alternatively, consideration could be given to the use of a piled foundation system. The groundwater

observations noted at the time of the fieldworks suggest that problems with respect to shallow depth excavations are unlikely.

The results of laboratory analysis have not noted any significant levels of contamination and therefore, no remedial measures are likely to be required as part of the proposed redevelopment.

Any spoil should be taken for disposal to an appropriately licensed landfill site. The classification of the spoil lies outside the scope of this report, as it is dependent upon parameters that may be set by the site operator or the Local or County Authority. In these circumstances, the results of laboratory testing should be used to classify the spoil and thus identify sites, which will accept excavated material.

The monitoring of landfill gases has noted an elevated level of carbon dioxide. Hence, gas protection schemes are likely to be required as apart of the proposed redevelopment.

II INTRODUCTION

It is proposed to construct a two-storey courtyard office building at 45 – 49 St Margarets Grove, Twickenham, TW1. Consequently, a geotechnical investigation has been undertaken in order to ascertain the nature and engineering properties of the soils underlying this site and to obtain data, which will assist in the formulation of a safe and economical foundation solution.

The programme of this investigation included the construction of a single borehole, using light cable percussion or shell and auger boring techniques, three probeholes and four trialpits using manual techniques. During this work, samples were taken for further examination and laboratory testing. In addition, a number of insitu tests were performed during the construction of the borehole and a standpipe was installed in the borehole upon its completion. This report describes the work undertaken, presents the information obtained and discusses the ground conditions in relation to the proposed development.

III DESK STUDY

The Envirocheck Report was commissioned from Landmark Information Group and is presented as Appendix V to this report. This data presents the historical map data any current sources of potential contamination within the vicinity and other information regarding water abstraction points and sensitive land uses within the site area. A summary of the historical map data is presented in Table 1 below.

Table 1

Date of Map	Scale	Information
1881	1:2,500	Area appears to be part of orchards.
1896	1:2,500	St Margarets Grove is now present as a residential area. The site itself is an open area with a few buildings being present.
1915	1:2,500	No significant change has occurred since 1896.
1935	1:2,500	A number of small structures are shown which are thought to be garages.
1960	1:2,500	The garages have been replaced by a number of larger buildings which generally coincide with the present layout.
1973	1:1,250	No significant change since 1966, except that the site is designated as a garage.

A summary of the table above indicates that the site has been subject to usage as a garage, which may have led to potential sources of contamination being present. Further consideration of the data within the Envirocheck Report indicates that the site has most recently been used as a garage and by carton makers and print finishers. The site is no longer in use. There are no other potential contaminative uses in the vicinity of the site, but another garage services establishment is recorded some 150m to the east. A number of pollution incidents are noted associated with the River Crane to the west of the site. These incidents are however some 150m-200m from the site and are unlikely to have had any impact on the site.

i) Walkover Survey

The site, Ordnance Survey National grid reference, 516480, 174380, is located within the residential area of St Margarets in Twickenham. The site location is given on drawing no 04/7014/1 in Appendix III. The site is generally level and the surface is concrete. A two-storey office building is present at the front of the site, which also has a number of single storey extensions to its rear. A single storey building is also present at the rear of the site. This structure was observed to have an asbestos roof. The photographs of the site are given in Appendix VII, and show the general site layout.

The general layout of the site at present is given on drawing no 04/7014/2, which is presented in Appendix IV to this report. A number of small inspection pits are present presumably associated with the sites use for garage services. There is no evidence of any fuel tanks at this site. In view of the fact that the site is relatively small it is unlikely that it would have had any facility to dispense fuel.

ii) Geology

An examination of the records of the Geological Survey map, drift edition, indicates that Kempton Park Gravel underlies the site. At depth London Clay is present.

iii) Hydrology and Hydrogeology

An examination of the ground water vulnerability map of the area, West London, sheet no 39, scale to 1:100,000, indicates that this site is underlain by a major aquifer of high leaching potential. This aquifer represents the Kempton Park Gravel.

The nearest water feature is the River Crane, which is present some 150m to the west of the site. An examination of the Environment Agencies website, indicates that this site lies outside the nearest source protection zone. An extract of the Environment Agencies web site in respect of groundwater is presented as drawing no 04/7014/3 in Appendix VI, to this report. There is an abstraction point to the north east of the site. At some 400m it is unlikely that the site would have any impact on this feature.

iv) Conceptual Site Model

In accordance with the Code of Practice BS 101175 entitled "Investigation of Potentially Contaminated Sites - Code of Practice", a conceptual site model has been prepared for this site. This model, which is presented in tabular form below, identifies any potential contamination, the receptors and the pathways between the two.

Table 2 - Conceptual Site Model

Contaminant/Source	Pathway	Receptor
Hydrocarbons spillages/leakages from garage services (TPH)	Dermal Contact/Inhalation	End User
	Migration through soils	Groundwater

v) Risk assessment

It is understood that an office structure will be built to the rear of the site. Moreover, it is likely that the remainder of the site will be made over to hard cover. Current CLEA guidelines are used in order to assess the risk from potentially contaminated land. The guidelines use the concept of source/pathway/receptor models in order to determine whether substances pose a risk to the receptors ie the end user or groundwater at this site. For a substance to pose a risk there needs to be a pathway between the contaminant and the receptor. In the case of the human receptors the pathways could either be by ingestion, dermal contact and inhalation. As the proposed development will result in the construction of a building and hard cover it is likely that the pathways will be broken and risks would no longer be present.

IV FIELDWORKS

The borehole, probeholes and trialpits were excavated during the period 12-14th July, 2004, at locations as shown on the site plan, drawing no 04/7014/4, which is presented as Appendix VIII to this report. The salient details of this drawing have been extracted from a site layout plan, which was supplied by the Consulting Engineers.

The depths and descriptions of the strata encountered in the borehole, probeholes and trialpits are given on their respective records, which comprise Appendix I to this report. These records note the depths at which samples were taken, the results of insitu hand shear vane tests and any groundwater observations noted at the time of the fieldworks. The details of the trialpits are presented as drawing nos 04/7014/5 to 8, also presented in Appendix I.

