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Halperns/Unimore Ltd
57-59 Leicester Road
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Consultant/Engineer:

Ground Investigation - Geotechnical

Texaco Fuel Station, Bury Old Road, Prestwich

Jan 2014

Site Ref: 5594/FSP-G

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1. Introduction

This report is an account of an intrusive Geotechnical Ground Investigation carried out by GeoAssist Limited at the request of Halperns/Unimore Ltd as the potential purchasers of the site at the Texaco Fuel Station, Bury Old Road, Prestwich.

The object of this geotechnical investigation was to obtain information on the nature, depth and extent of the superficial deposits beneath the site to enable others to evaluate design and construction of foundations for the proposed development.

Geotechnical parameters and groundwater regime were to be obtained.

The work was commissioned following acceptance of the quotation and an instruction to proceed issued by Hilary Goldstein on behalf of Halperns/Unimore Ltd on 5th December 2013.

It is understood that a commercial development with car parking facilities is proposed for the site.

The approximate grid reference for the centre of the site is 382875E, 402531N. The area of the site scheduled for investigation is outlined in red in the site plan in Appendix A1 along with the exploratory hole locations.

2. Description of the Site

The site is located on Bury Old Road in the suburban area of Prestwich, Bury and is accessed directly off Bury Old Road. The general topography of the site is relatively flat although a fall towards the rear (south west) of the site was noted. The site is roughly rectangular in shape and is currently in use as an active vehicle refuelling station with associated facilities such as carwash and shop. The vast majority of the site is covered by concrete hardstanding with associated positive drainage network flowing into interceptor separators. The concrete hardstanding was noted to be in a reasonable condition at the time of the fieldwork and the drainage free from detritus and free flowing. It is understood that the site is to be redeveloped into a commercial office building with associated car parking. The site is bounded by a mix of residential and retail property to the north, south and west and Bury Old Road to the east.

3. Geology

The relevant 1:10560 scale published geological map of the area, Sheet number 96 SW Lancashire shows the site to be located over drift deposits of Glacial Sand and Gravel over Boulder Clay of the Recent and Pleistocene epoch. The thickness of the superficial deposits is not readily discernable from the geological

plan but is likely to be at least 30m in thickness.

The underlying solid geology is shown as being Collyhurst Sandstone of the Permo-Triassic period.

No faults are shown as passing directly beneath the site.

4. Mineworkings

Inspection of the geological map of the area indicates that the bedrocks directly beneath the site are not coal bearing or suitable for brine extraction and consequently the risk to the development from coal workings or brine extraction is assessed as low. The Coal Mining Search report carried as part of the phase I report confirmed that the risk to the development from coal workings is low.

5. Intrusive Investigation

5.1 Exploratory Hole Programme

Five exploratory holes were completed to depth across the site by GeoAssist using windowless sampling techniques at the locations shown on the site plan in Appendix A1. Exploratory hole WS6 was terminated at 1.20m depth due to the presence of a concrete obstruction despite two attempts at excavating the inspection pit in this area. Exploratory holes WS4 and WS7 were abandoned due to the presence of services and obstructions at these locations. Hand excavated inspection pits were undertaken at each exploratory hole location in order to avoid services. The details of the strata in the exploratory holes were recorded by a suitably qualified Professional Engineer. Upon completion of the fieldwork exploratory holes WS1, WS3 and WS5 were converted to gas/groundwater monitoring standpipes.

All intrusive work was carried out in accordance with:

- § British standard 5930: 1999 Code of Practice for Site Investigations
- § British Standard 10175: 2011 where applicable
- § The Energy Institute code of safe practice for contractors working on filling stations March 2010

The fieldwork was completed on the 17/12/2013 and 18/12/2013 in mixed weather conditions.

5.2 Field Sampling and Testing

Representative samples were taken of all the strata encountered in the exploratory holes.

In situ Standard Penetration Tests and Dynamic Cone penetration test were undertaken at intervals in representative granular deposits where encountered in the exploratory holes. Hand vane test were undertaken in representative cohesive deposits where they were encountered in the exploratory holes. All samples were stored in airtight containers and returned to the laboratory for subsequent examination and geotechnical testing. Observations of groundwater conditions were made throughout the fieldwork operations.

In situ PID tests were undertaken at shallow depth using a MiniRae 2000 in all of the exploratory holes except WS6 and the results are recorded on the exploratory hole log.

5.3 Field Results

Full details of the subsoil conditions in the exploratory holes are given in the exploratory hole log sheets, which along with the subsequent gas/groundwater readings form Appendices C1 and C2 to this report.

6. Laboratory Investigation

6.1 Geotechnical Testing

The following geotechnical tests were performed in GeoAssist's laboratory on samples recovered from the exploratory holes.

Table 6.0 Geotechnical Testing

TEST	PURPOSE
Hand Vane test	Determination of shear strength parameters
Natural Moisture Content and Classification test	Assessment of in-situ subsoil conditions and compressibility of cohesive deposits
Sulphate and pH test	Assessment of potential aggressive ground conditions with respect to subsurface concrete
Particle Size Distribution	Determination of grading characteristics of granular deposits

6.2 Test Results

The results of the geotechnical tests are given in the laboratory test results summary sheets, which form Appendices D1 to D4 to this report. The results of the Hand vane tests are recorded on the exploratory hole logs.

7. Subsurface Stratigraphy

The subsoil profile obtained from the exploratory holes consists of grass/topsoil and concrete made ground to depths between 0.20m to 0.90m underlain by made ground to depths ranging from 0.90m and 2.80m and overlying sand with silt/clay. Exploratory holes WS1 and WS8 penetrated concrete hard standing to 0.20 and 0.30m depth respectively. Underlying the concrete and elsewhere the Made Ground consists mainly of clay, sand and gravel with brick and concrete fragments and cinders in varying proportions. The made ground is variable in material constituents and ranges from very loose to dense in state of compaction.

Exploratory holes WS1, WS2, WS3 and WS8 penetrated a sandy Silt/Clay stratum at depths ranging from 1.30m to 2.80m. This sand Silt/Clay contained organic inclusions varied from 0.60m to 1.50m in thickness, from low to medium in strength and intermediate to high in plasticity.

All the exploratory holes completed to depth were terminated in silty Sand with irregular gravel horizons. The silty sand varied from loose to medium dense in state of compaction and extended to at least 6.00m depth.

Bedrock was not encountered in any of the exploratory holes undertaken as part of this investigation.

Table 7.0 Subsoil Profile Summary

Strata	Depth of Strata (m) below ground level	
	Top	Base
Topsoil/Concrete/Made Ground Variable mixed mainly granular	Ground Level	0.90 to 2.80
Upper Superficial Natural Deposits Low to medium sandy Silt/Clay with organic inclusions Absent in WS5	1.30 to 2.80	1.70 to 4.20
Lower Superficial Natural Deposits Loose to medium dense silty Sand	0.90 to 4.20	>6.00
Bedrock	Not encountered	

8. Groundwater

Seepage groundwater was encountered in exploratory holes WS1, WS3 and WS5 at depths between 4.60m and 4.90m depth during the course of the fieldwork. Standing groundwater levels will be subject to seasonal variation and could be higher at certain times of the year particularly after periods of heavy rainfall. Subsequent monitoring of standpipe installations in the boreholes has confirmed that the depth to groundwater has varied between 4.20m and 4.50m across the site.

9. Geotechnical Properties

The following sections summarise the geotechnical properties for the main strata for the main structures and vehicle parking. The summary geotechnical properties are based on physical description, measured and empirical values.

9.1 Made Ground

Made ground has been identified on the entire site as being generally granular and present to a maximum depth of 2.80m in WS1.

Table 9.1 Summary of Geotechnical Properties – Made Ground

Property	Number of Tests	Range of Results	Value for Design
Sulphate 2:1 Water:Soil Extract	3	280 to 500mg/l	500mg/l
pH	3	8.0 to 8.3	NA
N value	3	3 to 30	not recommended

9.2 Upper Superficial Silt/Clay

Upper Cohesive deposits were encountered across the site as sandy Silty/Clay with organic inclusions.

Table 9.2 Summary of Geotechnical Properties – Superficial Deposits Silt/Clay

Property	Number of Tests	Range of Results	Value for Design
Liquid Limit	3	37% to 63%	52%
Plastic limit	3	24% to 36%	32%
Plasticity Index	3	13% to 31%	20%
Shear Strength From Hand Vane tests	5	27kN/m ² to 71kN/m ²	55kN/m ²

9.3 Lower Superficial Sand

Lower granular deposits were encountered across the site as gravelly silty Sand.

Table 9.2 Summary of Geotechnical Properties – Superficial Deposits Sands

Property	Number of Tests	Range of Results	Value for Design
N value	13	6 to 24	13

10. Geotechnical Assessment

10.1 Design Criteria

No information has been supplied by the Clients Engineer in respect of design criteria for foundations for the proposed development. However, it may be reasonably assumed that for the single storey commercial property proposed for this site that typical loads on strip footings would be 50kNm run.

10.2 Foundation Design Considerations

Reinforced concrete strip foundations located on trench fill extending to natural ground are not recommended as the depth of excavation for the trench fill will encounter stability issues due to the presence of very loose granular made ground deposits and the preferred more economical foundation solution will probably be piles driven into the underlying granular deposits.

10.3 Pile Foundation Design Considerations

Preliminary calculations indicate that driven piles penetrating to around 12m depth and end bearing in the silty Sands can be designed to an end bearing capacity of 100 kN.

This load is given as an indication only of the capacity of driven plies and the actual load can only be determined by consultation with the relevant piling specialist as it depends on the pile type and dimension as well as the set achieved during driving.

Initial enabling works will be required on this site to demolish the existing building and remove the underground fuel storage tanks and ancillary pipe work with considerable impact on the ground conditions subsequently present on the site. Consequently, it is recommended that further investigation works comprising exploratory holes penetrating to at least 15m depth are carried out at that stage in order that a more efficient and economical pile foundation design might be evaluated.

10.4 Excavations

Shallow to moderate depth excavations for the removal of the underground fuel storage tanks and ancillary pipe work will encounter mainly granular made ground and will require suitable support/battered sides with control of groundwater generally by pumping from open sumps.

10.5 Subsurface Concrete Attack

The results of the soluble sulphate and pH tests carried out on samples of made ground/subsoil obtained from this site in general indicate that according to Building Research Establishments Special Digest 1 (2005) no particular precautions for concrete foundations will be required.

