

REPORT ON GROUND INVESTIGATION

carried out at

QUEEN ELIZABETH HIGH SCHOOL

MIDDLETON

Prepared for

ROCHDALE METROPOLITAN BOROUGH COUNCIL
Highways & Engineering Service
Floor 3, Municipal Building
Smith Street
Rochdale
OL16 1LQ

Contract No: W06/40024/2

Date: MARCH 2007

Ian Farmer Associates (1998) Limited
17 Rivington Court, Warrington, Cheshire, WAI 4RT
Tel: 01925 855 440
Fax: 01925 855 441

EXECUTIVE SUMMARY

On the instructions of Rochdale Metropolitan Borough Council, a ground investigation was undertaken to determine ground conditions and geotechnical parameters, together with an assessment of contamination and gas emissions.

The site is situated at Queen Elizabeth High School, approximately 2km to the north of Middleton town centre.

The site work comprised five cable percussion boreholes.

For pad foundations placed in firm clay or medium dense sand, with dimensions of 1m by 1m at a minimum depth of 1.20m a presumed bearing pressure of 100kN/m² should provide an adequate factor against shear failure and limit settlement to 20mm.

The results of the soil analyses have been compared to the CLFA Soil Guideline Values (SGV) where available, or alternatively, Generic Assessment Criteria (GAC) determined by LQM and CIEH in accordance with current legislation and guidance, ref 10.1.

Contamination was not encountered at concentrations above guideline values.

A remediation strategy is not considered necessary due to the absence of significant contamination.

Gas monitoring to date indicates that no special precautions are required with respect to the ingress of carbon dioxide or methane.

CONTENTS

EXECUTIVE SUMMARY

1.0	INTRODUCTION	3
2.0	SITE SETTING	3
	2.1 Site Location	3
	2.2 Site Description	3
	2.3 Geological Setting	4
3.0	SITE WORK	4
4.0	LABORATORY TESTS	5
	4.1 Geotechnical Testing	5
	4.2 Chemical Testing	5
5.0	GROUND CONDITIONS ENCOUNTERED	6
	5.1 Sequence	6
	5.2 Made Ground	6
	5.3 Inter bedded Clay and Sand	6
	5.4 Groundwater	6
6.0	GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS IN RELATION TO PROPOSED DEVELOPMENT	7
	6.1 Structural Details	7
	6.2 Assessment of Soil Condition	7
	6.3 Foundation Design	7
	6.4 Ground Floor Slabs	8
	6.5 Excavations	8
	6.6 Road and Hard Standing Design	8
	6.7 Chemical Attack on Buried Concrete	9
7.0	ENVIRONMENTAL RISK ASSESSMENT IN RELATION TO PROPOSED DEVELOPMENT	9
	7.1 Contaminated Land	9
	7.2 Risk Assessment	9
	7.3 Pollutant Linkage	10
	7.4 Risk Estimation - Humans	11
	7.5 Risk Evaluation	11
8.0	MANAGEMENT OF CONTAMINATION	11
	8.1 General	11
	8.2 Management of Unidentified Sources of Contamination	11

9.0	RECOMMENDATIONS IN RELATION TO GAS	
	GENERATION	
12	9.1 Assessment of Gas Emission	
12		
13	10.0 REFERENCES	

APPENDIX 1	DRAWINGS	-
	Site Location	-
Figure A1.1	Exploratory Hole Location Plan	-
APPENDIX 2	SITE WORK	-
	General Notes on Site Work	-
	Borehole Records	-
APPENDIX 3	LABORATORY TESTS	-
	General Notes on Laboratory Tests on Soils	-
	Results of Laboratory Tests	-
APPENDIX 4	CHEMICAL TESTS	-
	Results of Chemical Tests	-
APPENDIX 5	DESIGN CONSIDERATIONS	-
	Guidelines for the Design of	-
	Piles - First Approximation	-
	of Working Loads	-
APPENDIX 6	CONTAMINATION ASSESSMENT	-
	General Notes on Chemical Contamination	-
APPENDIX 7	GAS GENERATION	-
	General Notes on Gas Generation	-
	Monitoring Records	-

1.0 INTRODUCTION

1.1 It is understood that it is proposed to develop the site for a school building of a minimum 3 storeys in height.

1.2 On the instructions of Rochdale Metropolitan Borough Council, a ground investigation was undertaken to determine ground conditions to enable foundation and road/hard standing design to be carried out, together with an assessment of contamination and gas emissions.

1.3 A desk study report (W06/40024/1) has been prepared and issued under separate cover. This report must be read in conjunction with the desk study report.

1.4 This report has been prepared for the sole use of the Client for the purpose described and no extended duty of care to any third party is implied or offered. Third parties using any information contained within this report do so at their own risk.

1.5 The comments given in this report and the opinions expressed herein are based on the information received, the conditions encountered during site works, and on the results of tests made in the field and laboratory. However, there may be conditions prevailing at the site which have not been disclosed by the investigation and which have not been taken into account in the report.

1.6 The comments on groundwater conditions are based on observations made at the time the site work was carried out. It should be noted that groundwater levels vary owing to seasonal or other effects.

2.0 SITE SETTING

2.1 Site Location

2.1.1 The site is situated at Queen Elizabeth High School, approximately 2km to the north of the town centre of Middleton and may be located by National Grid reference SD 867 078. A site location plan is included in Appendix 1, Figure A1.1.

2.2 Site Description

2.2.1 At the time of the investigation the site comprised two areas of different levels. The larger north side of the site was generally level and comprised tarmac except for a small strip of grass along the length of the north boundary.

2.2.2 The south side of the site was raised approximately 0.50m to 1.00m than the north side of the site and comprised grass. A small ramp was located on the

- west side of the site enabling access from the tarmac area to the raised grassed area.
- 2.2.3 The site is bound to the west by Queen Elizabeth High School, to the north by agriculture land, to the south by a road and to the east by a public footpath with agricultural land beyond.
- 2.2.4 A site plan is included in Appendix 1, Figure A1.2.

2.3 Geological Setting

- 2.3.1 Details of the geology underlying the site have been obtained from the British Geological Survey map, Sheet No.85, 'Manchester', solid and drift editions, 1:50,000 scale, published 1970 and 1975.
- 2.3.2 The geological map indicates the site to be underlain by superficial deposits of boulder clay.
- 2.3.3 The superficial deposits are underlain by Westphalian A Coal Measures of Carboniferous age.
- 2.3.4 The site is within an urban area and, although not indicated as present upon the site from the geological maps, the possibility that Made Ground is present cannot be discounted.

3.0 SITE WORK

- 3.1 The site work was carried out between the 18th and 21st December 2006. The site works were carried out on the basis of the practices set out in BS 10175:2001, ref. 10.7, and BS 5930:1999 ref. 10.8.
- 3.2 Five boreholes, designated BH01 to BH05 were sunk by light cable percussion method at the positions shown on the site plan, Appendix 1, Figure A1.2. The depths of boreholes, descriptions of strata encountered and comments on groundwater conditions are given in the borehole records, presented in Appendix 2.
- 3.3 Representative disturbed and undisturbed samples were taken at the depths shown on the borehole records and despatched to the laboratory. Standard (split-barrel and cone) penetration tests, ref. 10.9 were carried out in the light cable percussion boreholes in the various strata to assess the relative density or consistency. The values of penetration resistance are given in the borehole records.
- 3.4 Perforated standpipes, surrounded by pea shingle and protected by a stopcock cover were installed in boreholes BH01, BH02 and BH05, as detailed in the borehole records.
- 3.5 The ground levels at the borehole and trial pit locations were not determined.

3.6 Gas and groundwater monitoring visits were undertaken. The results of the monitoring are presented in Appendix 7.

4.0 LABORATORY TESTS

4.1 Geotechnical Testing

4.1.1 All soil samples were prepared in accordance with BS1377: Part One: 1990 ref. 10.9 and representative sub-samples were taken for testing. The following tests were carried out:

- Moisture content
- Plastic and liquid limit
- pH
- Water soluble sulphate content
- Particle size distribution
- Undrained shear strength
- Hand vane
- Bulk density

4.2 Chemical Testing

4.2.1 The chemical analyses were carried out on six samples of soil. The nature of the analyses is detailed below:

- 4.2.2 **Metals screen** - arsenic, cadmium, chromium, lead, mercury, selenium, boron (water soluble), copper, nickel and zinc
- 4.2.3 **Organic Screen** – total petroleum hydrocarbons – aliphatic/aromatic split, polyaromatic hydrocarbons (PAH) – USEPA 16 suite, monohydric phenols
- 4.2.4 **Inorganics Screen** - cyanide (total)
- 4.2.5 **Others** - pH, organic matter, asbestos
- 4.2.6 The results of these tests are shown in Appendix 4.

5.0 GROUND CONDITIONS ENCOUNTERED

5.1 Sequence

- 5.1.1 The sequence of the strata encountered during the investigation generally confirms the anticipated geology as interpreted from the geological map.
- 5.1.2 The sequence and indicative thicknesses of strata are provided below:

Strata Encountered	Depth Encountered (m)		Strata Thickness (m)
	From	To	
Made Ground	0.00	0.60 to 1.20	0.60 to 1.20
Inter bedded Clay and Sand	0.60 to 1.20	15.00 to 15.50	Not Proved

5.2 Made Ground

- 5.2.1 Made Ground was encountered in all of the boreholes and generally comprised soft and firm, brown, sandy, slightly gravely clay or slightly gravely and very gravely sand. Gravel included brick, sandstone and concrete.

5.3 Inter bedded Clay and Sand

- 5.3.1 Soft or firm slightly sandy locally sandy, slightly gravely clay was encountered in all of the boreholes at depths ranging between 0.60m to 10.20m with a minimum thickness of 0.30m and a maximum of 4.30m. The strength of clay generally increases with depth with stiff and very stiff clay encountered at depths ranging between 7.20m to 13.20m.
- 5.3.2 Loose and medium dense sand was encountered in all of the boreholes at depths ranging between 0.70m to 11.00m with a minimum and maximum thickness of 1.10m and 6.80m. The sand was generally of a silty, slightly gravely composition.
- 5.3.3 All five boreholes were terminated within the sand or clay at depths up to 15.50m.

5.4 Groundwater

- 5.4.1 Groundwater was encountered at depths between 4.10m and 12.30m below ground level.

6.0 GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS IN RELATION TO PROPOSED DEVELOPMENT

6.1 Structural Details

6.1.1 It is understood that the proposed development is to consist of a school building of a minimum of three storeys in height.

6.2 Assessment of Soil Condition

6.2.1 Five particle size distribution (PSD) tests were carried out and recorded fines content in the range of 11% to 51% with between 47% to 89% sand and 0% to 2% gravel.

6.2.2 A laboratory hand vane test indicated shear strength of 10 kN/m^2 corresponding to very soft in BH04 at a depth of 2.00m. A bulk density and dry density test was carried out in BH04 and recorded values of 2.21 Mg/m^3 and 1.86 Mg/m^3 respectively.

6.2.3 An undrained triaxial test, BH04 at 3.00m, recorded a C_u value of 43 kN/m^2 , corresponding to firm.

6.2.4 Four Atterberg limit tests carried out within the natural clay indicate the clay to be of low plasticity.

6.2.5 Eleven SPT tests were carried out within the natural clay and recorded 'N' values ranging from 9 to 35, indicating firm clay at shallower depths increasing to stiff or very stiff with depth.

6.2.6 SPT 'N' values within the natural sand ranged from 6 to 33 with a mean of 15, indicating predominantly medium dense conditions, locally loose or dense.

6.3 Foundations

6.3.1 On the basis of observations made on site together with results of in-situ and laboratory tests, it is recommended that consideration could be given to the adoption of traditional spread foundations to support the proposed structure.

6.3.2 Outside the zone of influence of existing and proposed trees, it is recommended that foundations be taken through any Made Ground, loose sand or soft clay and placed in the underlying medium dense sand or firm clay. Due to the depth of soft clay encountered locally in the boreholes, it is likely that foundations would have to be placed at depths up to 2.90m, within the vicinity of BH4.

6.3.3 To minimise differential settlement, foundations should be placed wholly within the same material type unless a specific geotechnical inspection and assessment has been undertaken.

6.3.4 On this basis pad foundations of dimensions 1m by 1m at a minimum depth of 0.90m a presumed bearing value of 100kN/m² would provide an adequate factor of safety against shear failure and limit settlement to 20mm.

6.3.5 When design details are available, it may be considered that for foundations carrying higher loads it may be more prudent to adopt a piled foundation solution. Guidelines for the design of piles are given in Appendix 5.

6.3.6 The carrying capacity of piles depends not only on their size and the ground conditions but also on their method of installation. Therefore, it is recommended that specialist Piling Contractors be contacted as to the suitability and carrying capacity of their piles in the ground conditions pertaining to the site.

6.4 Ground Floor Slabs

6.4.1 On the basis of observation on site together with the results of laboratory tests it is recommended that, outside the zone of influence of trees, consideration is given to constructing the ground floor slab on formation prepared in the natural strata. Any soft or deleterious material should be removed and replaced with properly compacted granular fill.

6.5 Excavations

6.5.1 On the basis of observations on site, together with the results of in-situ and laboratory tests, it is considered that excavations to less than 0.90m should stand unsupported in the short term. Side support for safety purposes should of course be provided to all excavations in excess of 0.90m deep in accordance with Health and Safety Regulations.

6.5.2 Groundwater should not be expected in shallow excavations for foundations or services. However, it is possible that perched groundwater could be present in the Made Ground overlying the natural strata. It is considered that this could be dealt with by pumping.

6.5.3 Groundwater could be expected in excavations taken to depths in excess of 4.10m.

6.6 Road and Hard Standing Design

6.6.1 The structural design of a road or hard standing is based on the strength of the subgrade, which is assessed on the California Bearing Ratio, **CBR**, scale. Experience has indicated that the measurement of the in-situ CBR value tends to give unreliable results because of the influence of the moisture

content of the materials. In practice, the correlation given in Transport and Road Research Laboratory, Report 1132, ref. 10.11, is usually more appropriate than direct determination of the CBR.

6.6.2 On the basis of laboratory classification tests it is recommended that for formation prepared in the cohesive and granular material, a subgrade CBR value of 6% and 20% respectively may be adopted for design purposes. Any areas of soft or deleterious material in the Made Ground should be excavated and replaced with a properly compacted granular fill.