V GEOLOGY AND STRATA CONDITIONS

An examination of the 1:50,000 Geological Survey map of the area, together with the relevant Handbook of Regional Geology, indicates that the site is underlain by Kempton Park Gravel, which overlies London Clay of late Eocene age. This over-consolidated deposit consists of grey fissured clay, which can weather to a brown colouration at, or near surface.

A study of the borehole records indicates that made ground varying in composition from concrete to brown clay with brick fragments was noted at the investigatory locations and was proved to depths of 0.1m and 1.0m. Brown clayey sand was exposed beneath the made ground in the borehole and was shown to extend to1m depth. Brown sand, becoming sandy gravel was noted upon penetration of the made ground and the clayey sand. The probeholes were concluded within this coarse granular soil at depths of between 1m and 1.9m. The sandy gravel was observed to extend to 7.70m in the borehole. It is considered that this soil is representative of the Kempton Park Gravel.

Grey fissured clay was encountered beneath the Kempton Park Gravel. This soil, which is typical of London Clay and was proved to the concluding depth of this investigation, the borehole being terminated at 12m.

No groundwater strikes were noted during the siteworks. It should be noted that water was added to assist boring through the granular soils at this site, which may have masked groundwater inflows. However, a short-term standing water level of 5m has been established at this site on completion of the borehole. On a return visit to the site on 1st September, 2004, the standpipe installed was monitored. A depth to water of 2.4m was recorded. At this time the presence of landfill gases was measured. No methane was

noted, although a value of carbon dioxide of 3.2% has been detected. The barometric pressure was 1016mb.

A number of standard penetration tests were performed during the construction of the borehole within the Kempton Park Gravel. Penetration resistances ranging from 29blows/0.3m to 34blows/0.3m have been recorded which relate to a medium dense to dense condition insitu for a purely granular soil.

VI LABORATORY TESTING

A programme of laboratory testing has been undertaken and the results are presented as Appendix II to this report. Each type of test is briefly summarised below and the results obtained have been used to assist in the formulation of the discussion of ground conditions.

a) Particle Size Distribution

Selected samples of the predominantly granular soils have been subjected to sieve analyses in order to ascertain their particle size distribution. In several instances, this work has been extended by sedimentation analyses in order to determine the proportions of silt and clay present within the samples. The results of the analyses are presented in the form of grading curves, which indicate that the soils can generally be described as well graded sandy gravel.

b) Triaxial Compression

The undrained shear strength characteristics of samples of the cohesive soils occurring at this site have been assessed by testing specimens in the triaxial compression apparatus. Undrained shear strengths, increasing from 45kPa to 330kPa have been obtained from this work, which are indicative of a firm to hard condition insitu for a purely cohesive soil.

c) Chemical Analyses - Sulphate and pH

Selected samples of the soils taken from, or above, likely foundation level, have been analysed in order to determine their soluble sulphate contents and pH values. Low concentrations of soluble sulphates were recorded in this work, these being associated with near neutral pH values.

d) Contamination

Samples of the near surface soils have been analysed for the presence of contamination in accordance with the current CLEA guidelines and the former ICRCL Guidance Note 59/83 requirements. In a number cases samples were tested for the presence of Total Petroleum Hydrocarbons. The analysis was completed at a UKAS accredited laboratory operated by Casella Analytic.

VII DISCUSSION OF GROUND CONDITIONS

It is understood that it is proposed to redevelop the site by the construction of a two-storey office structure. At the time of preparation of this report, no precise information was available with regard to the likely structural loadings.

It cannot be recommended that major structural foundations be located within the made ground revealed by this investigation. Soils of this origin are frequently present in a weak and variable condition, such that unacceptable settlement could occur, even under the action of light loading intensities. Therefore, it will be necessary to extend excavations through these undesirable materials, where they are of less than 1m in thickness to this minimum depth, in order to avoid that zone of soil, which is subject to normal seasonal moisture variation or frost action. The above precautions, however, do not necessarily apply to light ancillary structures, which are formed structurally discrete from the main development, and in which a greater degree of settlement can be tolerated.

Consideration of the data derived from this investigation indicates that strip or spread foundations located within the Kempton Park Gravel at a minimum depth of 1m can be designed to apply an increase in load of 200kPa. At this loading intensity, a factor of

safety of 3 against general shear failure will be operative. Moreover, settlements should remain within tolerable limits for the type of structure under consideration, these movements being sensibly complete during a normal construction period due to the free draining nature of the soils encountered at this site.

Excavations of less than 1m depth should not require temporary support. However, should excavations be extended below this level, then adequate temporary support should be provided in order to comply with current statutory safety regulation and to maintain the stability of the excavation faces.

The groundwater observations noted at the time of the fieldworks suggest that problems with respect to shallow depth excavations are unlikely. Should slight seepages be encountered or surface water run-off drain into foundation excavations, these should be dealt with using normal good practice.

The thicknesses of made ground revealed by this investigation implies that non-suspended ground floor slabs can be employed, providing the unsuitable superficial materials are removed and replaced by adequately compacted approved granular fill material. Alternatively, consideration could be given to the use of a fully suspended ground floor slab.

It is thought that a satisfactory foundation solution can be formulated on the basis of the foregoing discussions. However, if the above recommendations are considered unsuitable, then an alternative foundation system will be required. In this context, it is suggested that attention be directed to the use of piles in order to transmit the structural loads to the more competent soils encountered at greater depth. Should further consideration be given to the use of a piled foundation system, then the advice of suitably experienced specialist contractors should be sought in order to arrive at a satisfactory solution to the problem. The information given in Appendices I and II may be used in pile design.

VIII CONTAMINATION

Samples of the near surface soils have been tested for a range of parameters based on the former ICRCL Guidance Note 59/83. In addition, a number of samples have been

analysed for the presence of TPH. The ICRCL Guidance Note 59/83 has been withdrawn. Therefore an assessment of the results recorded values has been made using the Contaminated Land Exposure Assessment Model and, where applicable, Dutch Government Guidelines, E.U. Council Directive No 86/278/EEC (Agricultural Use of Sewage Sludge) and BRE Special Digest 1. The table below lists the determinants, current guideline values and the guideline sources.