Generally, the use of concrete mix design sulphate class DS-2 and according to ACEC Class AC-2 of Table

C2 conditions can be used for subsurface concrete mix design.



Matthew Benson BSc
Geotechnical/Environmental Engineer



Mark Richardson MSc CEng MICE
Technical Director

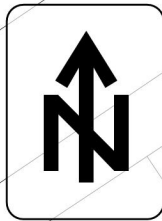
Field investigations have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions are, and can be, variable and have only been tested at isolated locations across the site. Therefore the potential exists for ground conditions to be encountered which are different to those considered in this report.

This report has been prepared by GeoAssist Limited with all reasonable professional skill, care and diligence within the terms of the contract with Halperns/Unimore Ltd. The report is confidential to Halperns/Unimore Ltd, their/the named persons advisors and bankers, and GeoAssist Limited accepts no responsibility of whatever nature to third parties to whom this report may be divulged. GeoAssist Limited owns the copyright in this report. All rights are reserved and unauthorised use is prohibited. Halperns/Unimore Ltd may use the report for their/her/his own purposes.

Appendix A

A1 Site Plan & Exploratory Hole Locations

GALv1.00



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A1 Exploratory Hole Plan

Site Name	Texaco Fuel Station
Location	Bury Old Road, Prestwich
GeoAssist Ref	5594FSP
Client	Halperns/Unimore Ltd
	57-59 Leicester Road Salford M7 4DA
Planning Consultant	
NGR (centre of site)	382875,402531
Production Date	Jan 2014
Survey Method	OSGB36 Data
Surveyor	M Benson
Status	V1.00
Base Survey	OSGB36



Appendix B

- B1 Terminology used in Soil Descriptions**
- B2 List of Abbreviations**
- B3 Concrete in Aggressive Ground**

Terminology used in Soil Descriptions

The procedure and principles given in BS EN ISO 14688-1:2002 Part 1: 'Identification and description' have been adopted in producing the soil descriptions contained within this report.

The general identification and description of soils is based on a flexible system for immediate (field) use by experienced persons, covering both material and mass characteristics by visual and manual techniques. Details are given of the individual characteristics for identifying soils and the descriptive terms in regular use, including those related to the results of tests from the field.

This part of ISO 14688 is applicable to natural soils *in situ*, similar man-made materials *in situ* and soils redeposited by man.

Particular sections of BS EN ISO 14688-1:2002 Part 1 are reproduced here in order to clarify the production of the soil descriptions contained within this report.

Identification of soil

General

Soil characteristics that generally permit soil to be identified with adequate accuracy for general (or preliminary) characterization are outlined below. A more accurate identification and classification based on grading, plasticity or organic content can be achieved by laboratory tests. In addition to identifying soils, the condition in which a soil is encountered, any particular secondary constituents, other features of a soil, such as carbonate content, particle shape, surface roughness of particles, odour, any common names and the geological classification are indicated.

The identification and description of soils generally follows the flow chart in Figure B1.1 attached.

Particle size

Particle size is the fundamental basis for designating mineral soils using particle fractions to distinguish the soil mechanical behaviour.

Table B1 shows the terms to be used for each soil fraction and its sub-fractions, together with the corresponding chosen range of particle sizes.

Basic soils are soils with uniform grading (i.e. they consist of particles of only one size range as specified in Table B1.1

Table B1.1 Particle Size Fractions

Soil fractions	Sub-fractions	Symbols	Particle sizes mm
Very coarse soil	Large boulder	LBo	> 630
	Boulder	Bo	> 200 to 630
	Cobble	Co	> 63 to 200
Coarse soil	Gravel	Gr	> 2,0 to 63
	Coarse gravel	CGr	> 20 to 63
	Medium gravel	MGr	> 6,3 to 20
	Fine gravel	FGr	> 2,0 to 6,3
	Sand	Sa	> 0,063 to 2,0
	Coarse sand	CSa	> 0,63 to 2,0
	Medium sand	MSa	> 0,2 to 0,63
	Fine sand	FSa	> 0,063 to 0,2
Fine soil	Silt	Si	> 0,002 to 0,063
	Coarse silt	CSi	> 0,02 to 0,063
	Medium silt	MSi	> 0,006 3 to 0,02
	Fine silt	FSi	> 0,002 to 0,006 3
	Clay	Cl	≤ 0,002

Composite soils

APPENDIX B1

Form No.: QF029AEN

General

Most soils are composite and consist of principal and secondary fractions. They are designated by a noun (main term) describing the principal fraction and by one or more adjectives (qualifying terms) describing the secondary fractions (e.g. sandy gravel saGr, gravelly clay grCl).

Principal fraction

The principal fraction in terms of mass determines the engineering properties of the soil and is given in capital letters for clarity.

In the case of very coarse soils, the principal fraction is the relevant very coarse soil fraction predominating in terms of mass. The very coarse fraction should be separated from the sample before identifying the fine and coarse fractions.

In the case of coarse soils, the principal fraction is the relevant coarse soil fraction predominating in terms of mass.

Composite coarse soils include a fines fraction (silt and/or clay) that does not determine the engineering properties of the soil.

In the case of fine soils, the principal fraction is the relevant fine soil type determining the engineering properties of the soil.

In the case of composite fine soils, the fines fraction determines the engineering properties of the soil. The fines fraction is regarded as determining the characteristics of a composite soil if this is of at least medium dry strength or exhibits a certain degree of plasticity.

In both cases, the soil is termed either "clay" or "silt", depending on the plasticity of the fines fraction and not on the grading.

Secondary fractions

Secondary and further fractions do not determine but will affect the engineering properties of the soil.

The secondary fractions as adjectives are placed with the term describing the principal fraction in the order of their relevance.

If coarse secondary fractions are present in a particularly small or particularly large proportion, the term "slightly" or "very" shall precede the qualifying term.

If it is a fine soil, the properties of which are determined by fines fractions, a soil can be identified as "silt" or "clay" by checking for the presence of fine secondary constituents on the basis of its plasticity properties.

If, in the case of coarse soils, two soil fractions are present in approximately equal proportions, an oblique shall be placed between the relevant terms, e.g. gravel/sand (Gr/Sa) or fine/medium sand (FSa/MSa).

Plasticity

Assessment of the plasticity and identification of a soil as either silt or clay permits the soil to be qualified as being of low plasticity or high plasticity.

An exact determination can only be made by establishing the liquid limit and the plastic limit in laboratory tests.

Organic content

Small quantities of dispersed organic matter in a soil can produce a distinctive odour and colour. The intensity of odour and colour indicates the proportion of organic matter and should be described.

Determination of consistency

The consistency of a cohesive soil shall be determined in a manual test, permitting the following identification and description:

- a) a soil is to be identified as **very soft** if it exudes between the fingers when squeezed in the hand;
- b) a soil is to be identified as **soft** if it can be moulded by light finger pressure;
- c) a soil is to be identified as **firm** if it cannot be moulded by the fingers, but rolled in the hand to thick threads without breaking or crumbling;
- d) a soil is to be identified as **stiff** if it crumbles and breaks when rolled to thick threads but is still sufficiently moist to be moulded to a lump again;
- e) a soil is to be identified as **very stiff** if it has dried out and is mostly light coloured. It can no longer be moulded but crumbles under pressure. It can be indented by the thumbnail.

Preliminary descriptions are based on visual and manual identification only.

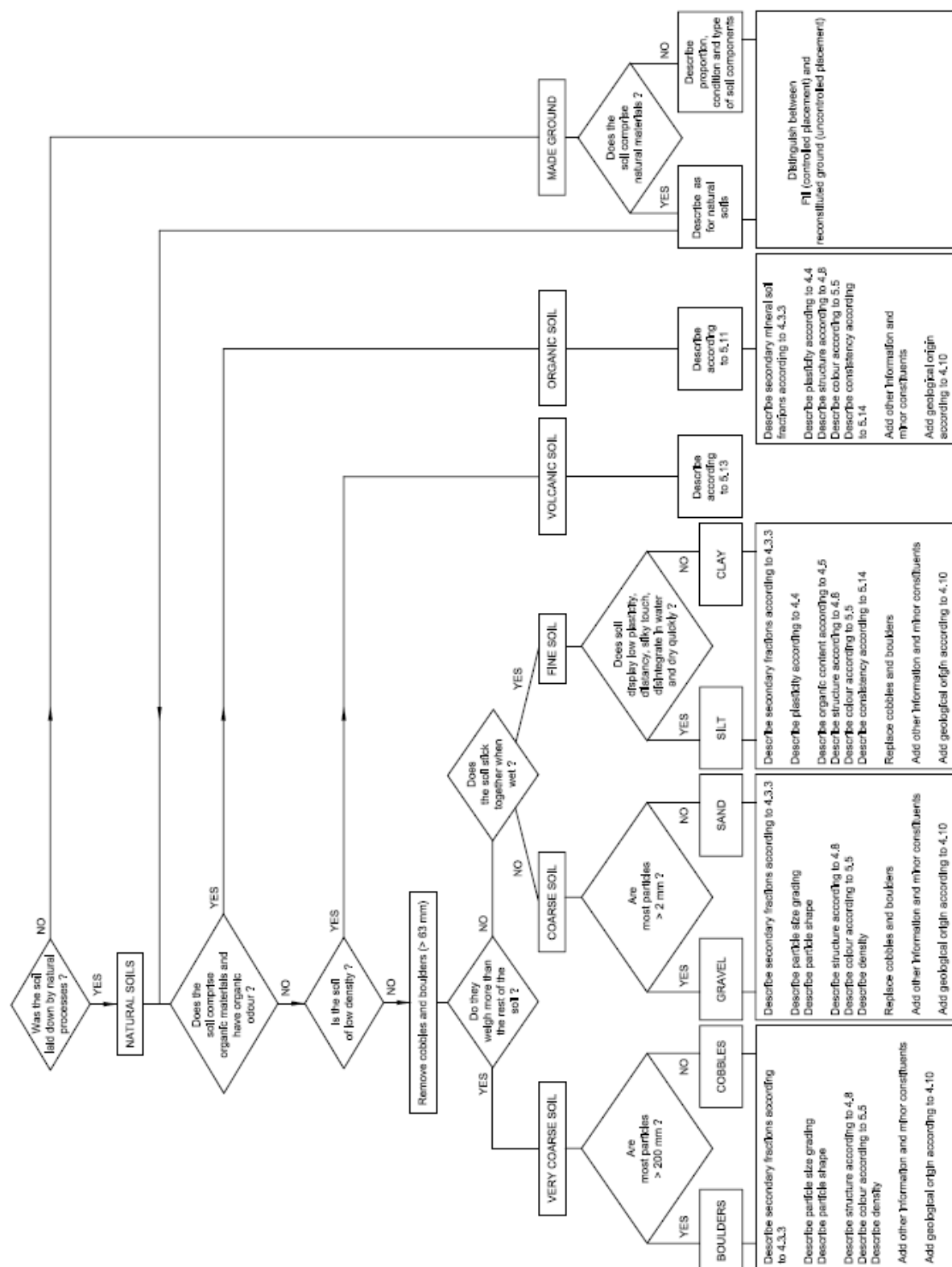


Figure B1.1 Flow chart for the identification and description of soils

Terminology used in Soil Classification

The procedure and principles given in BS EN ISO 14688-2:2004 Part 2: 'Principles for a classification' have been adopted in producing the soil descriptions contained within this report where laboratory or in situ field tests have been carried out.