6.7 Chemical Attack on Buried Concrete

6.7.1 The results of chemical tests indicate a sulphate concentration in the soil of between <0.1g/l and 0.4g/l as a 2:1 water/soil extract and between 0.17% and 0.24% as total sulphate with pH values in the range of 6.8 to 9.0. In accordance with the guidelines given in BRE Special Digest 1, ref. 10.12, the Aggressive Chemical Environment for Concrete (ACBEC) classification for the site is AC-1s. Consequently buried concrete should conform to Design Sulphate Class DS-1.

6.7.2 It is recommended that for conventional shallow foundations, the groundwater should be regarded as static.

7.0 ENVIRONMENTAL RISK ASSESSMENT IN RELATION TO PROPOSED DEVELOPMENT

7.1 Contaminated Land

7.1.1 The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref 10.13, which was introduced by the Environment Act 1995, ref 10.14;

- Land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

- significant harm is being caused or there is a significant possibility of such harm being caused; or
- significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused.

7.2 Risk Assessment

7.2.1 The definition of contaminated land is based on the principles of risk assessment. Risk is defined as a combination of:

- The probability, or frequency of exposure to a substance with the potential to cause harm, and;
- The seriousness of the consequence.

7.3 Pollutant Linkage

7.3.1 The basis of an environmental risk assessment involves identifying a 'source' of contamination, a 'pathway' along which the contamination may migrate and a 'receptor' at risk from the contamination.

7.3.2 Current legislation defines the various elements of the pollution linkage as:

- A contaminant is a substance which is in or under the ground and which has the potential to cause harm or to cause pollution of controlled waters.
- A pathway is one or more routes through which a receptor is being exposed to, or affected by, a contaminant, or could be so affected.
- A receptor is either a living organism, an ecological system, a piece of land or property, or controlled water.

7.3.3 A pollutant linkage indicates that all three elements have been identified. The site can only be defined as 'Contaminated Land' if a pollutant linkage exists and the contamination meets the criteria in Section 7.1 above.

7.3.4 The guidance proposes a four-stage approach for the assessment of contamination and the associated risks. The four stages are listed below:

- Hazard Identification
- Hazard Assessment
- Risk Estimation
- Risk Evaluation

7.3.5 The hazard identification and hazard assessment have been based upon the desk study and formed the conceptual site model, detailed in the desk study report.

7.3.6 It should be noted that the hazard identification and assessment stages are undertaken as part of a phase 1 desk study report and the risk estimation and evaluation stages are undertaken as part of a phase 2 interpretive report, after an intrusive ground investigation has taken place.

7.4 Risk Estimation - Humans

7.4.1 The proposed development consists of a school building. The risk assessment has therefore been based on guidelines for commercial / industrial. Should the proposed end-use of the site be changed in the future then further risk assessment may be required, particularly should a more sensitive end-use be envisaged.

7.4.2 The results of the soil analyses have been compared to the CLFA Soil Guideline Values (SGV) where available, or alternatively, Generic Assessment Criteria (GAC) determined by LQM and CIEH in accordance with current legislation and guidance, ref 10.1.

7.4.3 The results of chemical analyses have been processed in accordance with recommendations set out in CLR 7, ref 10.15. Where the concentrations determined on site are at or below the respective Guidance Level, they are considered not to pose a risk and are removed from further consideration, unless otherwise stated.

7.4.4 The individual analytical tests results are all below their respective guideline values.

7.5 Risk Evaluation

7.5.1 The analytical test results are consistent with the site history of an agricultural area succeeded by a school and therefore confirm the findings of the desk study. None of the determinands tested were encountered at concentrations above the relevant guideline values.

7.5.2 The above assessment identifies that the 'source - pathway - receptor' linkage does not have the potential to occur due to the absence of a significance source.

8.0 MANAGEMENT OF CONTAMINATION

8.1 General

8.1.1 The results of laboratory tests, statistical analysis of the data, together with consideration of the site conceptual model and exposure model for the proposed development, suggest that an overall site remediation strategy is not required due to the absence of any significant sources of contamination.

8.2 Management of Unidentified Sources of Contamination

8.2.1 There is the possibility that other sources of contamination may be present on the site, which were not detected during the investigation. Should such contamination be identified or suspected during the site clearance or ground

works, these should be dealt with accordingly. A number of options are available for handling this material, which include:

- The removal from site and disposal to a suitably licensed tip of all material suspected of being contaminated.

- Short-term storage of the suspected material while undertaking verification testing for potential contamination. The storage area should be a contained area to ensure that contamination does not migrate and affect other areas of the site. Depending upon the amounts of material under consideration, this could be either a skip or a lined area.

- Having a suitably experienced environmental engineer either on-call or with a watching brief for the visual and olfactory assessment of the material, and sampling for verification purposes.

8.2.2 Where contaminated materials are being removed from the site they should be disposed of at a suitably licensed landfill, with a 'duty of care' system in place and maintained throughout the disposal operations.

8.2.3 Current regulations relating to the landfill disposal of contaminated soils and excavated waste must be in accordance with the EC Landfill Directive, 1999/31/EC. Excavation wastes are now classified in accordance with the European Waste Catalogue, ref 10.16.

8.2.4 Any special requirements for the particular identified contamination, ref 10.17.

9.0 RECOMMENDATIONS IN RELATION TO GAS GENERATION

9.1 Assessment of Gas Emission

9.1.1 Based upon the desk study, the ground conditions encountered during the site work and the measurement of gas levels in the standpipes, it is considered that no special precautions need be adopted within the proposed structures to prevent the ingress of toxic gases.

9.1.2 Current guidelines from Manchester Area Pollution Advisory Council indicate that monitoring should be undertaken over a minimum period of twelve months or additional protection measures may be required.

9.1.3 Monitoring is currently ongoing and the above will be reviewed on completion.

10.0 REFERENCES

- 10.1 Generic Assessment Criteria for Human Health Risk Assessment, Nathaniel CP, McCaffery C, Ashmore M, Cheng Y, Gillett A, Hooker P and Ogden RC, Land Quality Press, 2006
- 10.2 CLR 3, 'Documentary research on industrial sites', Report by RPS Consultants Ltd, DoE 1994.
- 10.3 CLR 2, 'Guidance on preliminary site inspection of contaminated land', Report by Applied Environmental, DoE 1994.
- 10.4 CLR 1, 'A framework for assessing the impact of contaminated land on groundwater and surface water', Report by Aspinwall & Co., DoE 1994.
- 10.5 CLR 11, 'Model procedures for the management of contaminated land: Risk assessment procedure', DoE 2004
- 10.6 CLR 4, 'Sampling strategies for contaminated land'. Report by The Centre for Research into the Built Environment, the Nottingham Trent University, DoE, 1994.
- 10.7 British Standards Institute: BS 10175 'Code of practice for the investigation of potentially contaminated sites', BSI 2001.
- 10.8 British Standards Institute: BS 5930 'Code of practice for site investigations', BSI 1999.
- 10.9 British Standard 1377:1990, Part 9, 'Methods of Test for Soils for Civil Engineering Purposes'.
- 10.10 Geotechnique, June 1983.
- 10.11 Transport and Road Research Laboratory, Report 1132, 'The Structural Design of Bituminous Roads', 1984.
- 10.12 Building Research Establishment, Special Digest 1, 'Concrete in Aggressive Ground', 2005
- 10.13 The Environmental Protection Act, Part IIA, Section 78, 1990.
- 10.14 Environment Act 1995, Section 57, DoE 1995.
- 10.15 CLR 7, 'Assessment of risks to human health from land contamination: an overview of the development of soil guideline values and related research'. DEFRA/EA, March 2002.
- 10.16 European Waste Catalogue, 2002.

- 10.17 Special Waste (Amendment) Regulations 1996, and relevant statutory guidance.
- 10.18 CLR 8, 'Potential contaminants for the assessment of contaminated land', DEFRA/EA, March 2002.

- 10.19 Circular of 9/5/94 on 'Intervention Values for Soil Remediation', Dutch Ministry of Housing Spatial Planning and the Environment.

- 10.20 United States Environmental Protection Agency, Region 9, Preliminary Remediation Goals.

- 10.21 National Environment Protection Council. 1999. National Environment Protection (Assessment of Site Contamination) Measure: Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater.

- 10.22 'Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Module 4: Tier 1 Soil Acceptance Criteria' New Zealand Ministry of the Environment, 1999

- 10.23 Department of the Environment and the Welsh Office, 'The Building Regulations Approved Document C, Site Preparation and Resistance to Moisture', 1992.

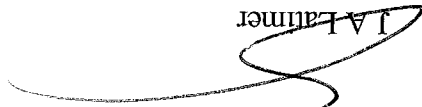
- 10.24 CIRIA Reports 149 to 152, 'Methane and Associated Hazards to Construction', 1995.

- 10.25 Wilton S A and Card G B, 'Reliability and Risk in Gas Protection Design', 2004.

- 10.26 Skennerton S, 'Landfill Gas: Rates vs Concentrations', Presentation notes from Remediation of Hazardous Gases: Workshop. Regional Group Meeting, Geological Society, 3 June 1997.

For and on behalf of Ian Farmer Associates (1998) Limited

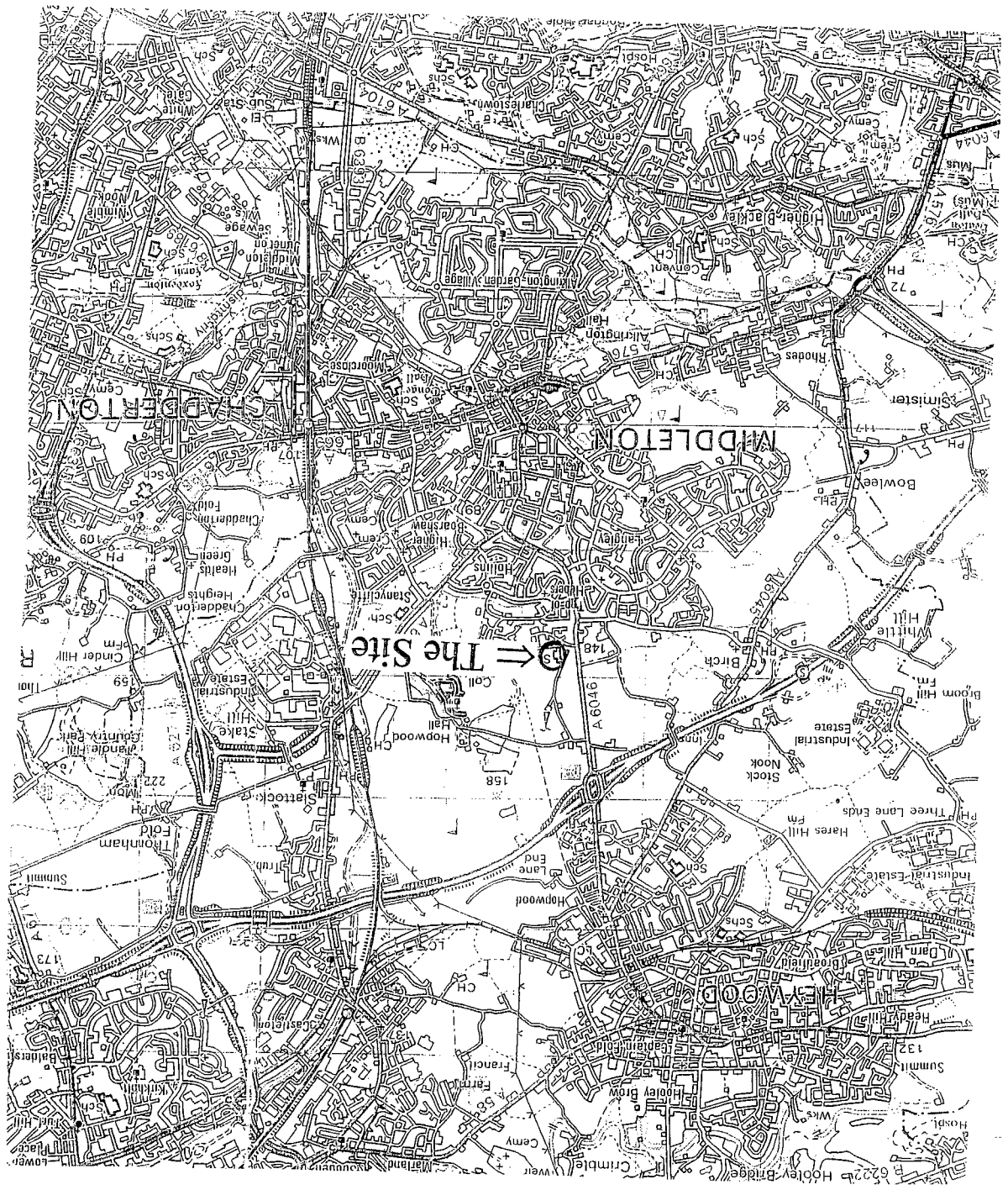

M L Hirst
BSc FGS
Senior Engineering Geologist


J A Lattimer
BSc (Hons) FGS
Director

APPENDIX 1
DRAWINGS

 IAN FARMER ASSOCIATES	
TITLE: Site Location Plan	
FIGURE NO. A1.1	SCALE: 1:50,000
PROJECT: Queen Elizabeth High School	

Reproduced from the 1997 1:50,000 Scale Landranger Sheet 109. Reproduced with the permission of the Controller of Her Majesty's Stationery Office. © Crown copyright. Licence No. AL 100031101



TITLE: Exploratory Hole Location Plan

FIGURE NO. A1.2. SCALE: N/A

PROJECT: Queen Elizabeth High School



APPENDIX 2
SITE WORK

APPENDIX 2

GENERAL NOTES ON SITE WORKS

A2.1 SITE WORK

A2.1.1 Light Cable Percussion Boring

For routine soil exploration to depths in excess of 3m, the light cable percussion rig is generally employed for boring through soils and weak rocks. It consists of a powered winch and tripod frame, with running wheels that are permanently attached so that the rig may be towed behind a suitable vehicle. The rig is towed into position and set up using its own winching system.

The locations of services are checked to make sure the borehole is not situated unacceptably near any services. Regardless of the proximity of services, a CAT scan is undertaken at the borehole location and a trial hole dug to 1.20m by hand.

Boreholes are advanced in soil by the percussive action of the cable tool. The force of the cylindrical tool as it is dropped a short distance cuts a plug of cohesive soil that is removed by the tool.

In non-cohesive soils, the borehole is advanced by a 'shell', otherwise known as a 'bailer' or 'sand pump', which incorporates a clack valve. Material is transferred into the shell and retained by the clack valve. The water level in a borehole is maintained above that in the surrounding granular soil to allow for temporary reductions in the head of water as the shell is withdrawn from the borehole. Water should flow from the borehole into the surrounding soil at all times to prevent 'piping' and loosening the soil at the base of the hole. The casing is always advanced with the borehole in granular soil so that material is drawn from the base rather than the borehole sides.