The ICRCL Guidance Note 59/83 has been withdrawn. Therefore an assessment of the results recorded values has been made using the Contaminated Land Exposure Assessment Model and, where applicable, Dutch Government Guidelines, E.U. Council Directive No 86/278/EEC (Agricultural Use of Sewage Sludge) and BRE Special Digest 1. The table below lists the determinants, current guideline values and the guideline sources.

CLEA Soil Guideline Values						**EU86/278**				**Dutch Government**	
Determinant (total mg/kg)	Residential with plant uptake			Residential without plant uptake	Industrial /commercial	Agricultural Use of Sewage Sludge					
	pH 6	pH 7	pH 8			pH 5.0<5.5	pH 5.5<6.0	pH 6.0<7.0	pH >7.0	Target	Intervention
Arsenic	20			20	500						
Boron	Normal range 1 - 100 (ICRCL 23/70)										
Cadmium	1	2	8	30	1400						
Chromium	130			200	5000						
Copper						130	170	225	330		
Cyanide										1	20
Lead	450			450	750						
Mercury	8			15	480						
Nickel	50			75	5000						
PAH										1	40
pH						<5					
Phenol										0.05	40
Selenium	35			260	8000						
Sulphate	2400 (BRE Special Digest 1)										
Sulphide	250 ICRCL 18/79										
Sulphur	5000 ICRCL 18/79										
Zinc						330	420	500	750		

The results obtained have been compared with CLEA soil guidance values for Industrial/Commercial usage. The results of laboratory testing show that for the contaminants with available guideline data there is no demonstrable contamination. With regard to TPH, the Dutch Government Standards have proposed a target value of 50

mg/kg. The results obtained are less than 10mg/kg which indicates that contamination by petroleum hydrocarbons has not occurred.

Any spoil should be taken for disposal to an appropriately licensed landfill site. The classification of the spoil lies outside the scope of this report, as it is dependent upon parameters that may be set by the site operator or the Local or County Authority. In these circumstances, the results of laboratory testing could be used to classify the spoil and thus identify sites, which will accept excavated material. However, additional testing may be necessary if the spoil is classified as a hazardous waste.

IX LANDFILL GAS

The monitoring of landfill gas has noted an elevated level of carbon dioxide. Therefore, it is likely that a gas protection scheme will be required as part of the proposed redevelopment. BRE Report BR212, 'The redevelopment of gas contaminated land', gives details on gas protection measures.

X EFFECT OF SULPHATES

The information obtained from this investigation has been compared with the criteria proposed in BRE Special Digest 1, Concrete in Aggressive Ground. Using the information in Table 2 of this publication the Aggressive Chemical Environment for Concrete Classification is AC- 1s, which coincides with a Design Sulphate Class DS-1.

This grouping has been compared with the information given in Part 2 of the Special Digest and it is apparent that for a low to normal structural performance concrete, special precautions on respect of buried concrete may not be required. However, it is important to clarify the final concrete design mix when the details of the development are available.

APPENDIX I

Boring, Probehole and Trialpit Records

ALBURY S.I. LTD Petworth Road, Witley, Godalming, Surrey GU8 5LH		Borehole No 1
CONTRACT	St Margarets Grove, Twickenham	Report No 04/7014/KJC
Client	Globe IFA Limited	Ground Level mOD
Site Address	St Margarets Grove, Twickenham, TW1	Boring Commenced 12.07.04 Boring Completed 13.07.04

Type and Diameter of Boring: Light cable percussion (shell and auger):

Water Strikes, m	Water Levels Recorded During Boring, m							
1 See remarks	Date	12.07	12.07	13.07				
2	Hole Depth	7.80	7.80	12.0				
3	Casing Depth	7.80	7.80	7.90				
4	Water Level	5.00	5.00	none				

Remarks

Water added to assist boring may have masked groundwater inflows. Standpipe installed.
Excavation of starter pit to clear services

Samples of Tests		SPT			Strata Description
Type	Depth, m	N	Depth	Legend	
D	0.25		0.45		Made ground (concrete/clay with brick fragments)
B	0.50-0.90				Brown/buff clayey sand
D	1.00-1.50	34	1.00		Medium dense to dense brown sandy gravel
B	2.50-3.00	29			
B	4.00-4.50	32			
B	5.50-6.00	34			
B	7.00-7.50	32			
D	7.70		7.70		Grey clay
B	8.60-8.80				
D	8.90				

Sampling Code: U - Undisturbed B - Large disturbed J - Jar W - Water (U*) Non recovery of U Sample

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Petworth Road, Witley, Godalming, Surrey GU8 5LH

Continuation Sheet no 1

Borehole No 1

CONTRACT St Margarets Grove, twickenham

REPORT No 04/7014/KJC

Samples of Tests		SPT			Strata Description
Type	Depth, m	N	Depth	Legend	
					Stiff to very stiff grey silty clay
U	9.60-10.00				
D	10.00				
U	11.00-11.50				
D	11.50-12.00	25			
			12.00		

Sampling Code: U - Undisturbed B - Large disturbed J - Jar W - Water (U*) Non recovery of U Sample

ALBURY S.I. LTD			**Probe no** 1
Contract	St Margarets Grove, Twickenham		**Report No** 04/7014/KJC
Client	Globe IFA Limited		**Date** 14.07.04
Site Address	45-49, St Margarets Grove, Twickenham, TW1		Ground Level mOD
Type of Excavator	manual	Water level after completion, m	none

Water Strikes, m	Pit Dimensions, m	Ease of Excavation, m	
1 none	Length 0.05	Very easy	Difficult
2	Breadth 0.05	Moderate GL – 1.90	Very hard @1.90

Remarks

Sample Type	Depth, m	Cohesion kPa	Scale 40mm: 1m Depth	Legend	Description
			0.10		Made ground (concrete)
					Brown silty clay
D	0.50				
D	1.00		1.00		
					Brown sand
D	1.50				
D	1.90		1.90		Brown sandy gravel

Sample Code: U - Undisturbed B - Large Distrubed D - Small Disturbed W - Water

ALBURY S.I. LTD		Probe no	2
Contract	St Margarets Grove, Twickenham	Report No	04/7014/KJC
Client	Globe IFA Limited	Date	14.07.04
Site Address	45-49, St Margarets Grove, Twickenham, TW1	Ground Level	mOD