The classification principles established in this part of ISO 14688 permit soils to be grouped into classes of similar composition and geotechnical properties and, with respect to their suitability for geotechnical engineering purposes.

This part of ISO 14688 is applicable to natural soil and similar man-made material *in situ* and redeposited, but it is not a classification of soil by itself.

Particular sections of BS EN ISO 14688-1:2002 Part 2 are reproduced here in order to clarify the production of the soil descriptions contained within this report.

Principles of soil classifications
General

Soils shall be classified into soil groups on the basis of their nature, which is the composition only, irrespective of their water content or compactness, taking into account the particle size distribution (grading), plasticity, organic content, genesis as appropriate.

The most common approach to classification is to divide the soils on the basis of particle size grading and plasticity. The division is made on the relative size fractions present for the coarser soil fractions, determined on the whole sample, and on the plasticity of the finer fractions (Table B1.2).

Table B1.2 Principles of a classification of soils

Criterion	Soil group	Quantification	Denomination into groups of similar properties			Further subdivision as appropriate by	
Wet soil does not stick together	very coarse	most particles > 200 mm	Bo	xBo		Requires special consideration	
				boCo	coBo		
	coarse	most particles > 63 mm	Co	saCo, grCo	sagrCo	Particle size (grading) Shape of grading curve Relative density Permeability (Mineralogy) (Particle shape)	
		most particles > 2 mm	Gr	coGr	cosaGr		
Wet soils sticks together	fine			saGr, grSa	sasiGr, grsiSa	Plasticity Water content Strength, sensitivity Compressibility, stiffness (Clay mineralogy)	
		most particles > 0,063 mm	Sa	siGr, clGr orSa	siSa, clSa, saclGr		
	fine	low plasticity dilatant	Si	saSi	sagrSi saclSi	Requires special consideration	
		plastic non-dilatant	Cl	clSi, siCl orSi, orCl	sagrCl		
Dark colour, low density	organic		Or	saOr, siOr	clOr	Requires special consideration	
Not naturally	Made ground	deposited	Mg	xMg	Man-made material	Requires special consideration	
					Relaid natural materials	As for natural soils	
Key to symbols						Cases requiring special consideration should be classified according to national or project requirements	
Soil	Principal	Secondary or tertiary component					
Boulders	Bo	bo	Gr(gr) and Sa(sa) can be subdivided into fine F(f), medium M(m) or coarse C(c)				
Cobbles	Co	co					
Gravel	Gr	gr					
Sand	Sa	sa					
Silt	Si	si					
Clay	Cl	cl	any combination of components				
Organic	Or	or					
Made ground	Mg	—					
		x					

Fractions

Soil is a mixture of materials of different particle size, which are grouped into fractions as specified in BS EN ISO 14688-1.

Classification of coarse and very coarse soils is to be based on the particle size distribution alone (see Table B1.3)

Table B1.3 Classification of very coarse soils

Fraction	Percent by mass	Term
Boulders	< 5	low boulder content
	5 to 20	medium boulder content
	> 20	high boulder content
Cobbles	< 10	low cobble content
	10 to 20	medium cobble content
	> 20	high cobble content

In the case of soils composed of both fine and coarse material, classification is to be based on both plasticity and particle size distribution.

Particle size distribution (grading)

The particle sizes and their distribution in a soil are determined by mechanical analysis carried out by the separation of the coarser fractions by sieving on a series of standard sieves and the determination of the finer fractions by sedimentation.

The results of the sieving and sedimentation process are plotted as a grading curve.

Plasticity

The fine fractions of soil, represented by clay and silt and containing clay minerals (see also BS EN ISO 14688-1), both alone or in mixtures with coarser material, are usually classified according to their plasticity characteristics. This is carried out on the basis of laboratory tests to determine the liquid limit w_L and plastic limit w_P .

Organic content

When soils with organic constituents are classified according to their organic content (Table B1.4), a distinction is to be made between organic soils and mineral soils with an organic content.

Table B1.4 Classification of soils with organic constituents

Soil	Organic content (≤ 2 mm) % of dry mass
Low-organic	2 to 6
Medium-organic	6 to 20
High-organic	> 20

APPENDIX B1

Form No.: QF029AEN

Classification of coarse and composite organic soils accumulated *in situ* is based on the type of organic matter and that of organic soils, on the genetic origin and the degree of decomposition of the organic constituents.

Undrained shear strength of fine soils

The terms to be used for the designation of the undrained shear strength according to the results of laboratory and field tests are given in Table B1.5.

Table B1.5 Undrained shear strength of fine soils

Undrained shear strength of clays	Undrained shear strength c_u kPa
Extremely low	< 10
Very low	10 to 20
Low	20 to 40
Medium	40 to 75
High	75 to 150
Very high	150 to 300
Extremely high ^a	> 300
^a Materials with shear strength greater than 300 kPa may behave as weak rocks and should be described as rocks according to ISO 14689-1.	

Table B1.6 Guiding values for the division of mineral soils on a basis of the contents of various fractions

Fraction	Content of fraction in wt % of material ≤ 63 mm	Content of fraction in wt % of material ≤ 0,063 mm	Name of soil	
			Modifying term	Main term
Gravel	20 to 40 > 40		gravelly	gravel
Sand	20 to 40 > 40		sandy	sand
Silt + clay (fine soil)	5 to 15 15 to 40 > 40	< 20 ≥ 20 < 20 ≥ 20 < 10 10 to 20 20 to 40 > 40	slightly silty slightly clayey silty clayey clayey silty	 silt silt clay clay

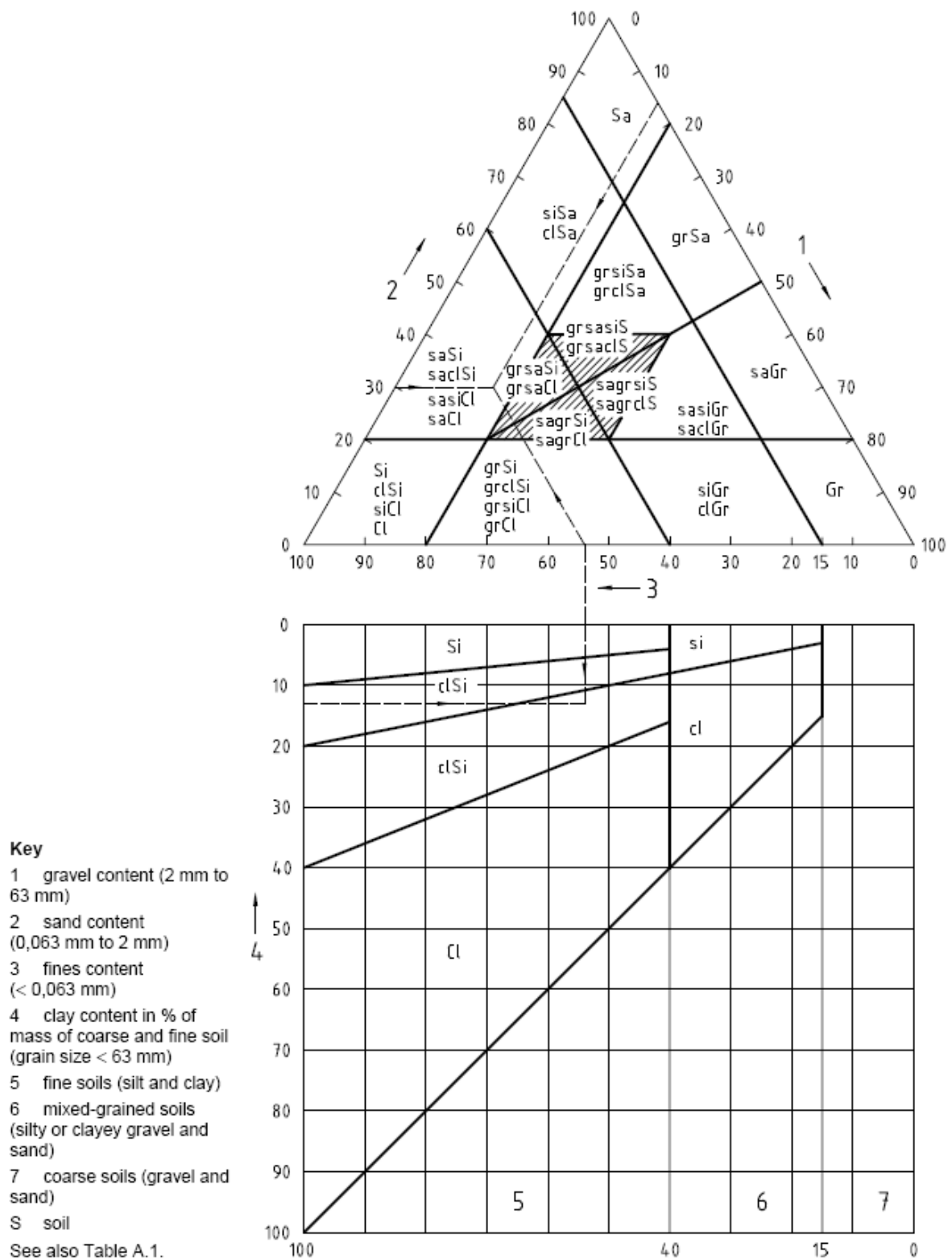


Figure B1.2 Classification of soils, based on grading alone

References

BS EN ISO 14688-1: 2002

Geotechnical investigation and testing — Identification and classification of soil — Part 1: Identification and description

BS EN ISO 14688-2: 2004

Geotechnical investigation and testing — Identification and classification of soil — Part 2: Principles for a classification

Abbreviations

Exploratory Hole log

Sample Type

AGS Code	Sample Type	AGS Code	Sample Type
B	Bulk Disturbed sample	SPT	Penetration Test – split spoon
CBR	CBR sample	U	Undisturbed sample – open drive
CPT	Penetration Test – cone	UF	Undisturbed sample failed recovery
D	Small disturbed sample	W	Water sample
PU	Piston sample	C - ES	Environmental sample

SPT and CPT – Standard Penetration Test

Blow Count (N) – If full penetration of 450mm then the total number of blows for the last 300mm is given. If limited penetration following 150mm seating blows then the number of blows for the stated penetration is given.