Obstructions to boring are overcome by fitting a serrated chiselling ring to the base of the percussion tool. For large obstructions, a heavy chisel with a hardened cutting edge may have to be used.

Disturbed samples are taken in polythene bags, jars or tubs that are sealed against air or water loss.

Undisturbed samples are generally taken in cohesive materials at changes in strata and at one metre intervals to 5 metres then at 1.5 metre intervals to the full depths of the borehole. The general purpose open-tube sampler is suitable for firm to stiff clays, but is often used to retrieve disturbed samples of weak rocks, soft or hard clay and also clayey sand or silts. This has been adopted for routine use, and usually consists of a 100mm internal diameter tube (U100), which is capable of taking soil samples up to 450mm in length. The undisturbed samples are sealed at each end using micro-crystalline wax to prevent drying.

Standard penetration tests are generally carried out in non-cohesive soils but also in stiff clays and soft rocks at frequencies similar to that of undisturbed sampling.

A2.2 IN-SITU TESTS

A2.2.1 Standard Penetration Test

The Standard Penetration Test is carried out in accordance with the proposals recommended by BS 1377, Part 9, 1990, ref 10.9.

The standard penetration test, **SPT**, covers the determination of the resistance of soils to the penetration of a split barrel sampler. A 50mm diameter split barrel sampler is driven 450mm into the soil using a 65kg hammer with a 760mm drop. The penetration

resistance is expressed as the number of blows required to obtain 300mm penetration below an initial seating drive of 150mm through any disturbed ground at the bottom of the borehole. The number of blows to achieve the standard penetration of 300mm is reported as the 'N' value.

The test is generally carried out in fine soils, however, it may also be carried out in coarse granular soils, weak rocks and glacial tills using the same procedure as for the SPT but with a 50mm diameter, 60° apex solid cone replacing the split spoon sampler, **CPT**.

When attempting the standard penetration test in very dense material or weathered rocks it may be necessary to terminate the test before completion to prevent damage to the equipment. In these circumstances it is important to distinguish how the blow count relates to the penetration of the sampler. This may be achieved in the following manner:

- Where the seating drive has been completed, the test drive is terminated if 50 blows are reached before the full penetration of 300mm is achieved. The penetration for 50 blows is recorded and an approximate N value obtained by linear extrapolation of the number of blows for the partial test drive.
- If the seating drive of 150mm is not achieved within the first 25 blows, the penetration after 25 blows is recorded and the test drive then commenced.
- For tests in soft rocks, the test drive should be terminated after 100 blows where the penetration of 300mm has not been achieved.

The N-value obtained from the Standard Penetration Test may be used to assess the relative density of sands and gravels as follows:

Term	SPT N-Value : Blows/300mm Penetration
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

A2.3 SAMPLES

U(x) represents undisturbed 100mm diameter sample with (x) being the number of blows required to obtain sample.

U fail indicates undisturbed sample not recovered

HV represents Hand Vane test with equivalent undrained shear strength

PP represents Pocket Penetrometer test with equivalent undrained shear strength

CBR represents California Bearing Ratio test

B represents large bulk disturbed samples

D represents small disturbed sample

J Represents chemical disturbed sample in amber jar

W represents water sample

▽ represents water strike

▼ represents level to which water rose

A2.4 DESCRIPTION OF SOILS

A2.4.1 General

The procedures and principles given in Section 6 of BS 5930, ref. 10.8 have been used in the soil descriptions contained within this report.

A2.4.2 Predominantly Coarse Soils

A coarse soil (omitting any boulders or cobbles) contains about 65% or more coarse material and is described as a SAND or GRAVEL depending on which of the constituents predominates. The secondary constituents of coarse soils should precede the main soil type e.g. 'Medium dense brown very gravelly coarse SAND. Gravel is subangular fine and medium of sandstone and mudstone'.

A2.4.3 Deposits containing silt-sized and clay-sized particles

Most soils are mixtures of clay and silt sized particles. Fine soil should be described as either a clay or a silt, depending on the plastic properties. If ambiguous, the term CLAY/SILT should be used.

A2.4.4 Deposits containing mixtures of fine and coarse soil.

The appropriate quantified terms should be used before the principal soil type. It is recommended that the dominant secondary fraction come immediately before the principal soil term. Additional detail can be added in a separate sentence thus, 'Gravelly very clayey SAND. Gravel (10%) is fine of rounded quartz. Clay is firm'. The terms 'silty' and 'clayey' are mutually exclusive as in a coarse soil and based on the plastic properties of the fine fraction.

Table 1 Deposits containing boulder-size and cobble-size particles

Term	Composition
BOULDERS (or COBBLES) with a little finer material	Up to 5% finer material
BOULDERS (or COBBLES) with some finer material	5 to 20% finer material
BOULDERS (or COBBLES) with much finer material	20 to 50% finer material
FINER MATERIAL with many boulders (or cobbles)	50 to 20% boulders (or cobbles)
FINER MATERIAL with some boulders (or Cobbles)	20 to 5% boulders (or cobbles)
FINER MATERIAL with occasional boulders (or cobbles)	up to 5% boulders (or cobbles)

Term	Field Identification	Undrained shear strength (KN/m ²)
Very Soft	Exudes between fingers when squeezed in hand	< 20
Soft	Moulded by light finger pressure	20 - 40
Firm	Can be moulded by strong finger pressure	40 - 75
Stiff	Cannot be moulded by finger. Can be indented by thumb.	75 - 150
Very Stiff	Can be indented by thumbnail.	150 - 300
Hard (or very weak mudstone)		> 300

For clays the strength scale is used as follows:

Term Before	Principal Term	Proportion of secondary Coarse soil	coarse and/or fine constituent soil
Slightly clayey or silty and/or sandy gravelly	SAND		< 5
Clayey or silty and/or sandy or gravelly	GRAVEL and/or		5 - 20 %
Very clayey or silty and/or sandy or gravelly	GRAVEL		20 %
Very sandy or gravelly	SILT or CLAY	< 65 %	
Sandy and/or gravelly		35 - 65 %	
Slightly sandy and/or gravelly		> 35 %	

Table 2 Mixtures of coarse and fine fractions.

Term	Principal Soil Type	Approximate proportion of secondary constituent
Slightly sandy or gravelly	SAND	Up to 5%
Sandy or gravelly	GRAVEL or SAND	5 to 20%
Very sandy or gravelly	SAND and GRAVEL	over 20%
		about equal proportions

Term	Organic Content	Typical Colour
Slightly organic clay or silt	2 - 5	Grey
Slightly organic sand	1 - 3	As mineral
Organic clay or silt	5 - 10	Dark grey
Organic sand	3 - 5	Dark grey
Very organic clay or silt	>10	Black
Very organic sand	>5	Black

Small quantities of dispersed organic matter can have a marked effect on plasticity and hence the engineering properties of the soil. The following quantifying terms are appropriate:

Organic Soils

A2.4.6

'Firm yellow brown slightly sandy CLAY with clods (up to 200mm) of firm to stiff orange CLAY (EMBANKMENT FILL)';

'MADE GROUND dense brown sandy GRAVEL with occasional tiles, wire and glass';

'MADE GROUND comprising plastic bags, window frames, garden refuse and newspapers';

Man made soils (Made Ground or Fill) have been placed by man and can be divided into those composed of natural reworked soils and those composed of man-made materials. Fills are placed in the ground in a controlled manner and soils defined as Made Ground are placed without any engineering control. For example:

Man Made Soils

A2.4.5

Borehole Number	Job Number	Client	Ground Level (mOD)	Boring Method		Location	Dates	Engineer	Sheet	Site
				Casing Diameter 150mm to 15.00m	Cable Percussion					
BH01	40024					Rochdale MBC	18/12/2006		1/2	Queen Elizabeth High School, Rochdale
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.10-0.90	B1					(0.90)	MADE GROUND: Soft, dark brown, sandy, slightly gravelly CLAY. Gravel is angular to subangular, fine to coarse including brick and stone (topsoil).			
1.00	D2	1.20				0.90	Firm, brown, sandy, slightly gravelly CLAY with rootlets. Gravel is angular to subangular, fine to medium, occasionally coarse including mudstone and sandstone.			
1.20-1.65	SPT N=9 D4 B3					(0.70)	Medium dense, brown, silty, slightly gravelly, fine to coarse SAND. Gravel is angular to subangular, mudstone and sandstone. Locally silt pockets.			
1.70	D5					1.60				
2.00-2.45	SPT N=18 D6 B6 D7	2.00	1.80	2.3/4,4,5,5						
3.00-3.45	SPT N=13 B8 D9	3.00	2.50	1,2/2,3,4,4						
4.00-4.45	SPT N=14 D10 D11	4.00	3.00	1,2/3,3,4,4						
5.00-5.45	SPT N=13 D13 B12	5.00	3.00	1,2/3,3,3,4						
6.00-6.45	SPT N=12 D15 B14	6.00	3.50	1,2/2,3,3,4						
7.20	D16					7.20	Loose, brown, silty, slightly gravelly, fine and medium SAND. Gravel is angular to subangular, fine to medium including mudstone and sandstone.			
7.50-7.95	SPT N=8 B17 D18	7.50	4.00	1,1/1,2,2,3		(1.20)				
8.40	D19					8.40	Firm, brown, slightly gravelly CLAY. Gravel is angular to subangular, fine to coarse including mudstone and sandstone.			
9.00-9.45	U20 0.45	9.00		60 blows						
9.50	D21									

Remarks
Slight seepage at 0.90m.
Excavating from 0.00m to 1.20m for 1.00 hour.

Figure No. 40024 BH01
Scale (approx) 1:50
Logged By AK

 IAN FARMER ASSOCIATES	Borehole Number BH01	Job Number 40024	Sheet 2/2	Site Queen Elizabeth High School, Rochdale		Boring Method Cable Percussion		Location Rochdale MBC		Dates 18/12/2006		Engineer Rochdale MBC		Client Rochdale MBC		Ground Level (mOD) 150mm to 15.00m		Level (mOD) (6.60)		Depth (m) (Thickness)		Description Below 10.50m: stiff.		Legend 		Water 		Instr 		Depth (m) 15.00-15.45 13.50-13.95 12.50 12.00-12.45 10.50-10.95		Sample / Tests SPT N=20 D23 U24 0.30 D25 SPT N=15 B26 D27		Casing Depth (m) 10.50 12.00 13.50 15.00		Water Depth (m) DRY DRY WET WET		Field Records 2.3/4.5, 5.6 60 blows Water strike(1) at 12.30m, rose to 11.90m in 20 mins, sealed at 13.30m.		1.2/3.4, 4.5 1.2/3.4, 4.5	Complete at 15.00m	Remarks 15.00-15.45 SPT N=16 D28 13.50-13.95 SPT N=15 B26 D27		Scale (approx) 1:50		Logged By AK		Figure No. 40024.BH01	
---	--------------------------------	---------------------	--------------	---	--	-----------------------------------	--	--------------------------	--	---------------------	--	--------------------------	--	------------------------	--	---------------------------------------	--	-----------------------	--	--------------------------	--	-------------------------------------	--	---	--	--	--	---	--	--	--	--	--	--	--	---	--	--	--	------------------------------	--------------------	---	--	------------------------	--	-----------------	--	--------------------------	--

Boring Method	Client	Job Number	Sheet
Casing Diameter 150mm to 15.00m Cable Percussion	Ground Level (mOD)	40024	1/2
Location	Dates	Engineer	
	19/12/2006-20/12/2006	Rochdale MBC	

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m)	Description	Legend	Water	Inst
-----------	----------------	------------------	-----------------	---------------	-------------	-----------	-------------	--------	-------	------

0.10-0.70	B1					(0.70)	MADE GROUND: Soft, brown, slightly sandy, slightly gravelly CLAY with rootlets. Gravel is angular to subangular, fine to coarse of brick.			
0.80	D2					0.70	Loose, brown, orange, silty, slightly gravelly, fine to coarse SAND with occasional, soft, brown, orange, sandy clay pockets. Gravel is angular to subrounded, fine and medium, occasionally coarse including sandstone and mudstone.			
1.20-1.65	SPT N=8 B3 D4	1.20	DRY	1,1/1,2,2,3		(1.50)				
1.20-2.45	SPT N=11 B5 D6	2.00	MOIST	1,2/2,3,3,3		2.20				
2.00-2.45	D7						Firm, brown, slightly sandy, slightly gravelly CLAY with organic rootlets. Gravel is angular to subrounded, fine to medium including mudstone and sandstone.			
3.00-3.45	U8 0.30	3.00	WET	30 blows		(1.90)	At 3.00m: sand bands.			
3.50	D9					4.10				
4.00-4.45	SPT N=16 B10 D11	4.00	DRY	2,3/3,4,4,5 Water strike(1) at 3.20m in 20 mins, 4.10m, rose to 4.10m, rose to 3.20m in 20 mins, sealed at 7.50m.		4.10	Medium dense, brown, slightly silty, slightly gravelly, angular to subangular, fine and medium of sandstone.			
4.50	D12	5.00				(1.40)				
5.00-5.45	SPT N=12 B13 D14	5.00	4.50	1,2/2,3,3,4		5.50				
5.00-5.45	D15						Medium dense, brown, silty, slightly gravelly, fine and medium SAND. Gravel is angular to subangular, fine and medium of sandstone. (Driller noted occasional thin clay bands).			
6.00-6.45	SPT N=11 B16 D17	6.00	5.00	1,2/2,3,3,3		(1.70)				
7.20	D18	7.50	DRY	80 blows		7.20	Stiff, brown, sandy, slightly gravelly CLAY. Gravel is angular to subrounded, fine to coarse including mudstone and sandstone.			
7.50-7.95	U19 0.45									
8.00	D20					(3.10)				
9.00-9.45	SPT N=26 B21 D22	9.00	DRY	2,4/5,6,7,8 Water strike(2) at 9.30m, rose to 6.90m in 20 mins, sealed at 10.00m.						

Remarks Excavating from 0.00m to 1.20m for 1.00 hour.