Type of Excavator	manual	Water level after completion, m	none

Water Strikes, m	Pit Dimensions, m	Ease of Excavation, m	
1 none	Length 0.05	Very easy	Difficult
2	Breadth 0.05	Moderate GL – 1.30	Very hard @1.30

Remarks

Sample Type	Depth, m	Cohesion kPa	Scale 40mm: 1m Depth	Legend	Description
			0.10		Made ground (concrete)
					Made ground (brown silty clay with brick fragments)
D	0.50				
D	1.00		1.00		
					Brown sand with gravel
			1.20		
D	1.30		1.30		Brown sandy gravel

Sample Code: U - Undisturbed B - Large Distrubed D - Small Disturbed W - Water

ALBURY S.I. LTD		Probe no	3
Contract	St Margarets Grove, Twickenham	Report No	04/7014/KJC
Client	Globe IFA Limited	Date	14.07.04
Site Address	45-49, St Margarets Grove, Twickenham, TW1	Ground Level	mOD

Type of Excavator	manual	Water level after completion, m	none

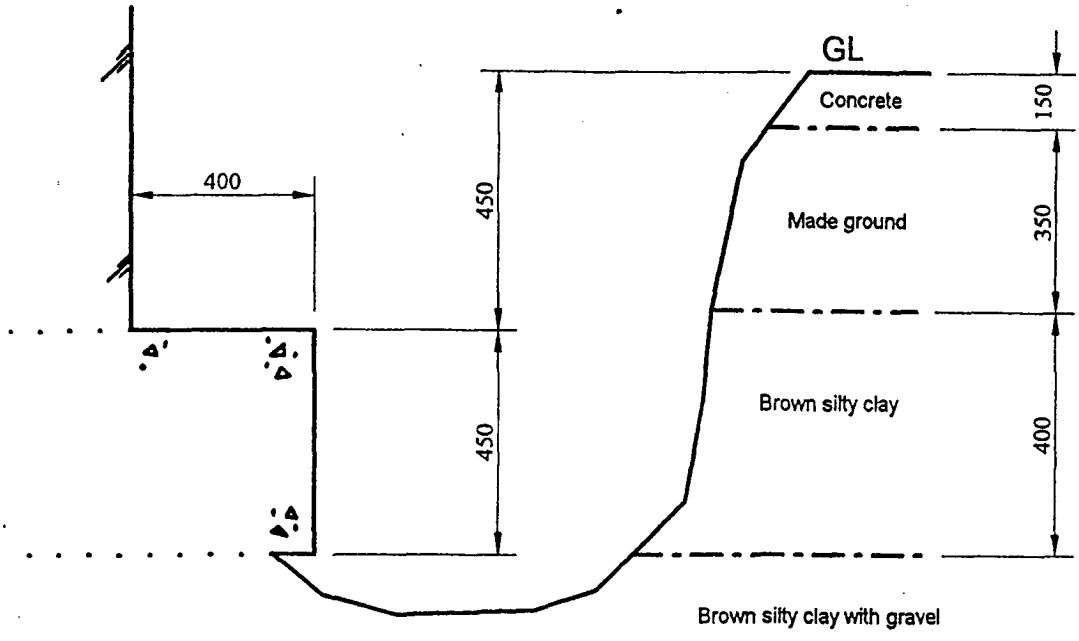
Water Strikes, m	Pit Dimensions, m	Ease of Excavation, m	
1 none	Length 0.05	Very easy	Difficult
2	Breadth 0.05	Moderate GL – 1.00	Very hard @1.00

Remarks

Sample Type	Depth, m	Cohesion kPa	Scale 40mm: 1m Depth	Legend	Description
			0.10		Made ground (concrete)
					Made ground (brown silty clay with brick fragments)
D	0.50				
D	1.00		1.00		
					Brown sand and gravel