If limited penetration then the total number of blows for the stated penetration is given.

The N values are actual blows recorded and uncorrected.

U - Undisturbed Sample

Blow Count – total number of blows for recovered length

Legend – As per British Standard – if blank then CAVITY/OPEN HOLE

Core Rec.:

T - Total Core Recovery as a percentage of the cored run

S – Solid Core Recovery as a percentage of the cored run

RQD – Rock Quality Designation as a percentage of the cored run

FI – Fracture index as number of fractures per metre

I_f – Fracture spacing as the average length of solid core pieces between natural fractures over core length of reasonable uniform characteristics

APPENDIX B2

Form No.: QF033AEN

Laboratory Test Summary Sheet

Tests on Soils

AGS Code	Test Name	AGS Code	Test Name
ASB	Asbestos	IDEN	In Situ Density
BDEN	Bulk Density	IGNIS	Loss on Ignition
CBR	California Bearing Ratio	IVAN	In Situ Vane
CD	Consolidated drained (single stage)	LS	Linear shrinkage
CDM	Consolidated drained (multi stage)	MCVG	Moisture Condition Value
CLSS	Atterberg Limits	NMC	Natural Moisture content
CMPG	Compaction	OMS	Organic Matter
CNMT	Contaminant and Chemical	PD	Particle density
CONG	Consolidation	PHS	pH
CU	Consolidated undrained with pwp measurement (single stage)	PTST	Laboratory permeability
CUM	Consolidated undrained with pwp measurement (multi stage)	RELD	Relative Density
DDEN	Dry Density	SHBG	Shear box
FRST	Frost Susceptibility	SLIM	Shrinkage Limit
GRAD HY	Particle Size (Hydrometer)	SULWS	Sulphate on 2:1 Water:Soil Extract
GRAD WS	Particle size (wet Sieve)	TNPC	Ten Per Cent Fines
HVP	Hand vane – peak	UU	Unconsolidated quick undrained (single stage)
ICBR	In situ CBR	UUM	Unconsolidated quick undrained (multi stage)

Tests on rocks and Aggregates

AGS Code	Test Name	AGS Code	Test Name
ACV	Aggregate crushing value	SHOR	Shore hardness
BRAZ	Tensile Strength by Brazilian method	SOUN	Aggregate Soundness Test
LOSA	Aggregate Los Angeles Abrasion	UCS	Uniaxial Compressive Strength
PLSI	Point Load Index – size corrected	WTAB	Aggregate Water Absorption

4. Reference AGS Format Edition 3

Concrete in Aggressive Ground

1. Assessing the Aggressive Chemical Environment

In order to assess the levels of sulphate in the ground or groundwater, which may have a deleterious effect on concrete, the sulphate content of soil and groundwater may be determined in accordance with BS 1377 (2001) Test 3:5. The sulphate contents determined are grouped into Aggressive Chemical Environment for Concrete (ACEC) site classifications in Building Research Establishment Special Digest 1 – Part 1 (2005) Tables C1 and C2 as reproduced below.

Based on this classification BRE Special Digest 1 gives recommendations for the design of suitable concrete mixes to resist chemical attack for each ACEC classification. Care should be taken in the interpretation of results over the site area, if classification is based solely on groundwater analysis, it should be based on the highest sulphate concentration recorded. Where a large number of results from soil analysis are available it should be based on the average of the highest 20 per cent of the results. If a varied set of results are recorded from a limited sampling programme it is important to carry out further analyses before a detailed classification is given.

2. References

BS 1377: 2001: 'Methods of Test for Soils for Civil Engineering Purposes': British Standards Institution.

BRE Special Digest 1: 2005: 'Concrete in Aggressive Ground': Building Research Establishment.

Table C1 Aggressive Chemical Environment for Concrete (ACEC) classification for natural ground locations ^a						
Sulfate Design Sulfate Class for location	2:1 water/soil extract ^b	Groundwater	Total potential sulfate ^c	Groundwater Static water	Mobile water	ACEC Class for location
1	2 (SO ₄ mg/l)	3 (SO ₄ mg/l)	4 (SO ₄ %)	5 (pH)	6 (pH)	7
DS-1	< 500	< 400	< 0.24	≥ 2.5	> 5.5 ^d 2.5–5.5	AC-1s AC-1 ^d AC-2z
DS-2	500–1500	400–1400	0.24–0.6	> 3.5 2.5–3.5	> 5.5 2.5–5.5	AC-1s AC-2 AC-2s AC-3z
DS-3	1600–3000	1500–3000	0.7–1.2	> 3.5 2.5–3.5	> 5.5 2.5–5.5	AC-2s AC-3 AC-3s AC-4
DS-4	3100–6000	3100–6000	1.3–2.4	> 3.5 2.5–3.5	> 5.5 2.5–5.5	AC-3s AC-4 AC-4s AC-5
DS-5	> 6000	> 6000	> 2.4	> 3.5 2.5–3.5	≥ 2.5	AC-4s AC-5

Notes

- ^a Applies to locations on sites that comprise either undisturbed ground that is in its natural state (ie is not brownfield – Table C2) or clean fill derived from such ground.
- ^b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous Digests (Box C7).
- ^c Applies only to locations where concrete will be exposed to sulfate ions (SO₄) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance (Appendix A1 and Box C8).
- ^d For flowing water that is potentially aggressive to concrete owing to high purity or an aggressive carbon dioxide level greater than 15 mg/l (Section C2.2.3), increase the ACEC Class to AC-2z.

Appendix B3

Page 1 of 2

GeoAssist Limited

Table C2 Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations^a

Sulfate and magnesium						Groundwater		ACEC Class for location
Design Sulfate Class for location	2:1 water/soil extract ^b		Groundwater		Total potential sulfate ^c	Static water	Mobile water	
1	2 (SO ₄ mg/l)	3 (Mg mg/l)	4 (SO ₄ mg/l)	5 (Mg mg/l)	6 (SO ₄ %)	7 (pH) ^d	8 (pH) ^d	9
DS-1	< 500		< 400		< 0.24	≥ 2.5	> 6.5 ^d 5.5–6.5 4.5–5.5 2.5–4.5	AC-1s AC-1 AC-2z AC-3z AC-4z
DS-2	500–1500		400–1400		0.24–0.6	> 5.5 2.5–5.5	> 6.5 5.5–6.5 4.5–5.5 2.5–5.5	AC-1s AC-2 AC-2s AC-3z AC-4z AC-5z
DS-3	1600–3000		1500–3000		0.7–1.2	> 5.5 2.5–5.5	> 6.5 5.5–6.5 2.5–5.5	AC-2s AC-3 AC-3s AC-4 AC-5
DS-4	3100–6000	≤ 1200	3100–6000	≤ 1000	1.3–2.4	> 5.5 2.5–5.5	> 6.5 2.5–6.5	AC-3s AC-4 AC-4s AC-5
DS-4m	3100–6000	> 1200 ^e	3100–6000	> 1000 ^e	1.3–2.4	> 5.5 2.5–5.5	> 6.5 2.5–6.5	AC-3s AC-4m AC-4ms AC-5m
DS-5	> 6000	≤ 1200	> 6000	≤ 1000	> 2.4	> 5.5 2.5–5.5	≥ 2.5	AC-4s AC-5
DS-5m	> 6000	> 1200 ^e	> 6000	> 1000 ^e	> 2.4	> 5.5 2.5–5.5	≥ 2.5	AC-4ms AC-5m

Notes

- ^a Brownfield locations are those sites, or parts of sites, that might contain chemical residues produced by or associated with industrial production (Section C5.1.3).
- ^b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered from previous Digests (Box C7).
- ^c Applies only to locations where concrete will be exposed to sulfate ions (SO₄), which may result from the oxidation of sulfides such as pyrite, following ground disturbance (Appendix A1 and Box C8).
- ^d An additional account is taken of hydrochloric and nitric acids by adjustment to sulfate content (Section C5.1.3).
- ^e The limit on water-soluble magnesium does not apply to brackish groundwater (chloride content between 12 000 mg/l and 17 000 mg/l). This allows 'm' to be omitted from the relevant ACEC classification. Seawater (chloride content about 18 000 mg/l) and stronger brines are not covered by this table.