Scale (approx)	Logged By	Figure No.
1:50	AK	40024 BH02

Site

Site

Produced by the GEOTECHNICAL DATABASE SYSTEM (GEODASY) (C) all rights reserved

Produced by the

Borehole Number	Site	Client	Ground Level (mOD)	Job Number	Sheet	Legend	Water
BH04	Queen Elizabeth High School, Rochdale	Engineer	Rochdale MBC	40024	1/2		
Boring Method		Location		Dates		Description	
Cable Percussion		Casing Diameter 150mm to 15.50m		20/12/2006-21/12/2006		MADE GROUND: Topsoil (driller's description): MADE GROUND: Brown, clayey, slightly gravelly, fine to coarse SAND with rare pockets of firm, brown clay. Gravel is angular to subangular, fine to coarse including sandstone and brick. MADE GROUND: Loose, brown, clayey, gravelly, fine SAND. Gravel is subangular to subrounded, fine to coarse including mudstone and sandstone.	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m)	Thickness (m)
0.50-0.90	B1	1.20	DRY	1.2/3.2,2.2	(0.10)	0.10	(0.10)
1.20-1.65	SPT N=9 D3 B2	1.20	DRY	1.2/3.2,2.2	(1.10)	0.90	(0.80)
2.00-2.50	U4	2.00	DRY	27 blows	2.00	2.00	(1.10)
2.50	J5				(0.90)	2.90	(0.90)
3.00-3.50	U6	3.00	DAM	29 blows			
3.50	J7						
4.00-4.45	SPT N=9 D9 B8	4.00	DAMP	2.3/2.2,2.3			
4.00-4.50							
5.00-5.50	U10	5.00	DAM	27 blows			
5.50	J11						
6.50-7.00	D13 B12	6.00		Water strike(1) at 5.10m in 20 mins. sealed at 11.00m.			
6.50-6.95	SPT N=19			2.3/5.4,5.5			
8.00-8.45	SPT N=14 B14 D15	8.00		1.2/2.3,4.5			
9.50-9.95	SPT N=9 B16 D17	9.50		2.1/2.2,2.3			
Remarks	Excavating from 0.00m to 1.20m for 1.00 hour.						
Figure No.	40024 BH04	Scale By Logged					
AK	1:50						

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.50-11.00	U18	11.00		47 blows		(2.90) 10.20	Firm, dark brown, sandy CLAY.		
11.00	J19					11.00			
12.00-12.50	B20 D21	12.00		Water strike(2) at 12.00m, rose to 11.10m in 20 mins, sealed at 13.50m. 2.1/2.2,3.3		(2.20) 13.20	Medium dense, brown, silty, fine SAND.		
12.00-12.45	SPT N=10								
13.50-14.00	U22	14.00		51 blows					
14.00	J23					(2.30) 15.50	Stiff, dark brown, sandy, slightly gravelly CLAY with pockets of fine to coarse sand. Gravel is angular to subrounded, fine to coarse of sandstone.		
15.00-15.45	SPT N=27 D24	15.00		4.5/6.6,7.8					
15.00-15.50							Complete at 15.50m		

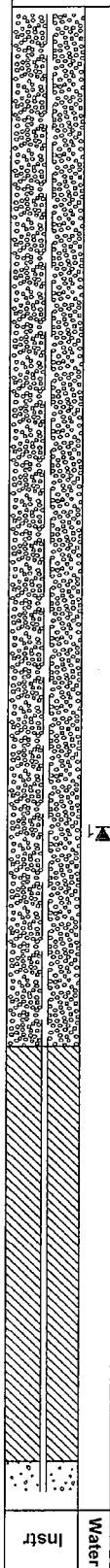
Produced by the GEOTECHNICAL DATABASE SYSTEM (GEODASY) (C) all rights reserved

Boring Method	Casing Diameter 150mm to 150.00m	Location	Dates 20/12/2006- 21/12/2006	Engineer Rochdale MBC	Client	Ground Level (mOD)	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (Thickness) (m)	Description	Legend	Water	Instr	Sheet	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (Thickness) (m)	Description	Legend	Water	Instr
0.10-0.60	B1					(0.10)	Grass over MADE GROUND: Topsoil (driller's description).			
0.60-0.90	B2					(0.50)	MADE GROUND: Firm, dark brown, sandy, slightly gravelly CLAY. Gravel is angular to subangular, fine to coarse of sandstone.			
1.00	D3					0.60	Soft, brown, sandy, slightly gravelly CLAY. Gravel is angular to subangular, fine and medium, occasionally coarse including sandstone and siltstone.			
1.20-1.65	B4 SPT N=10	1.20	DRY	1,2/2,2,3,3		(1.20)	Medium dense, brown, silty, fine and medium SAND.			
2.00-2.45	B6 SPT N=13	2.00	1.80	1,2/3,3,3,4		2.10	Medium dense, brown, silty, fine and medium SAND.			
2.00-2.45	D7 D8									
3.00-3.45	B9 SPT N=11	3.00	2.80	1,2/2,3,3,3						
4.00-4.45	B11 SPT N=13	4.00	3.00	1,2/3,3,3,4		(3.20)				
5.00-5.45	B13 SPT N=14	5.00	3.50	1,2/3,3,4,4		5.30				
6.00-6.45	D15 U16 0.45	6.00	DRY	65 blows			Firm, brown, sandy, slightly gravelly CLAY. Gravel is angular to subrounded, fine and medium including sandstone and quartzite.			
7.50-7.95	B18 SPT N=18	7.50	DRY	2,3/4,4,5,5		(3.70)	Below 7.50m: stiff. Driller noted occasional sand bands.			
9.00-9.45	D21 U20 0.40	9.00	2.50	70 blows		9.00	Stiff, brown, sandy, slightly gravelly CLAY. Gravel is angular to subrounded, fine and medium, occasionally coarse including mudstone, quartzite and sandstone. Driller noted occasional sand bands.			

Remarks
 Slight seepage at 1.30m.
 Water added from 3.00m to 5.70m. Excavating from 0.00m to 1.20m for 1.00 hour.

Scale (approx)	Figure No.	40024 BH05
1:50		



Produced by the GEOTECHNICAL DATABASE SYSTEM (GEODASY) (C) all rights reserved

APPENDIX 3 LABORATORY TESTS

APPENDIX 3

GENERAL NOTES ON LABORATORY TESTS ON SOILS

A3.1 GENERAL

A3.1.1

Where applicable all tests are carried out in accordance with the relevant British Standard. The laboratory test procedures are as below:

Test Name	Procedures
	BS1377:1990
	Part:Clause
Moisture Content	2:3
Liquid Limit	2:4
Plastic Limit and Plastic Index	2:5
Linear Shrinkage	2:6
Particle Size Distribution	2:9
Loss on Ignition	3:4*
Sulphate content	3:5
Chloride Content	3:7*
pH Value	3:9
Compaction Test	4:3*
Moisture condition Value	4:5
California Bearing Ratio	4:7
Consolidation	5:3
Bulk Density	7:2*
Laboratory Vane Tests	7:3*
Shear Box	7:4*
Triaxial Compression	7:8
Total Stress Single-Stage	7:8
Total Stress Multi-Stage	7:9
Effective Stress	Note 1 *
Permeability	Note 2 *
Desiccation	Note 3 *
In-situ density by Sand replacement	Part 9
Core Cutter	Part 9
Nuclear density	Part 9
	BS812
	Part:Clause
Ten % fines (Dry and Soaked)	111
Aggregate crushing value	110
Particle density and water absorption	2
Particle size distribution	103
Moisture content – oven drying	109
Soundness	121

Chloride Content
Sulphate content
Curing/density and compressive strength of concrete tubes
Location of reinforcement
Carbonation
Resistivity
Sampling of concrete dust by drilling
Half cell potential
Note 7
Note 6
Note 5
Note 4
204
116-111-114
124:10.3
124:10.2

A3.1.2
Any discussion in this report is based on the values and results obtained from the appropriate tests. Due allowance should be made, when considering any result in isolation, of the possible inaccuracy of any such individual result. Details of the accuracy of results are included in this section, where applicable.

Note 1 - Manual of soils laboratory testing volume 3: 1985, section 19.2 by K.H. Head
Note 2 - Manual of soils laboratory testing volume 2: 1985, section 10.7 by K.H. Head
Note 3 - BRE Information paper IP4 issued February 1993
Note 4 - BRE Information paper IP6/81
Note 5 - In-house document number 109
Note 6 - In-house document number 112
Note 7 - ASTM C876-91
* Tests are not included in UKAS accreditation

Ian Farmer Associates (1998) Ltd
17 Rivington Court
Warrington
Cheshire
WA1 4RT

F.A.O. Mr A Latimer

TEST REPORT - 40024/1

Site : Queen Elizabeth High School, Rochdale

Job Number : 40024

Originating Client :

Originating Reference : 40024

Date Sampled : Unknown

Date Scheduled : 25/01/07

Date Testing Started : 29/01/07

Date Testing Finished : 08/02/07

Remarks :

- First Report for above Job Number
- Samples will be disposed of 28 days after the report is issue unless otherwise agreed
- This report may contain results from tests which are not included within the scope of the UKAS accreditation. Please see final sheet for details.

Authorised By:

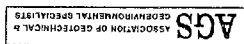


Jonathan Holden

Laboratory Manager

Date : 08/02/07

Page 1 of 13



Ian Farmer Associates (1998) Limited. Registered in England and Wales No. 3661447
Registered Office: Unit 1, Bamnburgh Court, TVE, Gateshead, Tyne & Wear, NE11 0TX
Offices in: Coventry (02476) 456565. Harpenden, Herts. (01582) 460018. Truro (01827) 261775
Warrington (01925) 855440. Newcastle upon Tyne (0191) 4828500. Motherwell (01698) 230231.

		Laboratory Test Report - 40024/1	
Site : Queen Elizabeth High School, Rochdale		Job Number 40024	
Client :		Page 2 / 13	
DETERMINATION OF MOISTURE CONTENT			
Borehole/ Trial Pit	Depth (m)	Sample	Moisture Content %
BH01	1.00	D2	15
BH02	3.00	U8	16
BH03	3.00	D11	19
BH04	1.20	D3	19
BH04	2.00	U4	19
BH04	3.00	U6	21
BH05	1.20	D5	22
BH05	5.50	D15	22
Brown silty sandy gravelly CLAY, Gravel is fine			
Grey silty SAND			
Brown gravelly SAND, Gravel is fine			
Black grey gravelly silty SAND, Gravel is fine			
Grey silty gravelly CLAY, Gravel is fine			
Grey silty gravelly CLAY, Gravel is fine			
Grey brown gravelly SAND, Gravel is fine			
Grey gravelly CLAY, Gravel is fine			
Description			
Method of Preparation : BS 1377:PART 1:1990:7.3.3 Preparation of samples for classification tests			
Method of Test : BS 1377:PART 2:1990:3.2 Determination of oven dried moisture content			
Remarks :			

Job Number40024		Page3 / 13										
Laboratory Test Report - 40024/1		Site : Queen Elizabeth High School, Rochdale										
Client :		Job Number40024										
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY AND LIQUIDITY INDEX												
Borehole/ Trial Pit	Depth (m)	Sample	Natural / Sieved	Natural Moisture Content %	Sample Passing 425µm Sieve Moisture Content %	Percentage %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Class	Description / Remarks
BH01	1.00	D2	Natural	15	89		22	13	9	0.44	CL	Brown silty sandy gravelly CLAY.Gravel is fine
BH02	3.00	U8	Natural	16	63		22	NP				Grey silty SAND
BH03	3.00	D11	Natural	19	61		27	NP				Brown gravelly SAND.Gravel is fine
BH04	1.20	D3	Natural	19	79		23	NP				Black grey gravelly silty SAND.Gravel is fine
BH04	2.00	U4	Natural	19	60		28	22	9	0.67	CL	Grey silty gravelly CLAY.Gravel is fine
BH04	3.00	U6	Natural	21	95		22	16	13	0.46	CL	Grey silty gravelly CLAY.Gravel is fine
BH05	1.20	D5	Natural	22								Grey brown gravelly SAND.Gravel is fine
BH05	5.50	D15	Natural	22	93		24	17	15	0.47	CL	Grey gravelly CLAY.Gravel is fine
Method of Preparation : BS 1377:PART 1:1990;7.4 Preparation of samples for classification tests BS 1377:PART 2:1990;4.2 & 5.2 Sample preparations												
Method of Test : BS 1377:PART 2:1990;3.2 Determination of moisture content 4.3 Determination of the liquid limit 5.3 Determination of the plastic limit and plasticity index												

 IAN FARMER ASSOCIATES		Laboratory Test Report - 40024/1				
Site : Queen Elizabeth High School, Rochdale		Job Number	40024			
Client :		Page	4 / 13			
DETERMINATION OF MOISTURE CONTENT / BULK DENSITY / DRY DENSITY						
Borehole/ Trial Pit	Depth (m)	Sample	Moisture Content %	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Description / Remarks
BH04	2.00	U4	19	2.21	1.86	Grey silty gravelly CLAY. Gravel is fine
Method of Preparation : BS 1377:PART 1:1990:8.2,8.3,8.4						
Method of Test : BS 1377:PART 2:1990:7 Determination of Density						

IAN FARMER ASSOCIATES Laboratory Test Report - 40024/1		Site : Queen Elizabeth High-School, Rochdale Client :		Job Number 40024 Page 5 / 13	
DETERMINATION OF PARTICLE SIZE DISTRIBUTION					
Borehole / Trial Pit		Depth (m)	Sample	Pipette/ Hydrometer	Description
BH01		2.00	D7	N/A	Brown sandy CLAY

Sieve / Particle Size % Passing		200 mm	100
		150 mm	100
		125 mm	100
		90 mm	100
		75 mm	100
		63 mm	100
		50 mm	100
		37.5 mm	100
		28 mm	100
		20 mm	100
		14 mm	100
		10 mm	99
		6.3 mm	99
		5 mm	99
		3.35 mm	99
		2 mm	99
		1.18 mm	99
		600 µm	98
		425 µm	97
		300 µm	91
		212 µm	67
		150 µm	44
		63 µm	29

Grading Analysis		D85	300.0 µm
		D60	200.0 µm
		D10	-
		Uniformity Coefficient	-

Particle Proportions		Cobbles + Boulders	0%
		Gravel	1%
		Sand	70%
		Silt/Clay	29%

CLAY		SILT		SAND		GRAVEL		COBBLES	BOULDERS
Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 7.4.5 Particle size tests

Preparation Details : Sample washed with no dispersant used, Oven Dried at 105 - 110°C