Sample Code: U - Undisturbed B - Large Distrubed D - Small Disturbed W - Water

TRIALPIT 1



All dimensions in millimetres

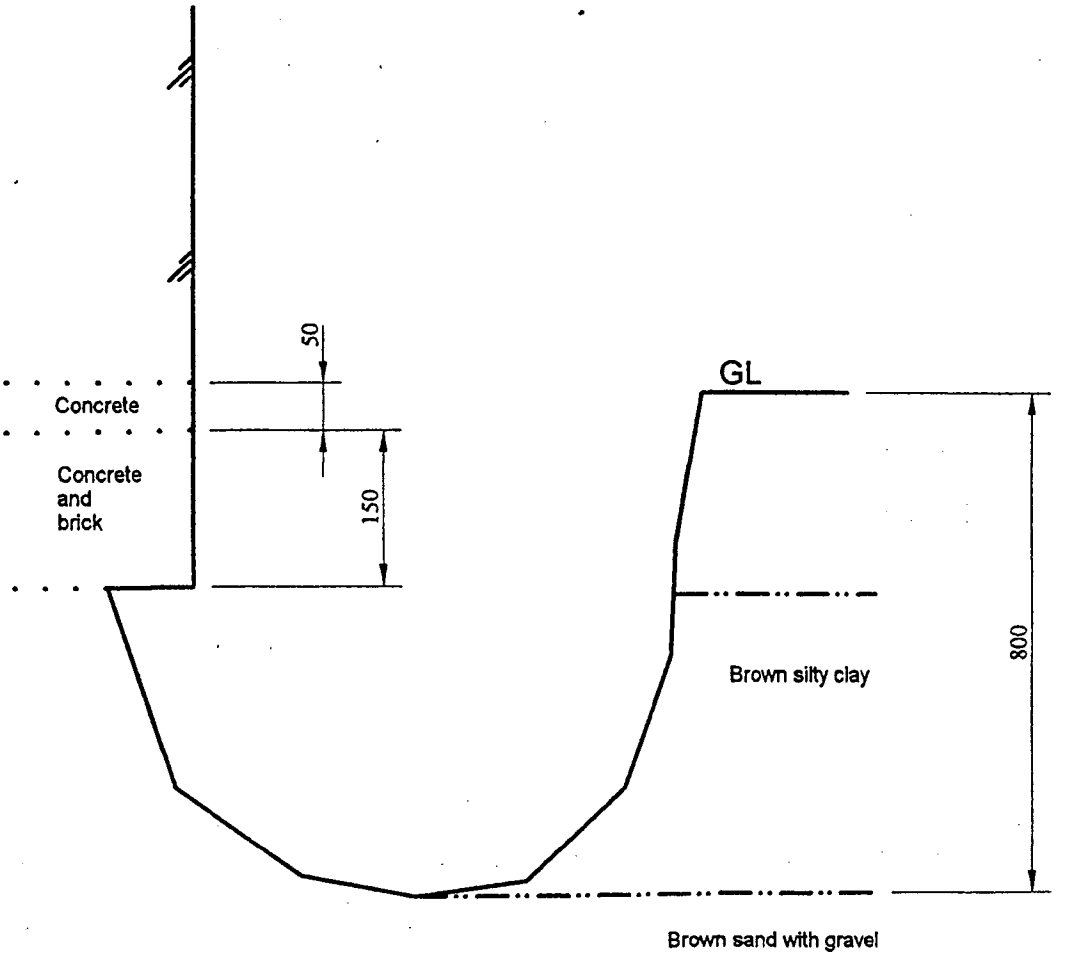
ALBURY S.I. LTD

ST MARGARETS GROVE, TWICKENHAM

Scale : N.T.S.

Drg No : 04/7014/5

TRIALPIT 2



All dimensions in millimetres

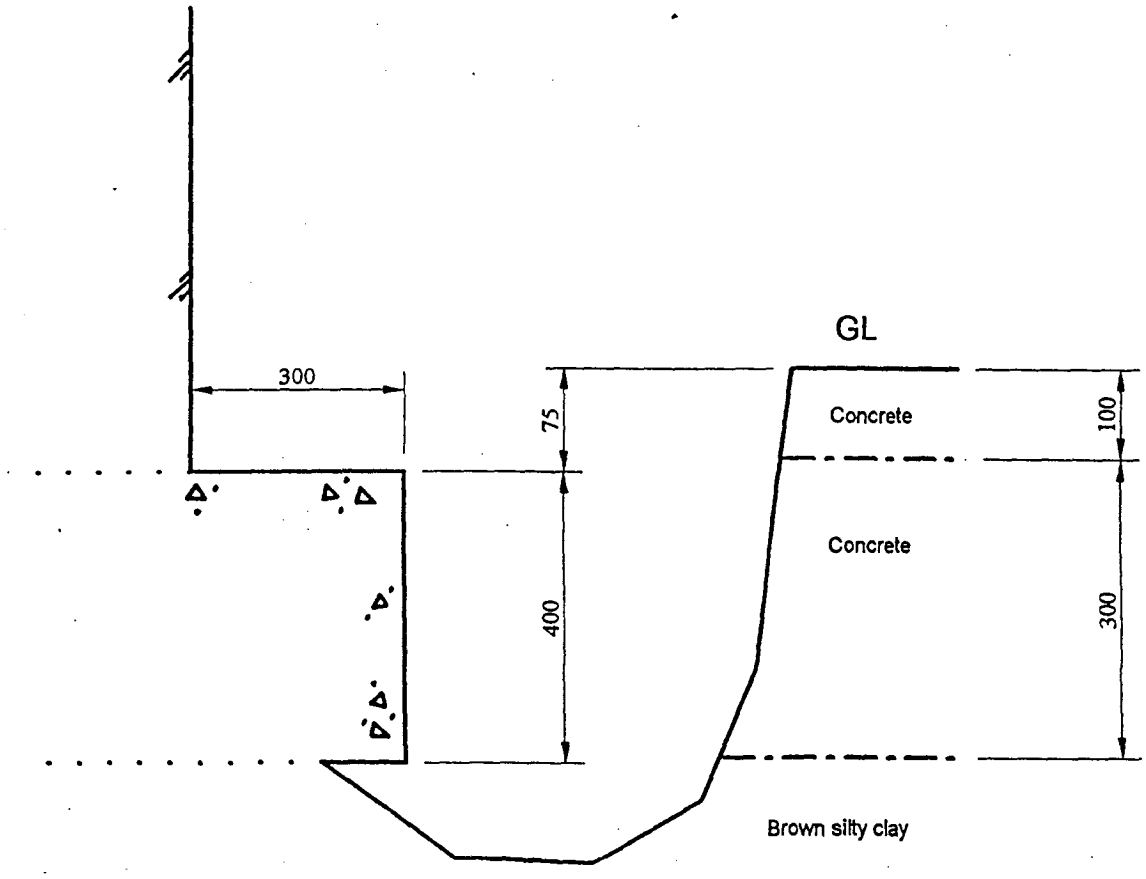
ALBURY S.I. LTD

ST MARGARETS GROVE, TWICKENHAM

Scale : N.T.S.

Drg No : 04/7014/6

TRIALPIT 3



All dimensions in millimetres

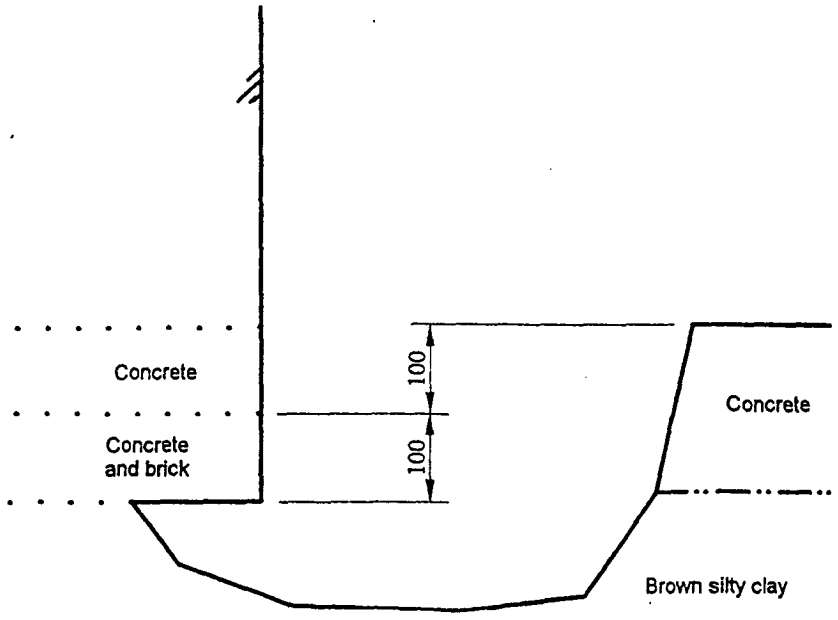
ALBURY S.I. LTD

ST MARGARETS GROVE, TWICKENHAM

Scale : N.T.S.