Appendix C

- C1 Exploratory Hole Logs WS1 to WS8
 excluding WS4 and WS7**
- C2 Groundwater Readings**

EXPLORATORY HOLE RECORD SHEETBorehole No. **WS1**

Consultant:

PROJECT : Texaco Fuel Station
LOCATION : Bury Old Road, Prestwich

Sheet 1 of 1

Client:
Halperns/Unimore
LtdEQUIPMENT:
Archway Dart RigCasing
Dia. Depth
(mm) (m)
100 5.00Ground Level : m. AOD
Co-ordinates E (m)
N (m)
Dates 18/12/2013 to 18/12/2013

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth (m) from to	Sample Type & No	Blow Count (N)/U				
PID = 3.4ppm	0.40 0.50	C1		CONCRETE	(0.20)		
				Brown clay, sand and gravel with brick fragments - MADE GROUND	0.20 (0.50)		
	0.90 1.00	C2		Dark brown/grey sand, gravel, brick and concrete fragments - MADE GROUND	0.70		
Hand Vane at 3.20m =70Pa	1.30 1.40	D1			(1.40)		
				Brown/grey gravelly sandy silty clay with brick fragments - MADE GROUND	2.10 (0.70)		
	3.20 3.30	D2		Firm brown medium strength gravelly sandy SILT/CLAY	2.80 (0.70)		
18/12/2013: On completion of exploratory hole at 6.00m. Casing at 5.00m. Standing water level 4.90m. On withdrawal of casing gas/groundwater monitoring standpipe installed to 5.60m depth with response zone from 1.00m to 6.00m.	4.40 4.50	D3		Brown with occasional black silty fine to medium SAND	3.50 (2.50)		
				Borehole complete	6.00		

REMARKS : 18/12/2013: Inspection Pit excavated by hand to 1.00m to avoid services

Logged : M Benson

Date : 18/12/2013

Checked : M Richardson

Date : 19/12/2013

Scale 1:25

Site Ref : 5594 FSP

EXPLORATORY HOLE RECORD SHEETBorehole No. **WS2**

Consultant:

PROJECT : Texaco Fuel Station
LOCATION : Bury Old Road, Prestwich

Sheet 1 of 1

Client:
Halperns/Unimore
LtdEQUIPMENT:
Archway Dart RigCasing
Dia. Depth
(mm) (m)
100 3.00Ground Level : m. AOD
Co-ordinates E (m)
N (m)
Dates 17/12/2013 to 17/12/2013

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (<i>Thick</i>) (m)	Reduced Level (m AOD)	Strata Legend
	Depth from	(m) to	Sample Type & No				
PID = 0.4ppm	0.40	0.50	C1		Grass over TOPSOIL	(0.20)	
					Grey cinders and ash - MADE GROUND	0.20	
	0.90	1.00	C2		Dark brown/grey sand, gravel, brick and concrete fragments - MADE GROUND	(0.10)	
						0.30	
						(1.70)	
	2.00	2.10	CP1	(3)		2.00	
					Very loose brown silty fine to medium SAND	(0.70)	
Hand Vane at 2.80m =48kPa	2.80	2.90	D1		Firm brown medium strength SILT/CLAY with organic inclusions	2.70	
						3.00 3.10	
	3.50	3.60	CP3	(6)		(1.50)	
	4.00	4.10	CP4	(3)		4.20	
	4.50	4.60	CP5	(24)	Medium dense brown slightly gravelly silty fine to medium SAND		
	5.00	5.10	CP6	(21)		(1.80)	
	5.50	5.60	CP7	(18)			
17/12/2013: On completion of exploratory hole at 6.00m. Casing at 3.00m. On withdrawal of casing exploratory hole backfilled as per specification.	5.90	6.00	CP8	(21)			
					Borehole complete	6.00	

REMARKS : 17/12/2013: Inspection Pit excavated by hand to 1.00m to avoid services

Logged : M Benson

Date : 17/12/2013

Checked : M Richardson

Date : 19/12/2013

Scale 1:25

Site Ref : 5594 FSP

EXPLORATORY HOLE RECORD SHEET

 Borehole No. **WS3**

Consultant:

 PROJECT : Texaco Fuel Station
 LOCATION : Bury Old Road, Prestwich

Sheet 1 of 1

 Client:
 Halperns/Unimore
 Ltd

 EQUIPMENT:
 Archway Dart Rig

 Casing
 Dia. Depth
 (mm) (m)
 100 5.00

 Ground Level : m. AOD
 Co-ordinates E (m)
 N (m)
 Dates 17/12/2013 to 17/12/2013

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth (m) from to	Sample Type & No	Blow Count (N)/U				
PID = 0.5ppm	0.40 0.50	C1		Grass over TOPSOIL	(0.15)		
				Medium dense to dense dark brown/grey sand, gravel, brick and concrete fragments - MADE GROUND	0.15		
	0.90 1.00	C2			(1.15)		
	1.00 1.10	CP1	(30)				
	1.20 1.30	D1					
	1.50 1.60	CP2	(6)	Very loose to loose dark brown/grey gravelly clayey silty sand with brick fragments - MADE GROUND	1.30		
	2.00 2.10	CP3	(3)		(1.40)		
	2.30 2.40	D2					
	2.80 2.90	D3		Firm brown medium strength SILT/CLAY with organic inclusions	2.70		
	3.00 3.10	CP4	(3)				
Hand Vane at 2.80m =61kPa	3.50 3.60	CP5	(3)		(1.40)		
	4.00 4.10	CP6	(3)		4.10		
	4.50 4.60	CP7	(15)	Loose to medium dense brown silty fine to medium SAND, very silty in parts with gravel horizons			
	4.70 4.80	D4					
	5.00 5.10	CP8	(6)		(1.90)		
	5.30 5.40	D5					
	5.50 5.60	CP9	(6)				
	5.90 6.00	CP10	(6)		6.00		
				Borehole complete			
17/12/2013: On completion of exploratory hole at 6.00m. Casing at 5.00m. Standing water level 4.60m. On withdrawal of casing gas/groundwater monitoring standpipe installed to 5.00m depth with response zone from 1.00m to 5.00m.							

REMARKS : 17/12/2013: Inspection Pit excavated by hand to 1.00m to avoid services

Logged : M Benson

Date : 17/12/2013

Checked : M Richardson

Date : 19/12/2013

Scale 1:25

Site Ref : 5594 FSP

EXPLORATORY HOLE RECORD SHEET

 Borehole No. **WS5**

Consultant:

 PROJECT : Texaco Fuel Station
 LOCATION : Bury Old Road, Prestwich

Sheet 1 of 1

 Client:
 Halperns/Unimore
 Ltd

 EQUIPMENT:
 Archway Dart Rig

 Casing
 Dia. Depth
 (mm) (m)
 100 5.00

Ground Level : m. AOD

 Co-ordinates E (m)
 N (m)

Dates 18/12/2013 to 18/12/2013

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth (m) from to	Sample Type & No	Blow Count (N)/U				
PID = 0.5ppm	0.40 0.50	C1	(6)	Grass over TOPSOIL	(0.20)		
				Dark brown/grey clay, sand and gravel with brick fragments - MADE GROUND	0.20		
	0.90 1.00 1.00 1.45	C2 P1	(6)	Dark grey clayey silty fine to medium SAND	(0.70)		
	1.50 1.60	D1			0.90		
	2.00 2.45 2.10 2.20	P2 D2	(11)	Loose to medium dense brown silty fine to medium SAND	(0.70)		
	3.00 3.45	P3	(8)		1.60		
	4.00 4.45	P4	(10)				
	5.00 5.45	P5	(11)		(4.40)		
18/12/2013: On completion of exploratory hole at 6.00m. Casing at 5.00m. Standing water level 4.80m. On withdrawal of casing gas/groundwater monitoring standpipe installed to 5.50m depth with response zone from 1.00m to 6.00m.				Borehole complete	6.00		

REMARKS : 18/12/2013: Inspection Pit excavated by hand to 1.00m to avoid services

 Logged : M Benson
 Date : 18/12/2013

 Checked : M Richardson
 Date : 19/12/2013

Scale 1:25

Site Ref : 5594 FSP

EXPLORATORY HOLE RECORD SHEET

 Borehole No. **WS6**

Consultant:

 PROJECT : Texaco Fuel Station
 LOCATION : Bury Old Road, Prestwich

Sheet 1 of 1

 Client:
 Halperns/Unimore
 Ltd

 EQUIPMENT:
 Archway Dart Rig

 Casing
 Dia. Depth
 (mm) (m)

Ground Level : m. AOD

 Co-ordinates E (m)
 N (m)

Dates 18/12/2013 to 18/12/2013

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth (m) from to	Sample Type & No	Blow Count (N)/U				
18/12/2013: On termination of two number inspection pits at 1.20m. Standing water level Nil. Exploratory holes backfilled as per specification.	0.40 0.50	C1		Grass over TOPSOIL Dark brown/grey sand, brick rubble - MADE GROUND	(0.10) 0.10		
	0.90 1.00	C2			(1.10)		
				CONCRETE OBSTRUCTION at 1.20m	1.20		
				Borehole complete			

REMARKS : 18/12/2013: Inspection Pit excavated by hand to 1.20m to avoid services. Exploratory hole terminated due to presence of concrete obstruction.

Logged : M Benson

Date : 18/12/2013

Checked : M Richardson

Date : 19/12/2013

Scale 1:25

Site Ref : 5594 FSP

EXPLORATORY HOLE RECORD SHEETBorehole No. **WS8**

Consultant:

PROJECT : Texaco Fuel Station
LOCATION : Bury Old Road, PrestwichSheet **1** of **1**Client:
Halperns/Unimore
LtdEQUIPMENT:
Archway Dart RigCasing
Dia. Depth
(mm) (m)
100 3.00

Ground Level : m. AOD

Co-ordinates **E** (m)
N (m)Dates **18/12/2013** to **18/12/2013**

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth (m) from to	Sample Type & No	Blow Count (N)/U				
PID = 0.5ppm Hand Vane at 1.50m =27kPa Hand Vane at 2.40m =67kPa 18/12/2013: On completion of exploratory hole at 3.00m. Casing at 3.00m. On withdrawal of casing exploratory hole backfilled as per specification.	0.40 0.50	C1		CONCRETE	(0.30) 0.30		
	0.90 1.00	C2		Dark grey/brown clayey sand with brick and concrete fragments - MADE GROUND	(1.00)		
	1.50 1.60	D1		Soft brown low strength sandy SILT/CLAY	1.30 (0.40) 1.70		
	2.20 2.30	D2		Brown gravelly silty fine to medium SAND with firm red.brown silty clay band at 2.40 to 2.45m	(0.75)		
	2.40 2.50	D3		Brown with occasional black silty fine to medium SAND	2.45 (0.55) 3.00		
				Borehole complete			

REMARKS : 18/12/2013: Inspection Pit excavated by hand to 1.00m to avoid services

Logged : M Benson
Date : 18/12/2013Checked : M Richardson
Date : 19/12/2013Scale **1:25**Site Ref : **5594 FSP**

Ground Gas and Groundwater depth Readings

Date - Time	BH	CH4 (%)	CO2 (%)	O2 (%)	H2S (ppm)	CO (ppm)	LEL (%)	aP (mb)	Flw (l/h)	H2O (m)	State
06/01/2014	WS1	0.0	0.0	20.3	0	0	0.0	976	0.0	4.50	
06/01/2014	WS3	0.0	0.8	19.7	0	0	0.0	976	0.0	4.20	
06/01/2014	WS5	0.1	2.5	16.8	0	0	2.3	976	0.3	4.40	
09/01/2014	WS1	0.0	0.0	20.6	0	0	0.0	996	0.0	4.50	
09/01/2014	WS3	0.1	0.8	19.5	0	0	2.3	995	0.5	4.20	
09/01/2014	WS5	0.1	3.2	15.7	0	0	2.3	995	0.0	4.40	
13/01/2014	WS1	0.0	0.0	20.6	0	0	0.0	995	0.0	4.50	
13/01/2014	WS3	0.0	0.8	20.0	0	0	0.0	995	0.0	4.2	
13/01/2014	WS5	0.1	3.9	15.5	0	0	2.9	995	0.0	4.40	