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

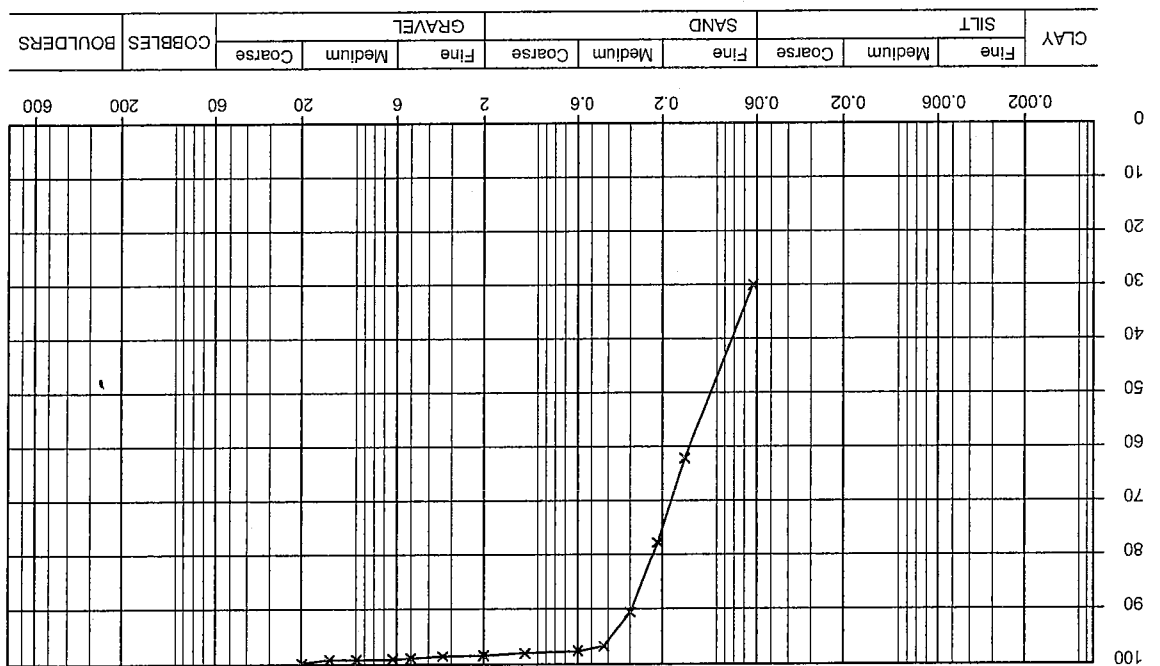
Job Number

Page

6 / 13

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Pipette/ Hydrometer	Description
BH02	1.20	D4	N/A	Gray brown gravelly SAND. Gravel is fine



Particle Proportions	
Cobbles + Boulders	0%
Gravel	1%
Sand	69%
Silt/Clay	30%

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 7.4.5 Particle size tests	Preparation Details : Sample washed with no dispersant used, Oven Dried at 105 - 110°C	Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution
---	--	--

:

Number

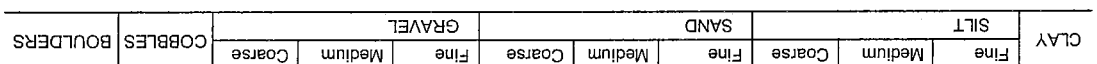
40024

Page

7 / 13

Description

Grey silty gravelly SAND. Gravel is fine



Particle Proportions	
0%	Cobbles + Boulders
2%	Gravel
47%	Sand
51%	Silt/Clay

Remarks

IAN FARMER ASSOCIATES Laboratory Test Report - 40024/1		Site : Queen Elizabeth High School, Rochdale		Job Number 40024		Page 8 / 13	
DETERMINATION OF PARTICLE SIZE DISTRIBUTION							
Borehole / Trial Pit	Depth (m)	Sample	Pipette/ Hydrometer	Description			BH03
5.00	D17	N/A	Brown coarse SAND				
CLAY							
SILT							
SAND							
GRAVEL							
COBBLES							
BOULDERS							
Particle Proportions							
Cobbles + Boulders 0%							
Gravel 0%							
Sand 89%							
Silt/Clay 11%							
Grading Analysis							
D85 400.0 µm							
D60 300.0 µm							
D10 -							
Uniformity Coefficient -							
Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 7.4.5 Particle size tests							
Preparation Details : Sample washed with no dispersant used, Oven Dried at 105 - 110°C							
Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution							
Remarks :							

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

CLAY

SILT

SAND

GRAVEL

COBBLES

BOULDERS

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

0.006

0.02

0.06

0.2

0.6

2

6

20

60

200

600

0

10

20

30

40

50

60

70

80

90

100

0.002

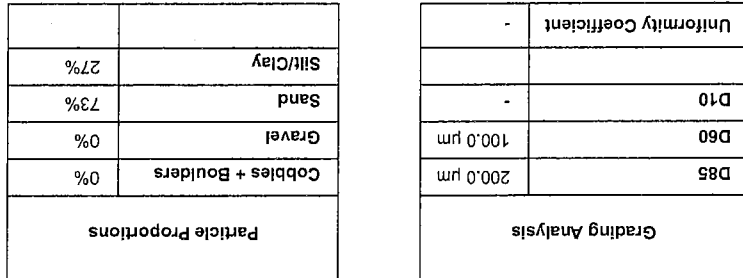
0.006

0.02

<

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

DETERMINATION OF PARTICLE SIZE DISTRIBUTION



Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 7.4.5 Particle size tests	Preparation Details : Sample washed with no dispersant used, Oven Dried at 105 - 110°C	Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution
---	--	--

DETERMINATION OF THE pH VALUE AND THE SULPHATE CONTENT OF SOIL AND GROUNDWATER

Borehole/ Trial Pit	Depth (m)	Sample	Concentration of Soluble Sulphate		Soil	Groundwater	Percentage of sample passing 2mm Sieve %	pH	Description / Remarks
			Total S04 %	S04 in 2:1 watersoil g/l					
BH01	1.00	D2		0.4			75	7.8	Brown silty sandy gravelly CLAY, Gravel is fine
BH01	2.00	D7	0.20				71	8.1	Brown sandy CLAY
BH01	4.00	D11	0.20				88	7.9	Brown coarse SAND
BH02	1.20	D4		0.2			104	8.4	Grey brown gravelly SAND, Gravel is fine
BH02	3.00	U8	0.17				85	8.1	Grey silty SAND
BH02	4.50	D12	0.18				84	8.3	Grey gravelly SAND, Gravel is fine
BH03	1.20	D3		0.2			93	7.0	Grey silty gravelly SAND, Gravel is fine
BH03	3.00	D11		0.4			87	8.7	Brown gravelly SAND, Gravel is fine
BH03	5.00	D17		0.1			100	9.0	Brown coarse SAND
BH04	1.20	D3	0.24				95	6.9	Black grey gravelly silty SAND, Gravel is fine
BH04	2.00	U4		0.2			93	6.8	Grey silty gravelly CLAY, Gravel is fine
BH04	3.00	U6		0.4			87	8.2	Grey silty gravelly CLAY, Gravel is fine
BH04	6.50	D13		0.1			68	9.0	Brown SAND with clay pockets
BH05	1.20	D5	0.18				77	7.5	Grey brown gravelly SAND, Gravel is fine
BH05	5.50	D15		<0.1			80	8.2	Grey gravelly CLAY, Gravel is fine

Method of Preparation : BS 1377:PART 1:1990:7.5 Preparation of soil for chemical tests BS 1377:PART 3:1990:5.2, 5.3, 5.4 & 9.4

Method of Test	
: BS 1377:PART 3:1990:5 Determination of the sulphate content of soil and ground water BS 1377:PART 3:1990:9 Determination of the pH value	

Number

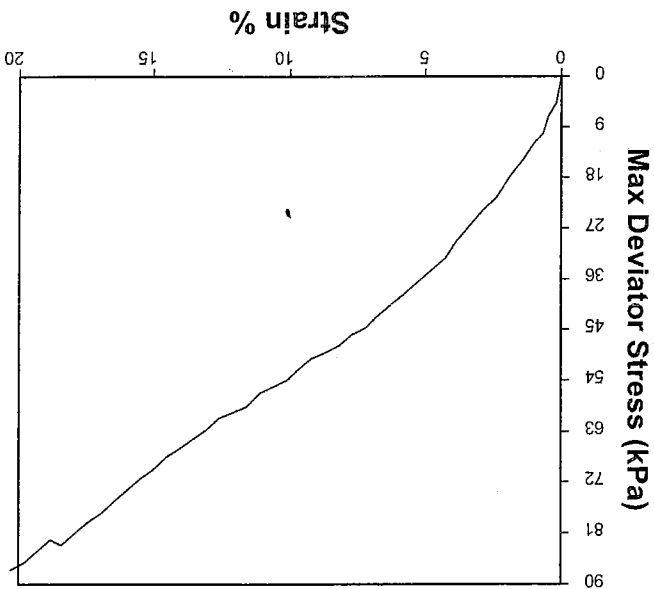
40024

8

DETERMINATION OF DENSITY, MOISTURE CONTENT AND UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT THE MEASUREMENT OF PORE PRESSURE

Borehole / Depth	Trial Pit (m)	U6	Grey silty gravelly CLAY, Gravel is fine
			Description

Initial Specimen		Test Type		Test Results	
		Single Stage		Measured Cell Pressure (kPa)	60
		Length of Specimen (mm)		Strain at Failure (%)	20.3
		Diameter of Specimen (mm)		Membrane Correction (kPa)	1.1
		Moisture Content (%)		Corrected Deviator Stress (kPa)	86
		21		Shear Stress (kPa)	43
		Bulk Density (Mg/m³)		Mode of Failure (B/P/C)	Plastic
		2.30			
		Dry Density (Mg/m³)			
		1.89			
Membrane Thickness (mm)					
0.3					
Membrane Type					
Latex					
Rate of Strain (%/min)					
2.90					



Method of Preparation : BS 1377:PART 1:1990:7.4.2 Moisture content, Preparation of undisturbed samples for testing BS 1377:PART 1:1990:8.3 Preparation of disturbed samples for testing BS1377 PART1:7.7.5.2	Method of Test : BS 1377:PART 2:1990:3.2 Determination of moisture content 7.2 Determination of density BS 1377:PART 8:1990:5.3,6.2,7 Consolidated Undrained shear strength Multistage loading with pwp	Remarks : Membrane Type: Latex
--	---	--------------------------------

 IAN FARMER ASSOCIATES		Laboratory Test Report - 40024/1					
Site : Queen Elizabeth High School, Rochdale		Job Number	40024				
Client :		Page	12 / 13				
Engineer :							
DETERMINATION OF EQUIVALENT SHEAR STRESS BY HAND VANE							
Borehole/ Trial Pit	Depth (m)	Sample	Type	Location	Readings	Equivalent Shear Stress kN/m ²	Description / Remarks
BH04	2.00	U4		Top	1.00 1.00 1.00	9.8	Grey silty gravelly CLAY. Gravel is fine
Method of Preparation : HV							
Method of Test : HV							

Test Report : 40024/1

Site : Queen Elizabeth High School, Rochdale
Job Number : 40024
Originating Client :

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

The following tests contained within this report are not UKAS Accredited.
Hand Vane

Date of Issue : 08/02/07

APPENDIX 4
CHEMICAL TESTS

08th February 2007

Ian Farmer Associates
 17 Rivington Court
 Warrington
 Cheshire
 WA1 4RT
 FAO Michelle Hirst

TEST REPORT - 81751

Site reference Queen Elizabeth High School

Your Ref 40024

Samples scheduled 6 soils

Date sampled Not known

Time sampled Not known

Preservation & Stabilisation of samples None

Date scheduled 22nd January 2007

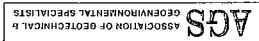
Date analysis started 22nd January 2007

Date analysis finished 08th February 2007

Authorised by *C Lopez Garabito*
 C Lopez Garabito M.Phil. Laboratory Manager

Page 1 of 8
 (plus 9 pages of STL report UKAS No1510)

Determinations marked * are not included in the UKAS scope for accreditation for our laboratory. Determinations marked M are included in the MCERTS scope for accreditation for our laboratory.
 Soil analysis are carried out on an air-dried and ground test portion of the sample unless otherwise stated in the standard procedure summary. Air drying is carried out at no greater than 30°C. All results are reported on an air-dried basis. Where tests are carried out on 'as received' samples, results are corrected by taking into account % of moisture and reported on an air-dried basis. This will be indicated in the standard procedure summary.
 Samples are not preserved or stabilised on site unless otherwise stated in the test report.
 Soil samples will be disposed of 30 days and water and leachates 10 days after a report is issued unless otherwise agreed.
 Information about standard procedure and performance characteristics of the determinations are available on request.



Ian Farmer Associates (1998) Limited. Registered in England and Wales No.3661447.
 Registered Office: Unit 1, Bamburg Court, Team Valley Trading Estate, Gateshead, NE11 0TX.
 Offices in: Coventry (024) 7645 6565. Harpenden, Herts. (01582) 460018. Metherwell (01698) 230231.
 Newcastle upon Tyne (0191) 482 8500. Truro (01872) 261775. Warrington (01925) 855440.

Dark brown LOAM with some stones and roots

Detname Std. Procedure Units Results Date of analysis

Moisture Content* 118 % 24.49 25/01/2007

Stones Content* 118 % 15.49 25/01/2007

Asbestos* 137 presence 23/01/2007

Arsenic (total)^M 122 mg/kg 23 31/01/2007

Barium (total)^M 122 mg/kg 140 31/01/2007

Cadmium (total)^M 122 mg/kg 0.74 31/01/2007

Chromium (total)^M 122 mg/kg 26 31/01/2007

Lead (total)^M 122 mg/kg 110 31/01/2007

Selenium (total)^M 122 mg/kg <1.2 31/01/2007

Zinc (total)^M 122 mg/kg 150 31/01/2007

pH^M 119 pH units 7.4 23/01/2007

Naphthalene^M 163 mg/kg <0.10 30/01/2007

Acenaphthylene^M 163 mg/kg <0.10 30/01/2007

Acenaphthene^M 163 mg/kg <0.10 30/01/2007

Fluorene^M 163 mg/kg <0.10 30/01/2007

Phenanthrene^M 163 mg/kg 1.4 30/01/2007

Anthracene^M 163 mg/kg 1.3 30/01/2007

Fluoranthene^M 163 mg/kg 1.6 30/01/2007

Pyrene^M 163 mg/kg 1.6 30/01/2007

Benzo(a)anthracene^M 163 mg/kg 1.0 30/01/2007

Chrysene^M 163 mg/kg 1.3 30/01/2007

Benzo(b)fluoranthene^M 163 mg/kg 1.5 30/01/2007

Benzo(k)fluoranthene^M 163 mg/kg 1.2 30/01/2007

Benzo(a)pyrene^M 163 mg/kg 2.6 30/01/2007

Indeno(123cd)pyrene^M 163 mg/kg 2.2 30/01/2007

Dibenzo(ah)anthracene^M 163 mg/kg <0.10 30/01/2007

Benzo(ghi)perylene^M 163 mg/kg 1.9 30/01/2007

PAH (total)^M 163 mg/kg 18 30/01/2007

Site Name/Reference

IFA Ref

81751-1

Sample Type

Soil

Borehole/trial pit

BH 01

Depth (m)

0.10

Date Sampled

Not Known

Sample Description

Comments

Checked and Issued By

C. Lopez-Garabito

Date 08/02/07

C Lopez-Garabito Laboratory Manager

Key

Not included in the UKAS scope for accreditation for our laboratory.