Drg No : 04/7014/7

TRIALPIT 4



All dimensions in millimetres

ALBURY S.I. LTD

ST MARGARETS GROVE, TWICKENHAM

Scale : N.T.S.

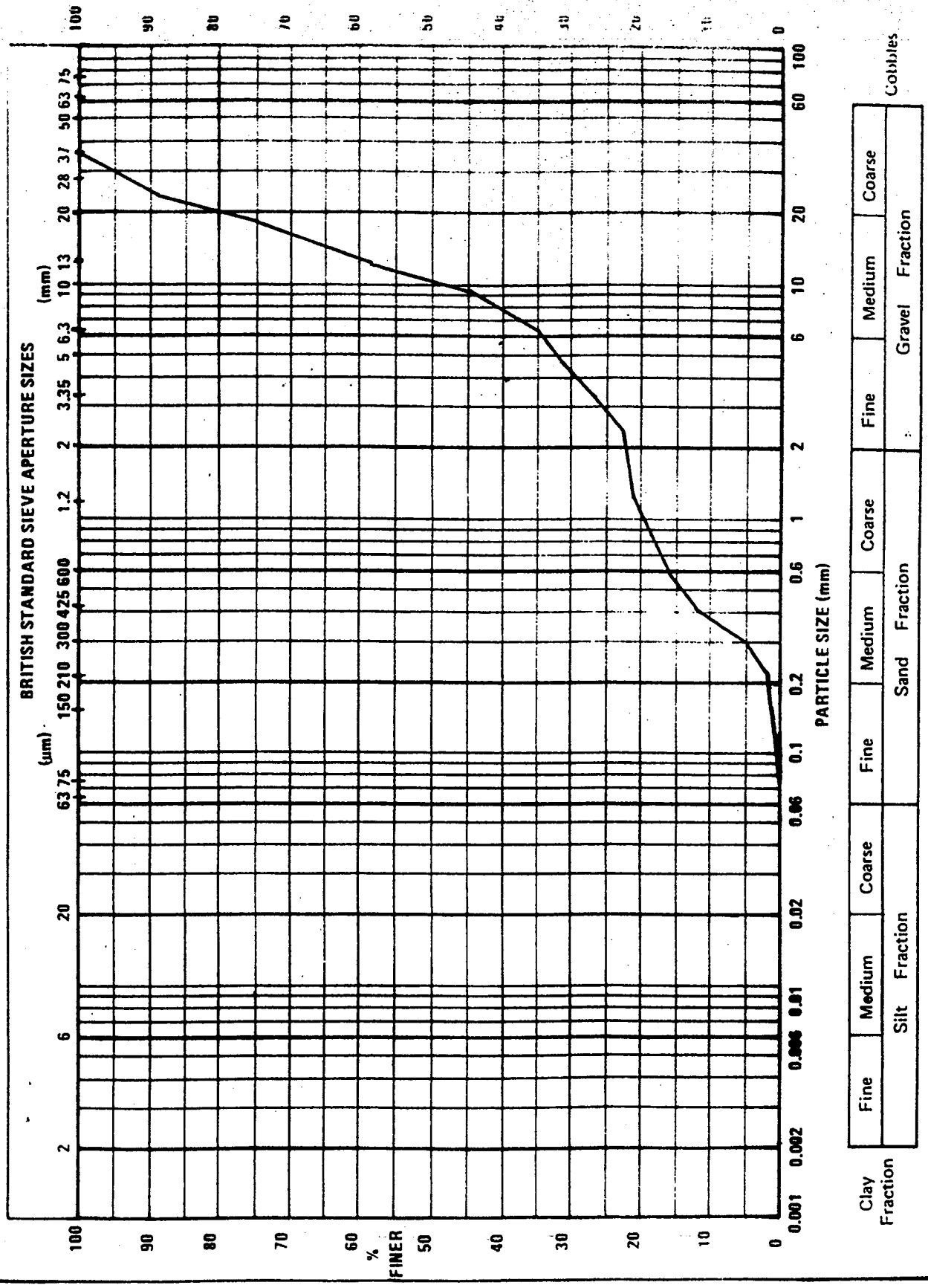
Drg No : 04/7014/8

APPENDIX II

Laboratory Test Results

PARTICLE SIZE DISTRIBUTION - GRADING CURVE

Contract Report No: St Margaret's Grove, Twickenham 04/7014/KJC



Borehole No 1 Sample No Depth of Sample, m 2.50-3.00