NM = Not Measured

Appendix D

- D1 Laboratory Summary Sheet**
- D2 Classification Summary**
- D3 Sulphate and pH Summary**
- D4 Particle Size Distribution Graphs**

GeoAssist Limited SOIL LABORATORY SUMMARY SHEET	Project: Texaco Fuel Station Location: Bury Old Road, Prestwich Client: Halperns/Unimore Ltd Consultant :	Site Ref: 5594/FSP Project Code :
		Hole Ref WS1 to WS8

Sample Ref.	Depth m	Sample Description	Classification					Triaxial Compression					Chemical			Test Code
			LL %	PL %	PI %	% passing 425 μ m	Moist Cont. %	Bulk Density Mg/m ³	Sample Diameter mm	Lateral Pressure kN/m ²	Deviator Stress kN/m ²	Shear Cohesion kN/m ²	So4 Water mg/l	pH	So4 Soil % D.W.	
WS1 D1	1.30	Dark brown/grey clay, sand and gravel with brick fragments – MADE GROUND					-						340	8.1		SULWS PHS
WS1 D2	3.20	Brown gravelly sandy SILT/CLAY	63	32	31	78	36									NMC CLSS
WS1 D3	4.40	Brown with occasional black silty fine to medium SAND					-									GRAD WS
WS2 D1	2.80	Brown SILT/CLAY with organic inclusions	53	36	17	83	39									NMC CLSS
WS3 D1	1.20	Dark brown/grey sand, gravel, brick and concrete fragments – MADE GROUND					-						280	8.0		SULWS PHS
WS3 D2	2.30	Dark brown/grey gravelly clayey silty sand with brick fragments – MADE GROUND					-									GRAD WS
WS3 D3	2.80	Brown SILT/CLAY with organic inclusions	55	35	20	70	36									NMC CLSS
WS3 D4	4.70	Brown silty very sandy GRAVEL					-									GRAD WS
WS3 D5	5.30	Brown slightly silty fine to medium SAND					-									GRAD WS
WS5 D1	1.50	Dark grey clayey silty fine to medium SAND					-						500	8.3		SULWS PHS
WS5 D2	2.10	Brown silty fine to medium SAND					-									GRAD WS
WS8 D1	1.50	Brown sandy SILT/CLAY	37	24	13	62	27									NMC

GeoAssist Limited SOIL LABORATORY SUMMARY SHEET	Project: Texaco Fuel Station Location: Bury Old Road, Prestwich Client: Halperns/Unimore Ltd Consultant :	Site Ref: 5594/FSP Project Code :
		Hole Ref WS1 to WS8

Sample Ref.	Depth m	Sample Description	Classification					Triaxial Compression					Chemical			Test Code
			LL %	PL %	PI %	% passing 425 μ m	Moist Cont. %	Bulk Density Mg/m ³	Sample Diameter mm	Lateral Pressure kN/m ²	Deviator Stress kN/m ²	Shear Cohesion kN/m ²	So4 Water mg/l	pH	So4 Soil % D.W.	
WS8 D2	2.20	Brown gravelly silty fine to medium SAND					-									GRAD WS
WS8 D3	2.40	Red/brown silty CLAY					19									NMC

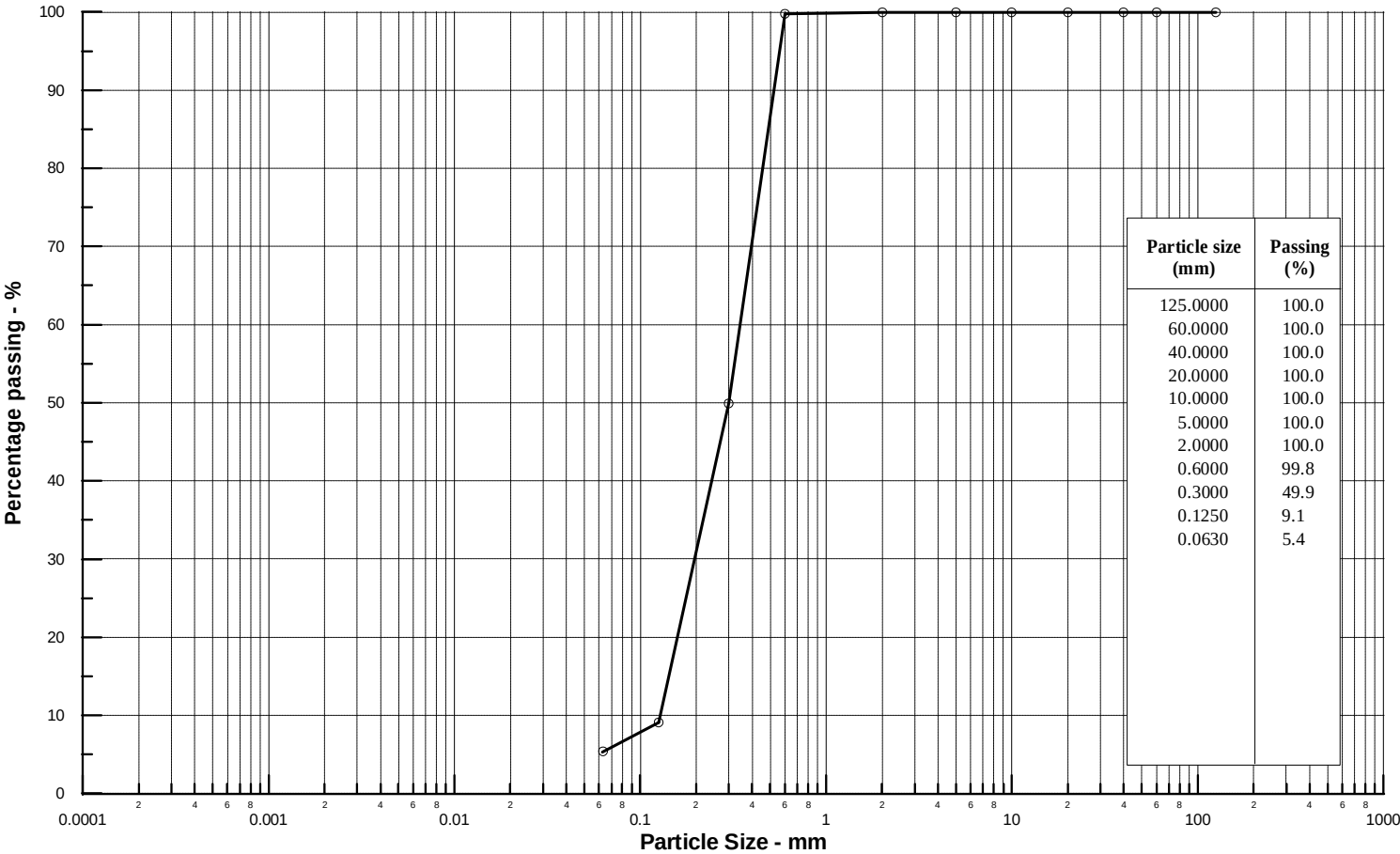
Site Reference:			5594 FSP				
Project Site:			Texaco Fuel Station				
Project Location:			Bury Old Road, Prestwich				
Client:			Halperns/Unimore Ltd				
Consultant:			0				
	CLASSIFICATION TEST						
Borehole Reference	Sample	Depth	Liquid Limit	Plastic Limit	Plasticity Index	% passing 425 micro	Natural Moisture Content
WS1	D2	3.20	63	32	31	78	36
WS2	D1	2.80	53	36	17	83	39
WS3	D3	2.80	55	35	20	70	36
WS8	D1	1.50	37	24	13	62	27
		Mean	52	32	20	73	35
		Maximum	63	36	31	83	39
CLAY		Minimum	37	24	13	62	27
	Standard Deviation		11	5	8	9	5
		Count	4	4	4	4	4

Site Reference:			5594 FSP				
Project Site:			Texaco Fuel Station				
Project Location:			Bury Old Road, Prestwich				
Client:			Halperns/Unimore Ltd				
Consultant:			0				
GEOTECHNICAL SULPHATE AND PH TEST							
Borehole Reference	Sample	Depth	SO4 2:1 Water:Soil extract mg/l	pH	SO4 Water mg/l		
WS1	D1	1.30	340	8.1			
WS3	D1	1.20	280	8.0			
WS5	D1	1.50	500	8.3			

GeoAssist Limited
PARTICLE SIZE DISTRIBUTION GRAPH

Site Ref: **5594 FSP**
Project code: **-**

Project: **TEXACO FUEL STATION**
Location: **BURY OLD ROAD, PRESTWICH**
Client: **HALPERNS/UNIMORE LTD**
Consultant: **-**