Not Scheduled

Insufficient Sample

None Detected

Not Received

SP No Standard Procedure No

81751-2

IFA Ref

Sample Type

Soil

Borehole/trial pit

BH 01

Depth (m)

1.20

Date Sampled

Not Known

Sample Description

Brown LOAM

Detname	Std. Procedure	Units	Results	Date of analysis
---------	----------------	-------	---------	------------------

Moisture Content*

Stones Content*

Asbestos*

Arsenic (total)^MBarium (total)^MCadmium (total)^MChromium (total)^MLead (total)^MSelenium (total)^MZinc (total)^MpH^MNaphthalene^MAcenaphthylene^MAcenaphthene^MFluorene^MPhenanthrene^MAnthracene^MFluoranthene^MPyrene^MBenzo(a)anthracene^MChrysene^MBenzo(b)fluoranthene^MBenzo(k)fluoranthene^MBenzo(a)pyrene^MIndeno(123cd)pyrene^MDibenzo(a,h)anthracene^MBenzo(ghi)perylene^MPAH (total)^M

Comments

Checked and Issued By *C. Lopez-Garabito*

Date 08/02/07

Key

* Not included in the UKAS scope for accreditation for our laboratory.

- Not Scheduled

! Insufficient Sample

nd None Detected

nr Not Received

SP No Standard Procedure No

Detname Std. Procedure Units Results Date of analysis

Moisture Content* 118 % 22.04 25/01/2007

Stones Content* 118 % 3.52 25/01/2007

Asbestos* 137 presence - -

Arsenic (total)^M 122 mg/kg 19 31/01/2007

Barium (total)^M 122 mg/kg 140 31/01/2007

Cadmium (total)^M 122 mg/kg 0.49 31/01/2007

Chromium (total)^M 122 mg/kg 20 31/01/2007

Lead (total)^M 122 mg/kg 50 31/01/2007

Selenium (total)^M 122 mg/kg <1.2 31/01/2007

Zinc (total)^M 122 mg/kg 67 31/01/2007

pH^M 119 pH units 7.1 23/01/2007

Naphthalene^M 163 mg/kg <0.10 30/01/2007

Acenaphthylene^M 163 mg/kg <0.10 30/01/2007

Acenaphthene^M 163 mg/kg <0.10 30/01/2007

Fluorene^M 163 mg/kg <0.10 30/01/2007

Phenanthrene^M 163 mg/kg 0.31 30/01/2007

Anthracene^M 163 mg/kg 0.26 30/01/2007

Fluoranthene^M 163 mg/kg 0.36 30/01/2007

Pyrene^M 163 mg/kg 0.35 30/01/2007

Benzo(a)anthracene^M 163 mg/kg 0.22 30/01/2007

Chrysene^M 163 mg/kg 0.28 30/01/2007

Benzo(b)fluoranthene^M 163 mg/kg 0.33 30/01/2007

Benzo(k)fluoranthene^M 163 mg/kg 0.26 30/01/2007

Benzo(a)pyrene^M 163 mg/kg 0.51 30/01/2007

Indeno(123cd)pyrene^M 163 mg/kg 0.45 30/01/2007

Dibenzo(a,h)anthracene^M 163 mg/kg <0.10 30/01/2007

Benzo(ghi)perylene^M 163 mg/kg 0.37 30/01/2007

PAH (total)^M 163 mg/kg 3.7 30/01/2007

Comments

Checked and Issued By

C. Lopez-Garabito

Date

08/02/07

Key

* Not included in the UKAS scope for accreditation for our laboratory.
- Not Scheduled
i Insufficient Sample
nd None Detected
nr Not Received
SP No Standard Procedure No

Detname Std. Procedure Units Results Date of analysis

Moisture Content*	118	%	5.28	25/01/2007
Stones Content*	118	%	62.36	25/01/2007
Asbestos*	137	presence	nd	23/01/2007
Arsenic (total) ^M	122	mg/kg	6.1	31/01/2007
Barium (total) ^M	122	mg/kg	210	31/01/2007
Cadmium (total) ^M	122	mg/kg	0.38	31/01/2007
Chromium (total) ^M	122	mg/kg	25	31/01/2007
Lead (total) ^M	122	mg/kg	13	31/01/2007
Selenium (total) ^M	122	mg/kg	1.6	31/01/2007
Zinc (total) ^M	122	mg/kg	63	31/01/2007
pH ^M	119	pH units	8.2	23/01/2007
Naphthalene ^M	163	mg/kg	2.6	30/01/2007
Acenaphthylene ^M	163	mg/kg	2.8	30/01/2007
Acenaphthene ^M	163	mg/kg	3.1	30/01/2007
Fluorene ^M	163	mg/kg	2.9	30/01/2007
Phenanthrene ^M	163	mg/kg	9.2	30/01/2007
Anthracene ^M	163	mg/kg	5.9	30/01/2007
Fluoranthene ^M	163	mg/kg	41	30/01/2007
Pyrene ^M	163	mg/kg	38	30/01/2007
Benzo(a)anthracene ^M	163	mg/kg	17	30/01/2007
Chrysene ^M	163	mg/kg	17	30/01/2007
Benzo(b)fluoranthene ^M	163	mg/kg	14	30/01/2007
Benzo(k)fluoranthene ^M	163	mg/kg	14	30/01/2007
Benzo(a)pyrene ^M	163	mg/kg	19	30/01/2007
Indeno(123cd)pyrene ^M	163	mg/kg	12	30/01/2007
Dibenzo(ah)anthracene ^M	163	mg/kg	4.0	30/01/2007
Benzo(ghi)perylene ^M	163	mg/kg	13	30/01/2007
PAH (total) ^M	163	mg/kg	220	30/01/2007

Comments

Checked and Issued By

C. Lopez-Garabito

Date

08/02/07

C Lopez-Garabito Laboratory Manager

Key

- * Not included in the UKAS scope for accreditation for our laboratory.
- Not Scheduled
- i Insufficient Sample
- nd None Detected
- nr Not Received
- SP No Standard Procedure No

Comments

Checked and Issued By

C. Lopez-Garabito

Date

08/02/07

Key

* Not included in the UKAS scope for accreditation for our laboratory.

- Not Scheduled

! Insufficient Sample

nd None Detected

nr Not Received

SP No Standard Procedure No

Detname	Std. Procedure	Units	Results	Date of analysis
---------	----------------	-------	---------	------------------

Moisture Content*	118	%	17.41	25/01/2007
-------------------	-----	---	-------	------------

Stones Content*	118	%	13.44	25/01/2007
-----------------	-----	---	-------	------------

Asbestos*	137	presence	nd	23/01/2007
-----------	-----	----------	----	------------

Arsenic (total) ^M	122	mg/kg	7.4	31/01/2007
------------------------------	-----	-------	-----	------------

Barium (total) ^M	122	mg/kg	58	31/01/2007
-----------------------------	-----	-------	----	------------

Cadmium (total) ^M	122	mg/kg	<0.30	31/01/2007
------------------------------	-----	-------	-------	------------

Chromium (total) ^M	122	mg/kg	16	31/01/2007
-------------------------------	-----	-------	----	------------

Lead (total) ^M	122	mg/kg	15	31/01/2007
---------------------------	-----	-------	----	------------

Selenium (total) ^M	122	mg/kg	<1.2	31/01/2007
-------------------------------	-----	-------	------	------------

Zinc (total) ^M	122	mg/kg	24	31/01/2007
---------------------------	-----	-------	----	------------

pH ^M	119	pH units	7.5	23/01/2007
-----------------	-----	----------	-----	------------

Naphthalene ^M	163	mg/kg	<0.10	30/01/2007
--------------------------	-----	-------	-------	------------

Acenaphthylene ^M	163	mg/kg	<0.10	30/01/2007
-----------------------------	-----	-------	-------	------------

Acenaphthene ^M	163	mg/kg	<0.10	30/01/2007
---------------------------	-----	-------	-------	------------

Fluorene ^M	163	mg/kg	<0.10	30/01/2007
-----------------------	-----	-------	-------	------------

Phenanthrene ^M	163	mg/kg	<0.10	30/01/2007
---------------------------	-----	-------	-------	------------

Anthracene ^M	163	mg/kg	<0.10	30/01/2007
-------------------------	-----	-------	-------	------------

Fluoranthene ^M	163	mg/kg	0.28	30/01/2007
---------------------------	-----	-------	------	------------

Pyrene ^M	163	mg/kg	0.28	30/01/2007
---------------------	-----	-------	------	------------

Benzo(a)anthracene ^M	163	mg/kg	0.17	30/01/2007
---------------------------------	-----	-------	------	------------

Chrysene ^M	163	mg/kg	0.23	30/01/2007
-----------------------	-----	-------	------	------------

Benzo(b)fluoranthene ^M	163	mg/kg	0.28	30/01/2007
-----------------------------------	-----	-------	------	------------

Benzo(k)fluoranthene ^M	163	mg/kg	0.22	30/01/2007
-----------------------------------	-----	-------	------	------------

Benzo(a)pyrene ^M	163	mg/kg	0.46	30/01/2007
-----------------------------	-----	-------	------	------------

Indeno(123cd)pyrene ^M	163	mg/kg	0.40	30/01/2007
----------------------------------	-----	-------	------	------------

Dibenzo(ah)anthracene ^M	163	mg/kg	<0.10	30/01/2007
------------------------------------	-----	-------	-------	------------

Benzo(ghi)perylene ^M	163	mg/kg	0.33	30/01/2007
---------------------------------	-----	-------	------	------------

PAH (total) ^M	163	mg/kg	2.7	30/01/2007
--------------------------	-----	-------	-----	------------

Comments

Checked and Issued By *C. Garabito* Date 08/02/07

C Lopez-Garabito Laboratory Manager

Key

- * Not included in the UKAS scope for accreditation for our laboratory.
- Not Scheduled
- ! Insufficient Sample
- nd None Detected
- nr Not Received
- SP No Standard Procedure No

Standard Procedure Summary

S.P. No.	Standard Procedure Summary
119	A (5:2) water to soil extract is analysed using a pH meter.
122	Metals are extracted from soil samples in aqua regia (hydrochloric/nitric acids 3:1 ratio). The extracts are then analysed by ICP-OES at defined wavelengths.
163	PAH's are extracted from 'as received' soil samples by dichloromethane under pressure in a Soxhlet. The extract is then reduced in a turbidimeter. The reduced extract is analysed by GC-MS. Results are reported on an air-dried basis.

Report Summary



STL

1314
1229
0897
1510

Ms Carolina Lopez
Ian Farmer Ass. (Coventry)
2/4 Bilton Road Industrial Est
Humber Avenue
Coventry
Warwickshire
CV3 1JL

Report Number : LL/401538/2007 Issue 2

Job Description : LHL - Coventry

Job Location : Ian Farmer Associates

Number of Samples included in report : 6
Job Received : 24 January 2007

Number of Test Results : 48
Analysis Commenced : 24 January 2007
included in report

Signed : 
Name : J. Rogers
Date : 07 February 2007
Title : Production Manager

STL was not responsible for sampling unless otherwise stated. Sampling is not covered by our UKAS accreditation. Information on the methods of analysis and performance characteristics are available on request. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. Tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for our laboratory. MCerts accreditation refers to analysis carried out at our Lockhurst Lane site only. Analysis carried out on air-dried and ground test portion of the sample(s), unless otherwise stated. Air drying is carried out at not greater than 30 degrees C. Samples are not preserved on site, unless otherwise stated. All results are reported on an air-dried basis.

Certificate of Analysis



STL

Matrix : Soil

Sample 1 Laboratory Number : 862513

1314
0897
1229
1510

of 6 Report Number : LL/401538/2007 Issue 2

Sample Source : Ian Farmer Ass. (Coventry)

Sample Point Description : Ian Farmer Associates

Sample Description : 1/BH01 0.10m

Visual Description : Dark brown loam occasional stone and root

Sample Date : Sample Time : 1

Sample Received : 24 January 2007

Test Description	Result	Units	Analysis Date	UoM	%	Accreditation	Method
Stones BG 2.6/3.0	24	%	07/02/2007			L	Stones
Moisture content at 30 C	23	%	07/02/2007			L	33A
Copper as Cu, dry weight	49	mg/kg	27/01/2007			M	30
Mercury as Hg, dry weight	0.30	mg/kg	27/01/2007			M	30C
Nickel as Ni, dry weight	23	mg/kg	27/01/2007			M	30
Cyanide (Total)	<2.0	mg/kg	26/01/2007			L	14
Organic matter	8.1	%	29/01/2007			L	36
Phenol, Total	2.3	mg/kg	26/01/2007			L	40A

Analyst Comment for 862513 :

Accreditation Codes : * = Not UKAS accredited, B = Analysed at STL Bridgend, C = Analysed at STL Coventry, R = Analysed at STL Runcorn, L = Analysed at STL Midlands, S = Sub-contracted, M = Microbiological determinands 0 or ND = Not Detected, DET = Detected, For Legionella ND=Not detected in volume of sample filtered.

I/S = Insufficient sample

Certificate of Analysis



STL

Matrix : Soil

Sample 2 Laboratory Number : 862514

1314
0897
1229
1510

of 6 Report Number : LL/401538/2007 Issue 2

Sample Source : Ian Farmer Ass. (Coventry)

Sample Point Description : Ian Farmer Associates

Sample Description : 2/BH01 1.20m

Visual Description : Brown loam

Sample Date : Sample Time : 2

Sample Received : 24 January 2007

Test Description	Result	Units	Analysis Date	UoM	%	Accreditation	Method
Stones BG 2.6/3.0	21	%	07/02/2007			L	Stones
Moisture content at 30 C	16	%	07/02/2007			L	33A
Copper as Cu, dry weight	16	mg/kg	27/01/2007			M	30
Mercury as Hg, dry weight	<0.20	mg/kg	27/01/2007			M	30C
Nickel as Ni, dry weight	25	mg/kg	27/01/2007			M	30
Cyanide (Total)	<2.0	mg/kg	26/01/2007			L	14
Organic matter	1.8	%	29/01/2007			L	36
Phenol, Total	0.81	mg/kg	26/01/2007			L	40A

Analyst Comment for 862514 :

Accreditation Codes : * = Not UKAS accredited, B = Analysed at STL Bridgend, C = Analysed at STL Coventry, R = Analysed at STL Runcom, L = Analysed at STL Midlands, S = Sub-contracted, M = MCerts
For Microbiological determinands 0 or ND = Not Detected, DET = Detected, For Legionella ND=Not detected in volume of sample filtered.