Visual Description Brown sandy gravel

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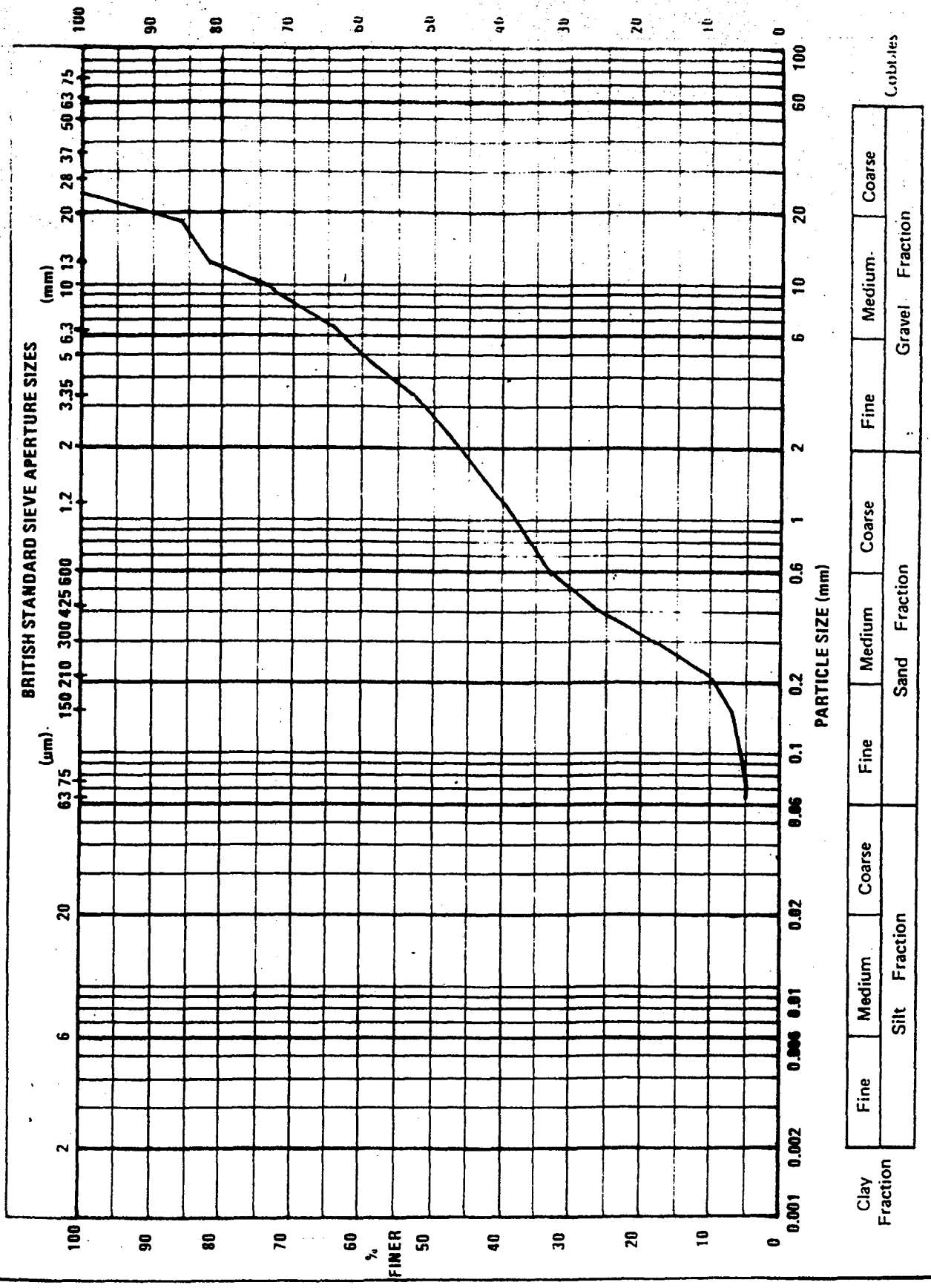
PARTICLE SIZE DISTRIBUTION GRADING CURVE

Contract Report No: St Margaret's Grove, Twickenham 04/7014/KJC

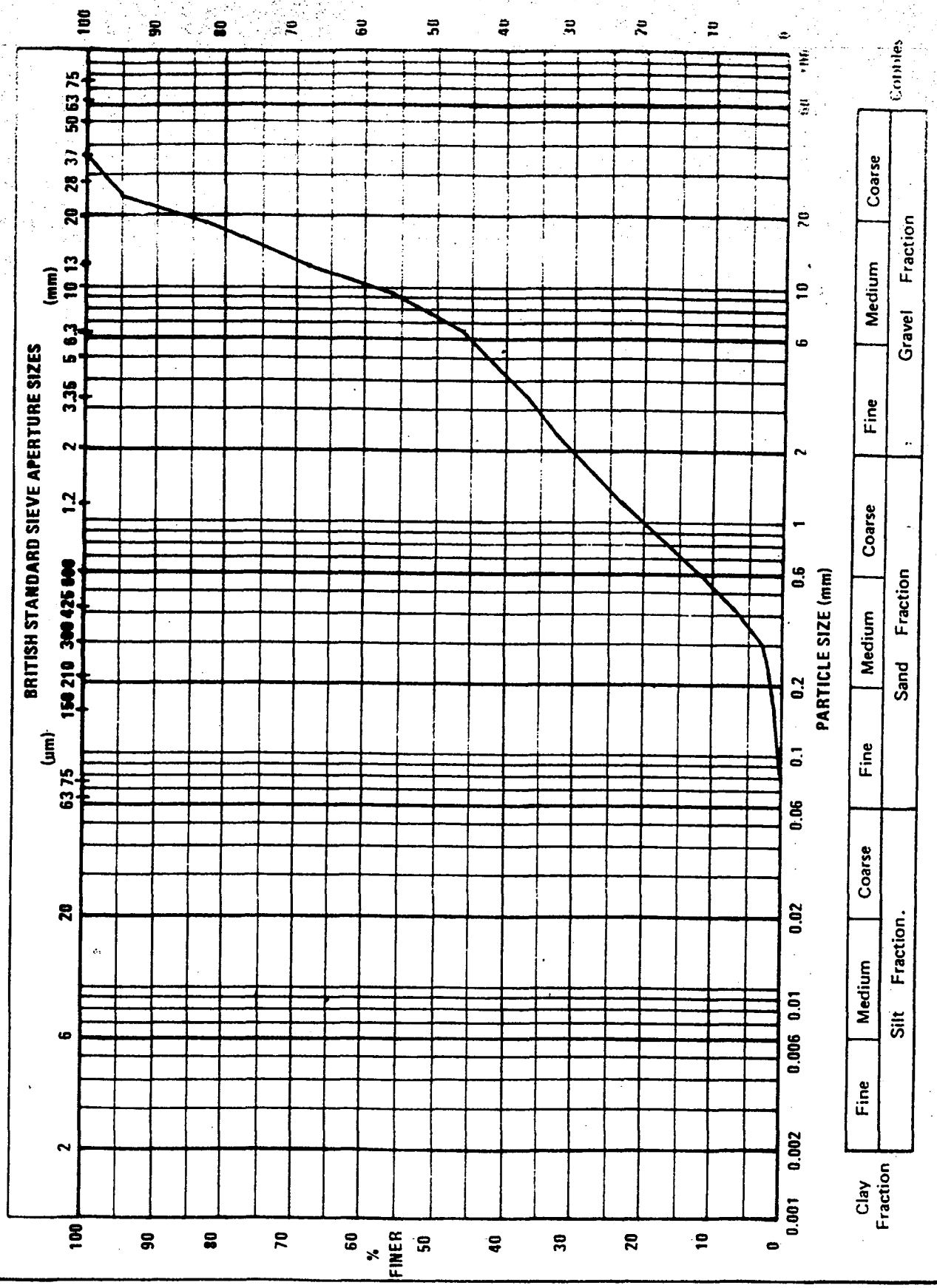


Borehole No	1	Sample No	Depth of Sample, m	1.00-1.50
Visual Description	Brown sandy gravel			