BH No: WS1
Sample: D3
Depth : 4.40m

%	SIZE
0.0	Cobbles
0.0	Gravel
94.6	Sand
5.4	Silt and Clay

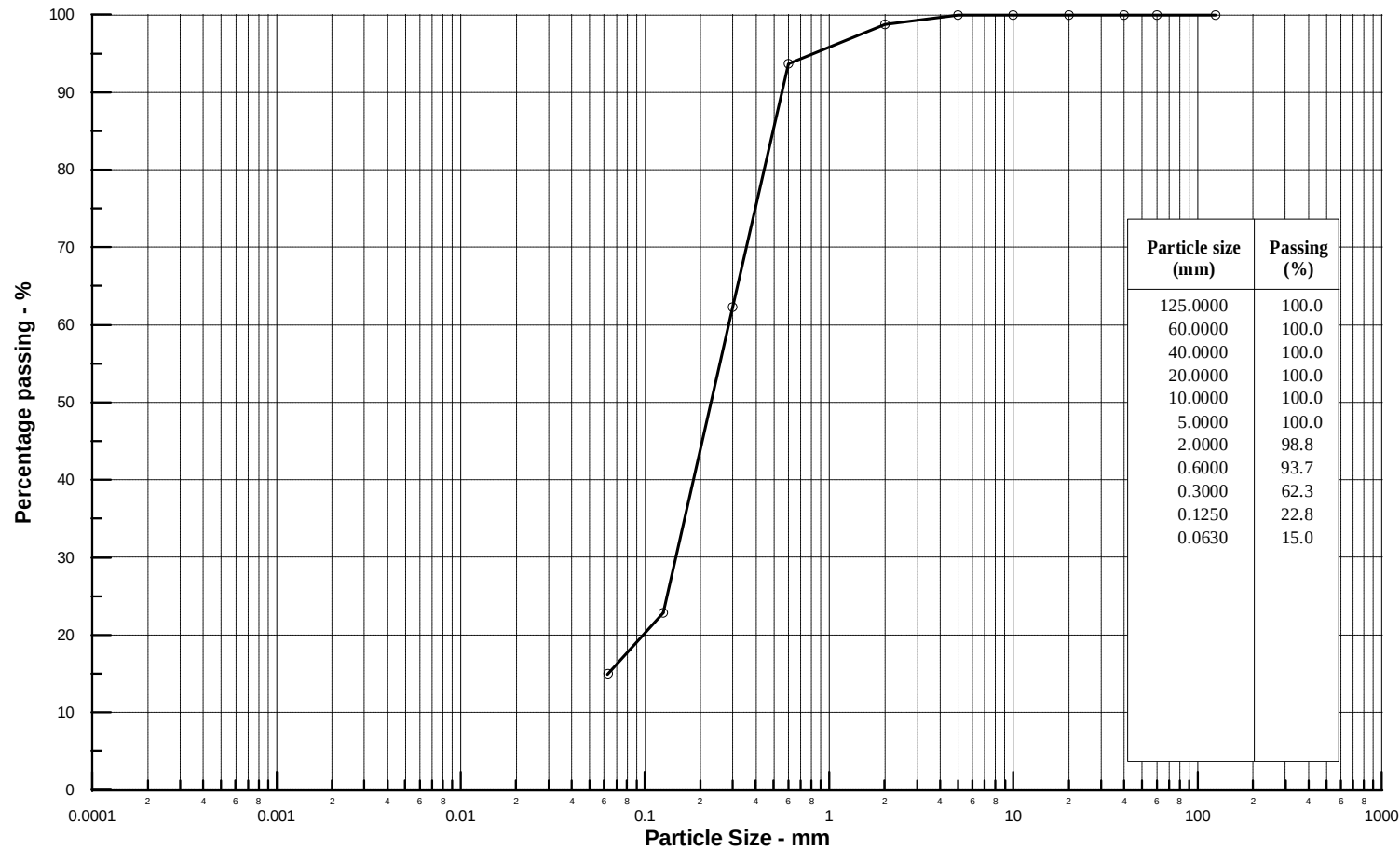
CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	GRAVEL	COB- BLES	BOUL- DERS
	SILT			SAND					

GeoAssist Limited

PARTICLE SIZE DISTRIBUTION GRAPH

Site Ref: **5594 FSP**
Project code: **-**

Project: **TEXACO FUEL STATION**
Location: **BURY OLD ROAD, PRESTWICH**
Client: **HALPERNS/UNIMORE LTD**
Consultant: **-**



BH No: WS3
Sample: D2
Depth : 2.30m

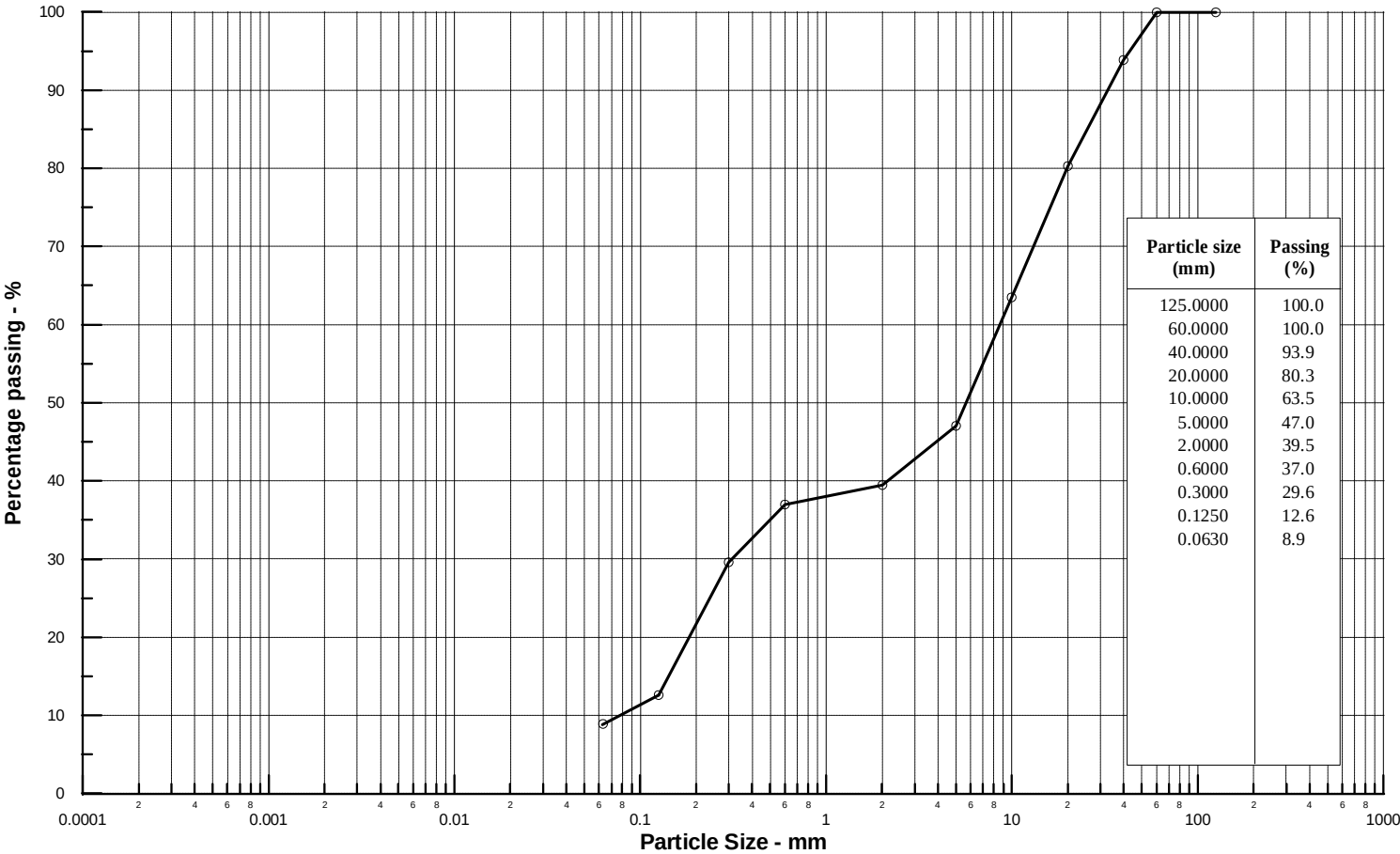
%	SIZE
0.0	Cobbles
1.2	Gravel
83.8	Sand
15.0	Silt and Clay

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	GRAVEL	COB- BLES	BOUL DERS
	SILT			SAND					

GeoAssist Limited
PARTICLE SIZE DISTRIBUTION GRAPH

Site Ref: **5594 FSP**
Project code: **-**

Project: **TEXACO FUEL STATION**
Location: **BURY OLD ROAD, PRESTWICH**
Client: **HALPERNS/UNIMORE LTD**
Consultant: **-**



BH No: WS3
Sample: D4
Depth : 4.70m

%	SIZE
0.0	Cobbles
60.5	Gravel
30.6	Sand
8.9	Silt and Clay

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	GRAVEL	COB- BLES	BOUL- DERS
	SILT			SAND					