I/S = Insufficient sample

Severn Trent Laboratories Ltd

Rayner House, 80 Lockhurst Lane, Coventry CV6 5PZ Tel : 02476 584800 Fax : 02476 584848

Certificate of Analysis



STL

Matrix : Soil

Sample 3 Laboratory Number : 862515

1314
0897
1510

of 6 Report Number : LL/401538/2007 Issue 2

Sample Source : Ian Farmer Ass. (Coventry)

Sample Point Description : Ian Farmer Associates

Sample Description : 3/BH02 0.10m

Visual Description : Brown loam occasional stone and brick

Sample Date : Sample Time : 3

Sample Received : 24 January 2007

Test Description	Result	Units	Analysis Date	UoM	%	Accreditation	Method
Stones BG 2.6/3.0	28	%	07/02/2007		*	L	Stones
Moisture content at 30 C	17	%	07/02/2007		*	L	33A
Copper as Cu, dry weight	23	mg/kg	27/01/2007			M	30
Mercury as Hg, dry weight	<0.20	mg/kg	27/01/2007			M	30C
Nickel as Ni, dry weight	22	mg/kg	27/01/2007			M	30
Cyanide (Total)	<2.0	mg/kg	26/01/2007			L	14
Organic matter	3.3	%	29/01/2007			L	36
Phenol, Total	3.1	mg/kg	26/01/2007			L	40A

Analyst Comment for 862515 :

Accreditation Codes : * = Not UKAS accredited, B = Analysed at STL Bridgend, C = Analysed at STL Coventry, R = Analysed at STL Runcom, L = Analysed at STL Midlands, S = Sub-contracted, M = Microbiological determinands 0 or ND = Not Detected, DET = Detected, For Legionella ND=Not detected in volume of sample filtered, I/S = Insufficient sample

Certificate of Analysis



STL

Matrix : Soil

Sample 4 Laboratory Number : 862516

of 6 Report Number : LL/401538/2007 Issue 2

Sample Source : Ian Farmer Ass. (Coventry)

Sample Point Description : Ian Farmer Associates

Sample Description : 4/BH03 0.10m

Visual Description : Brown loam occasional white stone

Sample Date : Sample Time : 4

Sample Received : 24 January 2007

Test Description	Result	Units	Analysis Date	UoM	%	Accreditation	Method
Stones BG 2.6/3.0	47	%	07/02/2007			*	Stones
Moisture content at 30 C	5.1	%	07/02/2007			*	33A
Copper as Cu, dry weight	17	mg/kg	27/01/2007			M	30
Mercury as Hg, dry weight	<0.20	mg/kg	27/01/2007			M	30C
Nickel as Ni, dry weight	23	mg/kg	27/01/2007			M	30
Cyanide (Total)	<2.0	mg/kg	26/01/2007			L	14
Organic matter	11	%	29/01/2007			L	36
Phenol, Total	0.54	mg/kg	26/01/2007			L	40A

Analyst Comment for 862516 :

Accreditation Codes : * = Not UKAS accredited, B = Analysed at STL Bridgend, C = Analysed at STL Coventry, R = Analysed at STL Runcorn, L = Analysed at STL Midlands, S = Sub-contracted, M = MCERTS
For Microbiological determinands 0 or ND = Not Detected, DET = Detected, For Legionella ND=Not detected in volume of sample filtered.

L/S = Insufficient sample

Certificate of Analysis



STL

Matrix : Soil

Sample 5 Laboratory Number : 862517

1314
0897
1229
1510

of 6 Report Number : LL/401538/2007 Issue 2

Sample Source : Ian Farmer Ass. (Coventry)

Sample Point Description : Ian Farmer Associates

Sample Description : 5/BH03 1.20m

Visual Description : Brown loam

Sample Date :

Sample Time : 5

Sample Received : 24 January 2007

Test Description	Result	Units	Analysis Date	UoM %	Accreditation	Method
Stones BG 2.6/3.0	23	%	07/02/2007		*	L Stones
Moisture content at 30 C	22	%	07/02/2007		*	L 33A
Copper as Cu, dry weight	25	mg/kg	27/01/2007		M	L 30
Mercury as Hg, dry weight	<0.20	mg/kg	27/01/2007		M	L 30C
Nickel as Ni, dry weight	14	mg/kg	27/01/2007		M	L 30
Cyanide (Total)	<2.0	mg/kg	26/01/2007			L 14
Organic matter	6.5	%	29/01/2007			L 36
Phenol, Total	0.59	mg/kg	26/01/2007			L 40A

Analyst Comment for 862517 :

Accreditation Codes : * = Not UKAS accredited, B = Analysed at STL Bridgend, C = Analysed at STL Coventry, R = Analysed at STL Runcom, L = Analysed at STL Midlands, S = Sub-contracted, M = Microbiological determinands 0 or ND = Not Detected, DET = Detected, For Legionella ND=Not detected in volume of sample filtered, I/S = Insufficient sample

Severn Trent Laboratories Ltd

Rayner House, 80 Lockhurst Lane, Coventry CV6 5PZ Tel : 02476 584800 Fax : 02476 584848

Certificate of Analysis



STL

Matrix : Soil

Sample 6 Laboratory Number : 862518

1314
0897
1229
1510

of 6 Report Number : LL/401538/2007 Issue 2

Sample Source : Ian Farmer Ass. (Coventry)

Sample Point Description : Ian Farmer Associates

Sample Description : 6/BH304 0.50m

Visual Description : Brown loam occasional root and stone

Sample Date : Sample Time : 6

Sample Received : 24 January 2007

Test Description	Result	Units	Analysis Date	UoM	%	Accreditation	Method
Stones Bg 2.6/3.0	19	%	07/02/2007			*	L
Moisture content at 30 C	18	%	07/02/2007			*	L
Copper as Cu, dry weight	15	mg/kg	27/01/2007			M	L
Mercury as Hg, dry weight	<0.20	mg/kg	27/01/2007			M	L
Nickel as Ni, dry weight	11	mg/kg	27/01/2007			M	L
Cyanide (Total)	<2.0	mg/kg	26/01/2007				L
Organic matter	3.6	%	29/01/2007				L
Phenol, Total	0.82	mg/kg	26/01/2007				L

Analyst Comment for 862518 :

Accreditation Codes : * = Not UKAS accredited, B = Analysed at STL Bridgend, C = Analysed at STL Coventry, R = Analysed at STL Runcom, L = Analysed at STL Midlands, S = Sub-contracted, M = MCerts
For Microbiological determinands 0 or ND = Not Detected, DET = Detected, For Legionella ND=Not detected in volume of sample filtered.

L/S = Insufficient sample

Signed :

Name : J. Rogers

Date : 07 February 2007

Title : Production Manager

DETERMINAND COMMENTS FOR REPORT

Sample No	Description	Determinand	Comments
-----------	-------------	-------------	----------

Signed :			
Name :		Date : 07 February 2007	
Title :			

Method	Statement
--------	-----------

14	The cyanides in the sample are determined in two stages. The free cyanide is liberated by heating with pH 4 buffer and the resulting gas collected in sodium hydroxide solution. Complex cyanide is liberated using phosphoric acid under the same conditions. The two portions of sodium hydroxide are then analysed for cyanide content using a discrete autoanalyser.
----	--

30	Metals are extracted from land samples by boiling with hydrochloric/nitric acids (3:1 ratio). The measurement of metal concentrations is determined directly on an ICP-OES at defined wavelengths.
----	--

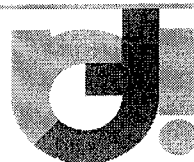
30C	Metals are extracted from land samples by boiling with hydrochloric/nitric acid (3:1 ratio). The measurement of metal concentrations is determined by means of hydride generation / atomic vapour on an ICP-OES at defined wavelengths.
-----	---

33A	Moisture Content is the weight difference between an as received sample and the air dried sample at 30 °C.
-----	--

36	This method determines the percentage, by dry mass, of natural organic matter present in soil.
----	--

40A	This method determines steam distillable phenolic compounds in land materials. Phenol is extracted from air dried soil using steam distillation. The pH adjusted distillate is measured colorimetrically at a defined wavelength.
-----	---

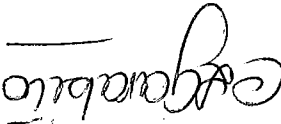
Stones	The percentage weight of the stones that are naturally occurring and are greater than 10mm in diameter of the total weight of sample.
--------	---



09th March 2007

Ian Farmer Associates
17 Rivington Court
Warrington
Cheshire
WA1 4RT
FAO Michelle Hirst

TEST REPORT - 81836

Site reference	Queen Elizabeth High School
Your Ref	40024
Samples scheduled	2 soils
Date sampled	Not known
Time sampled	Not known
Preservation & Stabilisation of samples	None
Date scheduled	27th February 2007
Date analysis started	Samples subcontracted to DETS
Date analysis finished	08th March 2007
Authorised by	C Lopez Garabito M.Phil. Laboratory Manager
	
	Page 1 of 1 (plus 2 pages of DETS report UKAS No2139)



2139

Certificate of Analysis

Certificate Number: 07-10133

Date: 09/03/2007

Client:

Ian Farmer Associates
2-4 Bilton Industrial Estate,
Humber Avenue,
Coventry
CV3 1JL

Our Reference:

07-10133

Client Reference:

81836

Contract Title:

2 soil samples

Date Received:

01/03/2007

Date Started:

01/03/2007

Date Completed:

09/03/2007

Test Procedures:

Identified by prefix DETSn, details available upon request.

Notes:

Observations and interpretations are outside the scope of UKAS accreditation
* denotes test not included in laboratory scope of accreditation
\$ denotes tests completed by approved subcontractors
I/S denotes insufficient sample to carry out test
N/S denotes that the sample is not suitable for testing
Solid samples will be disposed 1 month and liquids 2 weeks
after the date of issue of this test certificate

Approved By:

Rob Brown

Business Manager

Authorised Signatories:

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.

Summary of Chemical Analysis

Our Ref: 07-10133
Client Ref: 81836

Contract Title:

Lab No.	Sample Ref	Depth	Other Ref	Sample Type	Units	Test
68179	BH01	0.10		DETSxx		
68180	BH04	0.50				

Aliphatic C5-C6	mg/kg	DETS 072*	< 1	< 1	< 1
Aliphatic C6-C8	mg/kg	DETS 072*	< 1	< 1	< 1
Aliphatic C8-C10	mg/kg	DETS 072*	< 1	< 1	< 1
Aliphatic C10-C12	mg/kg	DETS 072*	< 10	< 10	< 10
Aliphatic C12-C16	mg/kg	DETS 072*	< 10	< 10	< 10
Aliphatic C16-C21	mg/kg	DETS 072*	15	< 10	< 10
Aliphatic C21-C35	mg/kg	DETS 072*	46	< 10	< 10
Aromatic C5-C7	mg/kg	DETS 072*	< 1	< 1	< 1
Aromatic C7-C8	mg/kg	DETS 072*	< 1	< 1	< 1
Aromatic C8-C10	mg/kg	DETS 072*	< 1	< 1	< 1
Aromatic C10-C12	mg/kg	DETS 072*	< 10	< 10	< 10
Aromatic C12-C16	mg/kg	DETS 072*	< 10	< 10	< 10
Aromatic C16-C21	mg/kg	DETS 072*	15	< 10	< 10
Aromatic C21-C35	mg/kg	DETS 072*	< 10	< 10	< 10
Aliphatic C5-C35	mg/kg	DETS 072*	60	< 10	< 10
Aromatic C5-C35	mg/kg	DETS 072*	15	< 10	< 10
TPH All/Aro	mg/kg	DETS 072*	75	< 10	< 10

APPENDIX 5
DESIGN CONSIDERATIONS

APPENDIX 5

GUIDELINES FOR THE DESIGN OF PILES

FIRST APPROXIMATION OF WORKING LOAD

A5.1 GENERAL

The ultimate carrying capacity, Q_u , of a particular pile is taken as the sum of the ultimate shaft friction resistance, Q_s , and the ultimate end bearing resistance, Q_b . This may be expressed as follows:-

$$Q_u = Q_s + Q_b$$

$$= f.A_s + q.A_b$$

$$= \text{unit shaft resistance} \quad \text{where} \quad f$$

$$= \text{embedded surface area of pile} \quad A_s$$

$$= \text{unit end bearing resistance} \quad q$$

$$= \text{effective cross-sectional area of pile base} \quad A_b$$

A5.2 COHESIVE SOILS

A5.2.1 Shaft Resistance

The ultimate shaft resistance, f , for piles in both compression or tension in cohesive soils is determined by applying a factor to the undrained shear strength, C_s , which exists in the soils along the embedded length of the pile, and is given by:-

$$f = \alpha.C_s$$

Where α is an adhesion factor, which for straight-shafted bored piles may be taken as 0.45 to 0.60.

Ultimate unit shaft friction should not exceed 100kN/m².

A5.2.2 End Bearing

For piles terminating in cohesive soils, the ultimate unit end bearing resistance q , is given by:-

$$q = N_c.C_b$$

where C_b is the undrained shear strength at the base of the pile

and N_c is a bearing capacity factor

The value of N_c for a cohesive material is variable, depending on the depth of the penetration of the pile into the bearing stratum. Generally, N_c could be taken to have a value of 9, except in the case of large diameter short piles where a lesser value should be used.

A5.3 COHESIONLESS SOILS

A5.3.1 Shaft Resistance

For piles driven in cohesionless soils the ultimate unit shaft resistance, f , may be calculated using the following method, which gives:-

$$f = 0.5\gamma (D+d) K_s \tan \delta$$

where γ = average effective unit weight of soil surrounding

the pile

D = depth to the pile toe or to the base of the

granular stratum whichever is the lesser

d = depth to the top of the granular stratum

δ = angle of friction between pile and soil

(see below)

K_s = a coefficient (see below)

VALUES OF K_s AND δ

Pile Type	δ	K_s	
		Relative Density	
		Low	High
Tension Piles	20°	0.5	1.5
		1.0	2.0
Steel	0.75 ϕ	0.5	0.5
Concrete	22°	0.5	0.5

For bored and cast-in-place piles, $\delta = 22^\circ$ and $K_s = 1$ should be used to allow for loosening of the soil during boring.