ALBURY S.I. LTD

PARTICLE SIZE DISTRIBUTION - GRADING CURVE

Contract Report No: St Margaret's Grove, Twickenham 04/7014/KJC



Borehole No	1	Sample No	Depth of Sample, m	7.00-7.50
Visual Description	Brown sandy gravel			

ALBURY S.I. LTD

Contract: St Margarets Grove, Twickenham
Report no: 04/7014/K-JC

BH No	Depth of Sample m	Description of Sample	INDEX PROPERTIES				TRIAXIAL COMPRESSION						
			Liquid Limit %	Plastic Limit %	Plasticity Index %	Soil Classification	Code	Lateral Pressure kPa	Compression Strength kPa	Cohesion kPa	Angle of Friction (degrees)	Bulk Density kg/m^3	Water Content (% dry wt)
1	9.60-10.00	Grey clay					38U	150	230	120	0	1950	28.8
								300	200			1970	28.8
								450	275			1970	28.1
	11.00-11.50	Grey clay					38U	150	285	155	0	1970	28.1
								300	295			1935	27.4
								450	340			1970	27.5

TRIAXIAL COMPRESSION TEST CODE: 38-38mm dia specimen 100-100mm dia specimen

REMARKS

U-Undrained **CD-Consolidated Drained** **CU-Consolidated Undrained** **P-Pore water pressure measurement**
M-Multistage **F-Functional** **R-Remoulded** **LV-Laboratory Vane Test**

RESULTS OF CHEMICAL ANALYSES

Determination of Sulphate Content and pH value

Contract: St Margarets Grove, Twickenham **Report No:** 04/7014/KJC

BH No	Depth of sample, m	Description	Concentrations of Sulphates expressed as SO_4			pH value
			In soil		In ground-Water *g/l*	
			Total SO_4 (%)	2:1 water:soil extract *g/l*		
1	2.50-3.00	Sand and gravel		<0.25		6.9

[illegible] PO Box 15, Runcorn, Cheshire WA7 4QX
T +44 (0)1928 517800 F +44 (0)1928 517830 E sealinfo@casellagroup.com

CASELLA SEAL

Chemistry Laboratory Certificate

Client	Albury SI Ltd Miltons Yard, Petworth Road, Witley, Surrey, GU8 5LH	**Date Reported**	10 August, 2004
		Date Received	27 July, 2004
Site	Twickenham	**Certificate No.**	04/3616/50/C1
Date Tested	03/08/04, 05/08/04, 06/08/04, 10/08/04	**File No.**	04/3616/50
Methodology	CTP07, CTP11(.1mgkg, CTP11(.5mgkg, CTP11(5mgkg), CTP12, CTP14, CTP16, CTP18c, CTP20, CTP21a, SOP02 GC-MS, SOP11 S	**Client Ref.**	
Sample Type	Solid		

Results

Sample Ref	Lab Ref.	pH	Sulphate (total) mg/kg	Sulphide mg/kg	Sulphur (elemental) mg/kg	Cyanide (total) mg/kg	PAH (total) mg/kg #	TPH (FT-IR) mg/kg #	Phenols (screen) mg/kg	Arsenic mg/kg	Boron (water soluble) mg/kg	Cadmium mg/kg	Chromium (total) mg/kg	Copper mg/kg
BH1 @ 0.50-0.90m	N237297	8.2	220	6	<20	<10	1	<10	<1	13	<1	<0.5	24	13
WS1 @ 0.5m	N237298	7.6	470	6	<20	<10	<1	<10	7	14	1	<0.5	31	15
WS1 @ 1.5m	N237299	8.4	210	7	<20	<10	<1	<10	<1	12	<1	<0.5	13	5
WS2 @ 0.5m	N237300	7.4	220	2	<20	<10	<1	-	<1	15	<1	<0.5	25	14
WS3 @ 0.5m	N237301	7.8	430	<2	<20	<10	<1	-	6	15	<1	<0.5	24	18
TP3 @ 0.5m	N237302	7.5	370	2	<20	<10	2	-	<1	17	1	<0.5	25	39

Tests marked # are not UKAS accredited in this certificate and are not included in the UKAS Accreditation Schedule for our laboratory.
Any information relating to the sample received for testing has been supplied by the client unless otherwise specified

Prepared by:

C Tarbuck
Account Manager

Approved by:

J Gustafson
Laboratory Manager

UKAS TESTING

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Business & Technical Park, PO Box 13, Rimcorn, Cheshire WA7 4QX
T +44 (0)1928 517 800 F +44 (0)1928 517 830 E scalinfo@casellagroup.com

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Methodology	CTP07, CTP11(.1mgkg, CTP11(.5mgkg, CTP11(5mgkg), CTP12, CTP14, CTP16, CTP18c, CTP20, CTP21a, SOP02 GC-MS, SOP11 S	**Client Ref.**	
Sample Type	Solid		

Results

Sample Ref	Lab Ref.	Lead mg/kg	Mercury mg/kg	Nickel mg/kg	Selenium mg/kg	Zinc mg/kg
BH1 @ 0.50-0.90m	N237297	31	<0.1	20	<5	47
WS1 @ 0.5m	N237298	29	<0.1	29	<5	55
WS1 @ 1.5m	N237299	14	<0.1	13	<5	22
WS2 @ 0.5m	N237300	27	0.3	32	<5	51
WS3 @ 0.5m	N237301	56	0.3	23	<5	94
TP3 @ 0.5m	N237302	210	0.7	27	<5	98

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