GeoAssist Limited

PARTICLE SIZE DISTRIBUTION GRAPH

Site Ref: 5594 FSP

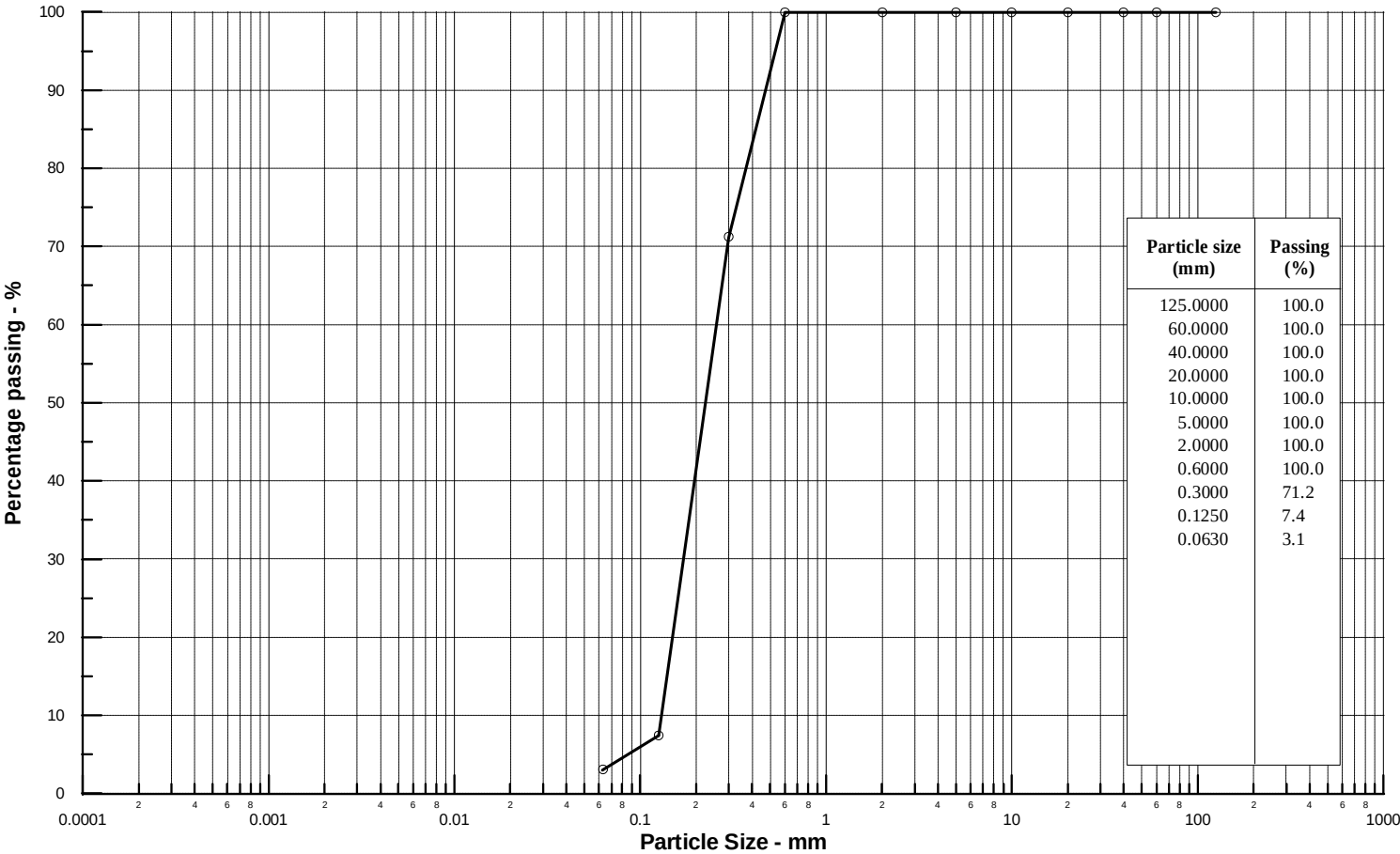
Project code: -

Project: TEXACO FUEL STATION

Location: BURY OLD ROAD, PRESTWICH

Client: HALPERNS/UNIMORE LTD

Consultant: -



BH No: WS3

Sample: D5

Depth : 5.30m

%	SIZE
0.0	Cobbles
0.0	Gravel
96.9	Sand
3.1	Silt and Clay

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	GRAVEL	COB- BLES	BOUL- DERS
	SILT			SAND					

GeoAssist Limited

PARTICLE SIZE DISTRIBUTION GRAPH

Site Ref: 5594 FSP

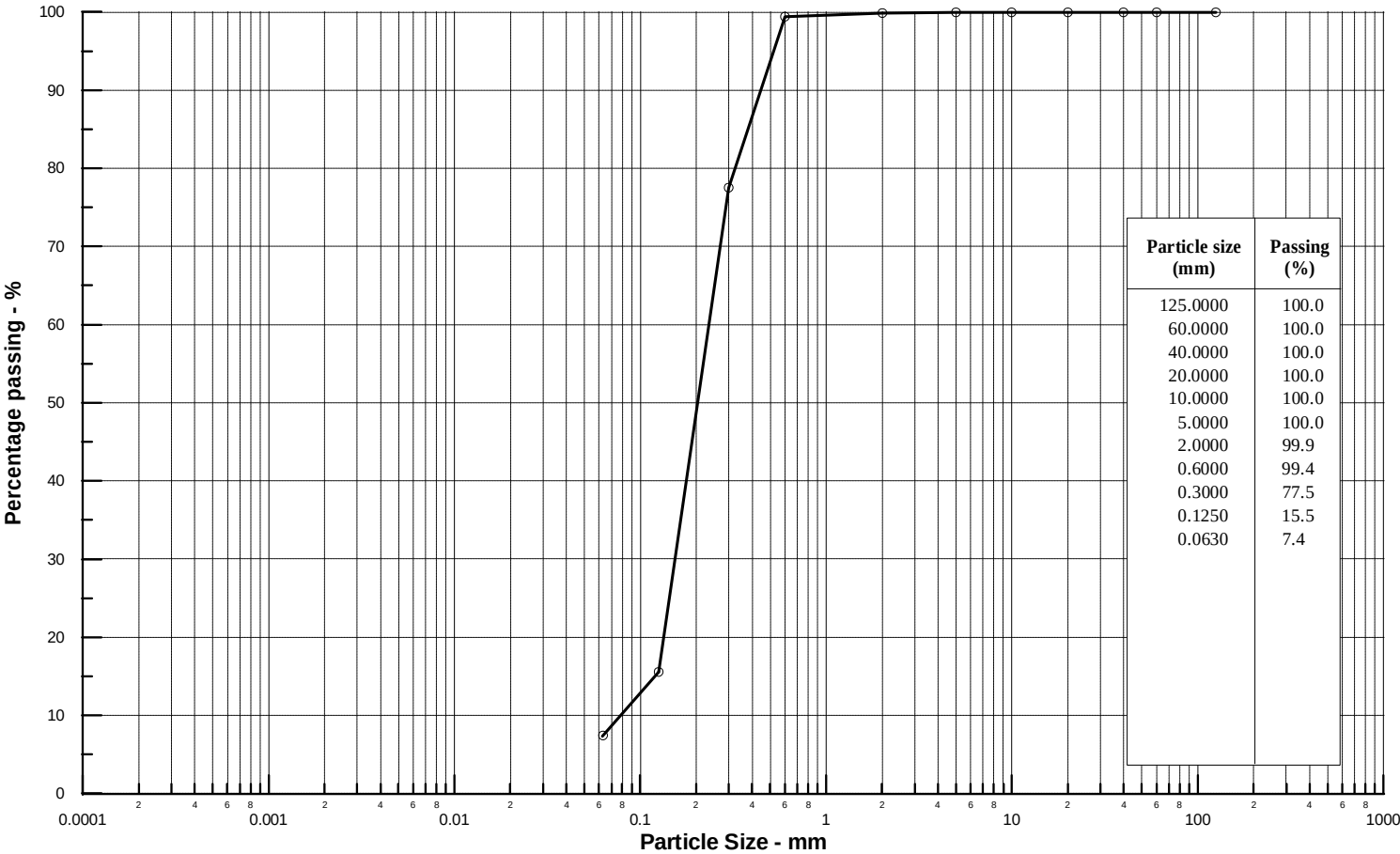
Project code: -

Project: TEXACO FUEL STATION

Location: BURY OLD ROAD, PRESTWICH

Client: HALPERNS/UNIMORE LTD

Consultant: -



BH No: WS5

Sample: D2

Depth : 2.10m

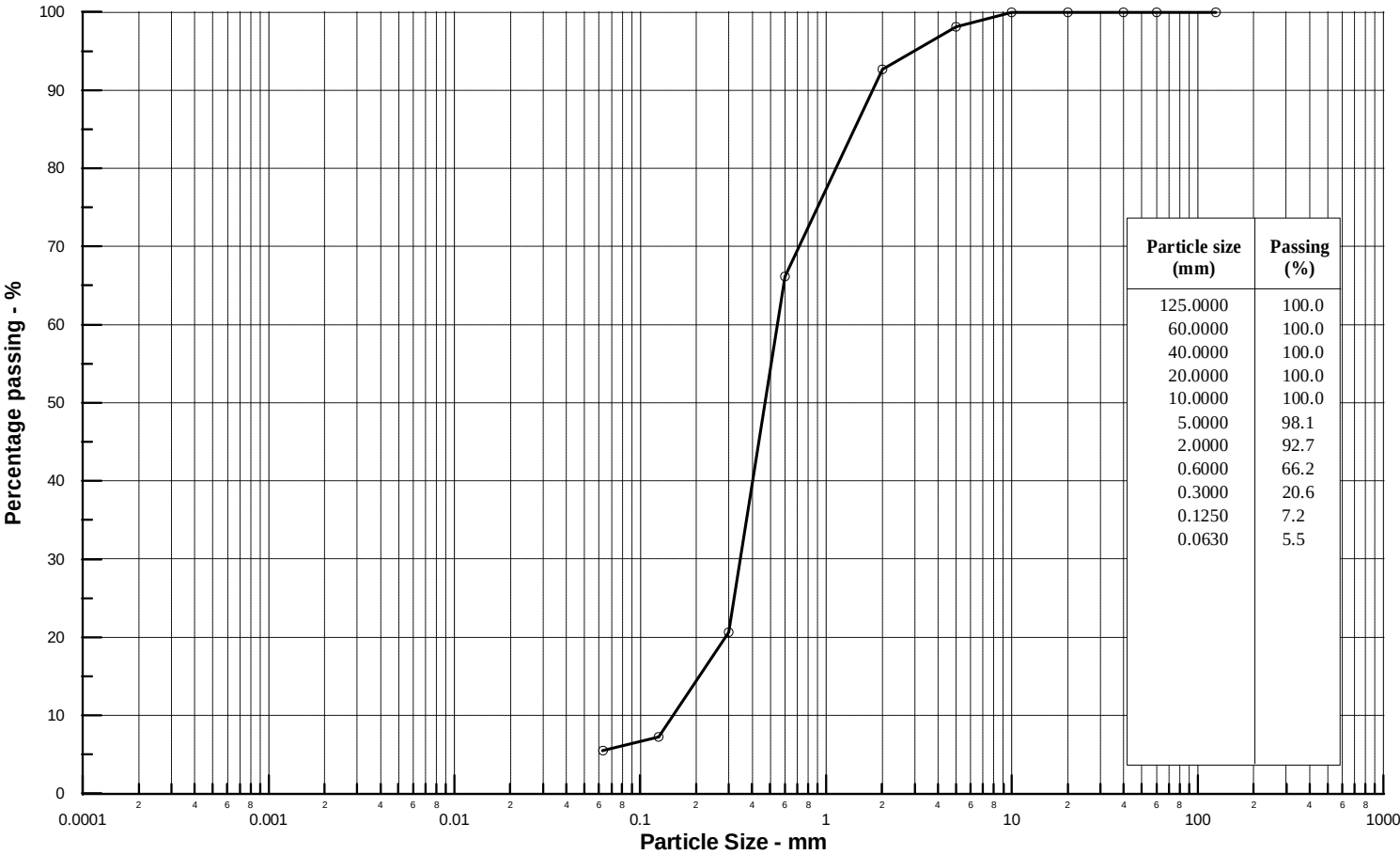
%	SIZE
0.0	Cobbles
0.1	Gravel
92.5	Sand
7.4	Silt and Clay

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	GRAVEL	COB- BLES	BOUL DERS
	SILT			SAND					

GeoAssist Limited
PARTICLE SIZE DISTRIBUTION GRAPH

Site Ref: 5594 FSP
Project code: -

Project: TEXACO FUEL STATION
Location: BURY OLD ROAD, PRESTWICH
Client: HALPERNS/UNIMORE LTD
Consultant: -



BH No: WS8
Sample: D2
Depth : 2.20m

%	SIZE
0.0	Cobbles
7.3	Gravel
87.2	Sand
5.5	Silt and Clay

CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	GRAVEL	COB- BLES	BOUL DERS
	SILT			SAND					