It has been found that the ultimate unit shaft resistance does not exceed 100kN/m² and therefore this value should not be exceeded in design.

For cohesive and non-cohesive soils a factor of safety of 3 may be used to obtain the allowable or safe carrying capacity of piles from the ultimate carrying capacity.

A5.4.1 Cohesive and Non-cohesive Soils

A5.4 FACTORS OF SAFETY

In addition, the ultimate unit base resistance should not exceed a value of 11,000kN/m². For bored and cast-in-place piles the value of N_q used should correspond to loose soil conditions.

$$\begin{aligned}
 q &= \gamma \cdot D \cdot N_q \\
 \text{where } \gamma &= \text{average effective unit weight of soil surrounding the pile} \\
 D &= \text{depth to pile toe} \\
 N_q &= \text{bearing capacity factor}
 \end{aligned}$$

The unit ultimate end bearing resistance (q) of piles in cohesionless soils may be calculated as follows:-

A5.3.2 End Bearing

CONTAMINATION ASSESSMENT

APPENDIX 6

APPENDIX 6

GENERAL NOTES ON CONTAMINATION ASSESSMENT

A6.1 STATUTORY FRAMEWORK AND DEFINITIONS

A6.1.1 The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref 10.13, which was introduced by the Environment Act 1995, ref 10.14;

'Land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

- (a) significant harm is being caused or there is a significant possibility of such harm being caused; or
- (b) pollution of controlled waters is being, or is likely to be, caused.'

A6.1.2 The UK guidance on the assessment of contaminated has developed as a direct result of the introduction of these two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document, CLR 11, ref 10.5 has only been made available to date as a draft.

A6.1.3 In establishing whether a site fulfils the statutory definition of 'contaminated land' it is necessary to identify, whether a pollutant linkage exists in respect of the land in question and whether the pollutant linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage,
- presents a significant possibility of significant harm being caused to that receptor,
- is resulting in the pollution of the controlled waters which constitute the receptor, or
- is likely to result in such pollution.

A6.1.4 A 'pollutant linkage' may be defined as the link between a contaminant 'source' and a 'receptor' by means of a 'pathway'.

A6.2 ASSESSMENT METHODOLOGY

A6.2.1 The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

- A6.2.2 Stages 1 and 2 develop a 'conceptual model' based upon information collated from desk-based studies, and frequently a walkover of the site. The walkover survey should be conducted in general accordance with CLR 2, ref 10.3.
- A6.2.3 The extent of the desk studies and enquiries to be conducted should be in general accordance with CLR 3, ref 10.1. The information from these enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the conceptual model. CLR 8, ref. 10.18, together with specific DoE 'Industry Profiles' provides guidance on the nature of contaminants relating to specific industrial processes.
- A6.2.4 In most cases the recommendations will indicate that a site investigation is required to further refine the conceptual model, which should be planned in general accordance with CLR 4, ref 10.6. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. To this end a two-stage investigation may be more appropriate where time constraints are less of an issue. The first stage investigation being conducted as an initial assessment for the presence of potential sources, a second being a more refined investigation to delineate wherever possible the extent of the identified contamination.
- A6.2.5 All site works should be in general accordance with the British Standards, BS 5930:1999, ref. 10.8 and BS 10175:2001, ref 10.7.
- A6.2.6 The risk estimation stage compares the results of the analysis with generic guidance values. Soils will be compared with the available generic Soil Guideline Values (SGVs) as published by the Department of Environment Food and Rural Affairs (DEFRA) and The Environment Agency (EA), and developed using the Contaminated Land Exposure Assessment (CLEA) Model.
- A6.2.7 Where there are no currently available SGVs for specific soil contaminants, Ian Farmer Associates (1998) Ltd has developed Soil Screening Values (SSV) using the CLEA model or other relevant and appropriate risk assessment models. Where insufficient data exists, such as toxicity, to permit the calculation of SSVs in accordance with the CLR documents, other internationally accepted guidance has been used. This includes the Dutch Intervention Levels, ref 10.19, USEPA Preliminary Remediation Goals (PRGs), ref 10.20, Australian National Environment Protection Council (NPEC) Soil Investigation Levels (SILs), ref 10.21 and/or the New Zealand Tier 1 Soil Screening Values, ref 10.22.
- A6.2.8 Although now superseded, in the absence of any other relevant UK guidance, the ICRCL levels are utilised for the assessment of phytotoxicity.
- A6.2.9 The CLEA developed SGV are not applicable to contaminants in groundwater. Where specifically required, site specific SGVs may be developed utilising the CLEA model.
- A6.2.10 Chemical laboratory test results are processed as follows. A statistical analysis of the results is conducted, as detailed in CLR 7, ref 10.15. Individual concentrations are compared to the selected guideline values to identify concentrations of contaminants that are above the selected screening criteria.
- A6.2.11 The mean value test is applied to determine whether the mean characteristics of the selected soil unit present a significant possibility of significant harm to human health. The significance of the data is further tested using the maximum value test. This determines whether the highest recorded contaminant concentrations are from the same statistical distribution or whether they may represent a 'hot spot'.
- A6.2.12 Where the risk estimation identifies significant concentrations of one or more contaminants, a further risk evaluation needs to be undertaken.
- A6.2.13 The risk evaluation will address the potential pollutant linkages between an identified source of contamination and the likely receptors both on and off site.

A6.2.14 The potential receptors include:

- 1) Humans – current site occupants, construction workers, future site users and neighbouring site users.

2) Controlled Waters – surface water and groundwater resources

3) Plants – current and future site vegetation

4) Building materials

A6.2.15 The potential hazards to be considered in relation to contamination are:

a) Ingestion and inhalation.

b) Uptake of contaminants via cultivated vegetables.

c) Dermal contact

d) Phytotoxicity (the prevention or inhibition of plant growth)

e) Contamination of water resources

f) Chemical attack on building materials and services

g) Fire and explosion

A6.2.16 It should be noted that throughout the above process the conceptual model is refined and amended based upon data generated from each stage of the work, and from the input of any additional information that may be available, such as potential changes to the proposed land-use.

A6.2.17 Based upon the Client requirements, recommendations will be made on ways to minimise or mitigate the potential impacts of the contamination, if present. Further work may be recommended to assist in a cost effective and site-specific remediation and validation methodology, as well as procedures for the appropriate handling of the contaminated material; or, procedures and recommendations for the long-term maintenance and monitoring of the site.

APPENDIX 7
GAS GENERATION

APPENDIX 7

GENERAL NOTES ON GAS GENERATION

A7.1 GENERAL

- A7.1.1 Soft organic clays, peat, Made Ground and landfills are potentially subject to significant microbial degradation resulting in the formation of a mixture of gases and vapours.
- A7.1.2 The chemical composition of landfill gas varies over time, a typical landfill gas can comprise up to 65% methane and 35% carbon dioxide. The properties of landfill gases are determined principally by the proportions of these two gases together with their mixture with air. Trace amounts of other gases such as hydrogen and hydrogen sulphide plus a range of organic vapours can also be present.
- A7.1.3 Methane is colourless, odourless, non-toxic asphyxiant gas, which is flammable in air. However, the gas will only burn when mixed with air in certain proportions defined by the lower and upper limits of flammability (or explosibility). Any mixture of methane in air within these limits will burn if ignited. However, a mixture with a concentration of methane above the upper explosive limit (UEL) should not be considered safe since dilution with clean air will result in a composition within the flammable range. Thus mixtures above the UEL are a potential hazard and only mixtures below the lower explosive limit (LEL) can be considered safe. The LEL and UEL for methane are 5%v/v and 15%v/v respectively.
- A7.1.4 Carbon dioxide is a non-flammable toxic gas with a long-term exposure limit of 0.5% by volume and a short-term limit of 1.5% by volume.
- A7.1.5 On sites such as former docklands or reclaimed estuaries, gas is generated slowly and is characterised by low volumes of gas and low surface emissions. Development has taken place on such sites over many years without problems.
- A7.1.6 In the case of recent landfills or mine workings, methane can be generated rapidly. This gives rise to large volumes of gas being produced with high surface emission rates. These conditions pose a risk to development.
- A7.1.7 The Building Regulations Approved Document C (1992), ref. 10.23, gives guidance on the problems associated with the presence of landfill gas. This guidance suggests that where the level of methane is unlikely to exceed 1% by volume no further protection needs to be provided if the ground floor is suspended concrete and ventilated.
- A7.1.8 Carbon dioxide should be considered independently of methane. Concentrations exceeding 1.5% by volume in the ground indicate a need to consider gas exclusion measures, while a level of 5% implies that specific design measures are required.
- A7.1.9 Guidelines produced in Table 28 of CIRIA Report 149, ref. 10.24 are frequently used as a design tool with little regard to the nature of the gassing source or surface emission rates. However, this table was never intended as a definitive design tool.
- A7.1.10 The most important aspect relating to the risk posed to a development by the gas regime below the site is how quickly is the gas coming out of the ground. The lower the surface emission rate the lower the risk.
- A7.1.11 For design purposes the gas flow rate and gas concentration provide a more reliable method for classifying a site and specifying the scope of gas protection.
- A7.1.12 A rational method for classifying gassing sites in terms of the risks posed by the presence of gas should consider the following, ref. 10.25.

A7.1.15

A new method for characterising gassing sites is proposed, taking into account flow rates as well as gas concentrations, ref. 10.25.

Scenario	Gas concentration	Borehole flow rate	Risk ranking
1	High	High	1
2	High	Low	3
3	Low	High	2
4	Low	Low	4

A7.1.14

The importance of surface emission rates together with gas concentrations lead to the following ranking system, ref. 10.26.

Source	Gas generation potential
Natural soils, low peat/lowest organic content	Low generation potential from small amounts of degradable material
Carbonate deposits e.g. Chalk	
Dock silt, Made Ground, low organic content	
Natural soil, Made Ground, high peat/organic content	
Landfill – pre 1960	Moderate generation due to increased levels of degradable material
Mineworking – susceptible to flooding	
Potential for high generation if working (and pumping and ventilation) ceases and groundwater levels rise	High potential for gas generation due to high organic content
Potential for high generation if groundwater levels rise	
Potential for high generation if water levels vary	
Mineworking unflooded inactive	High potential for gas generation due to high organic content
Mineworking flooded	
Landfill site, post 1960	

A7.1.13

A risk ranking, ref. 10.24 deemed natural soils with low organic content posed the lowest risk in terms of gas generation while recent landfills, post 1960's, the greatest risk.

- the source of the gas
- the generation potential of the source
- the location of the source and the presence of any natural geological barriers to migration
- the borehole flow rate and surface emission rate
- measured gas concentrations
- the nature of proposed development
- the confidence in the knowledge of the gas regime and any likely variations in concentration and borehole flow rate

A new method for characterising gassing sites is proposed, taking into account flow rates as well as gas concentrations, ref. 10.25.

Characteristic Situation	Typical scope of protection measures	
	Residential Building	Office/commercial/industrial development
1	No special precautions	No special precautions
2	Well constructed ground or suspended floor slab. Waterproofing membrane sealed around penetrations, passively ventilated underfloor sub-space and wall cavities	Reinforced concrete cast in-situ ground slab. All joints and penetrations sealed. Possibly waterproofing membrane. Granular layer below slab passively vented to atmosphere with interleaved geocomposite strips or pipes

A7.1.16

On the basis of the Characteristic Situation the scope of protection measures may be determined as below.

1. Limiting volume flow rate of gas = gas concentration x measured borehole flow rate
2. Site characterisation should be based on gas monitoring of concentrations and borehole flow rates for a minimum of one year and covering a range of atmospheric conditions. For readings covering less than one year but over six months, increase Characteristic Situation by 1. For readings covering less than 6 months but over three months, increase Characteristic Situation by 2.
3. Source of gas and generation potential/performance must be identified

Characteristic Situation	Limiting volume flow of CH ₄ or CO ₂ (l/hr) ¹ from borehole	Additional limiting factors	Typical source of generation
1	<0.07	Methane not to exceed 1% volume and carbon dioxide not to exceed 5% by volume	Natural soils with low organic content
2	<0.7	Borehole air flow rate not to exceed 70l/hr otherwise increase to Situation 4	Natural soil, high peat/organic
3	<3.5	Borehole air flow rate not to exceed 70l/hr otherwise increase to Situation 4	Old landfill, inert waste, mineworking flooded
4	<15	Quantitative risk assessment required to evaluation scope of protection measures	Mineworking – flooding, completed landfill, inert waste
5	<70		Mineworking unflooded inactive
6	>70		Recent landfill site

1. Typical scope of protection measures may be rationalised for specific developments on the basis of quantitative risk assessments based on CIRIA Report 152.
2. Note the type of protection is given for illustration purposes only. Individual site specific designs should provide the same number of separate protection methods for any given Characteristic Situation.
3. In all cases there should be minimum penetration of ground slabs by services and minimum number of confined spaces such as cupboards above the ground slab. Any confined spaces should be ventilated.
4. Foundation design must minimise differential settlement particularly between structural elements and ground bearing slabs.
5. Buildings with basement car parks, provided with ventilation in accordance with the Building Regulations, may not require gas resistant membranes for Characteristic Situations 3 and 4.

3	Wall constructed suspended or ground slab. Gas resistant membrane and passively ventilated underfloor sub-space	Reinforced concrete cast in-situ ground slab. All joints and penetrations sealed. Waterproof/gas resistant membrane and passively ventilated underfloor sub-space
4	Well constructed suspended or ground slab. Gas resistant membrane and passively ventilated underfloor sub-space, oversite capping and in ground venting layer	Reinforced concrete cast in-situ ground slab. All joints and penetrations sealed. Gas resistant membrane and passively ventilated underfloor sub-space
5	Specific gas resistant membrane and ventilated underfloor void, oversite capping and in ground venting layer and in ground venting wells	Reinforced concrete cast in-situ slab. All joints and penetrations sealed. Gas resistant membrane and passively ventilated underfloor sub-space. In ground venting wells
6	Not suitable unless gas regime is reduced first and quantitative risk assessment carried out to assess design of protection measures in conjunction with foundation design	Reinforced concrete cast in-situ ground slab. All joints and penetrations sealed. Gas resistant membrane and actively ventilated underfloor sub-space, with monitoring. In ground venting wells

Geotechnical & Environmental Specialists

>>>> = Flow above detection limit of 30 l/hr, <<<< = Negative flow greater than -10 l/hr.

>>>> = Flow above detection limit of 30 l/hr, <<<< = Negative flow greater than -10 l/hr.