



have then been compared to the Revised Wilson and Card Classification) presented within CIRIA Report 665.

It is recommended that the gas risk should be assessed by the consideration of pathways to human receptors as follows:

- Gas entering the building through the substructure and building up to hazardous levels.

### ***Results***

The following ground gas parameters have been recorded over the 8 no. gas monitoring rounds:

- A maximum 'initial' methane concentration of 28.5%;
- A maximum 'steady state' carbon dioxide concentration of 3.4%;
- A maximum 'initial' flow rate of 4.5 l/hr; and
- A maximum 'steady state' flow rate of 0.1 l/hr.

The worst case Gas Screening Values (GSV) for both methane and carbon dioxide have been calculated. In accordance with NHBC guidance for methane the GSV is calculated using the peak concentration and flow and for carbon dioxide the residual concentrations and flow rates are used. The gas results have been assessed on a hole by hole basis in accordance with BS 8485.

Some initial high flow rates from BH7 and BH8 have been discounted because the very shallow water level on these occasions was within the unperforated top section of the standpipe, causing a pressure imbalance which is released during monitoring.

The high methane concentration in BH7 only occurred once and is not readily explainable. There is no apparent source of gas here, or anywhere on the site, in terms of the desk study or the borehole logs. BH7 lies just off the western boundary of the site plan supplied by the client, as shown in Appendix A. As such it is unlikely to be located under any proposed buildings, and the potential for gas migration is low due to the likely low permeability clay geology.

### ***Conclusion***

GSVs for methane and carbon dioxide have been calculated to be 0.26 l/hr and 0.0 l/hr respectively.



Therefore the site falls into ‘Characteristic Situation’ 2 (low hazard) in Table 8.5 of CIRIA 665.

The type of building proposed is commercial and for this Table 8.6 of CIRIA 665 indicates that the following special protection measures are required in the new buildings.

- Reinforced cast insitu floor slab with at least 1200 gauge DPM
- Beam block or precast concrete slab and at least 2000 gauge DPM/reinforced gas membrane
- Underfloor venting
- All joints and penetrations sealed

Underfloor venting is not required in large spaces such as warehouse but it is required where smaller rooms such as offices are present.

### **7.1.5 Conclusion on Contamination**

The investigation has generally shown contaminant levels in the soil to be below the assessment criteria, which indicates that no risks to health have been identified. TP12 showed 5000mg/kg lead which exceeds the human health guideline of 750mg/kg. This could be due, for instance, to a fragment of lead-glazed pottery (ceramics were logged in this sample).

There are a few exceedances of groundwater guidelines, but these sampled were obtained using a bailer and it is likely that if low-flow sampling were carried out lower results would be returned. In additions the geology is classed as unproductive strata with low presumed permeability. Therefore the site is considered unlikely to pose a risk to water resources.

One instance of an elevated methane concentration was encountered in BH7 (28.5%).

## **7.2 Final Conceptual Site Model & Risk Assessment**

### **7.2.1 General**

This section of the report aims to refine the ‘Initial Contamination Conceptual Model’, in the light of the findings of the ground investigation. Furthermore, this section of the report is based on the information set out in the previous sections, and should not be read independently of the other sections of the report.



## 7.2.2 Risk Assessment Methodology

Risk is a combination of the ‘likelihood’ of an even occurring and the magnitude of its ‘consequences’. Therefore, in order to assess risk, both the likelihood and the consequences of an event must be taken into account. RSK Group Plc has adopted guidance provided in CIRIA C552 for use in the production of risk assessments.

The likelihood of an event can be classified on a four point system using the following terms and definitions based on CIRIA C552:

- **Highly likely:** The event appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution;
- **Likely:** It is probable that an event will occur, or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term;
- **Low likelihood:** Circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term;
- **Unlikely:** Circumstances are such that it is improbably the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

- **Severe:** Short term (acute) risk to human health likely to result in ‘significant harm’ as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in ‘Draft Circular on Contaminated Land’, DETR 2000);
- **Medium:** Chronic damage to human health (‘significant harm’ as defined in ‘Draft Circular on Contaminated Land’, DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in ‘Draft Circular on Contaminated Land’, DETR 2000);



- **Mild:** Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services (‘significant harm’ as defined in ‘Draft Circular on Contaminated Land’, DETR 2000). Damage to sensitive buildings, structures or the environment; and
- **Minor:** Harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the likelihood of an event occurring and its severity have been classified, a risk category can be assigned the table below.

		Consequence			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low likelihood	Moderate	Moderate/Low	Low	Very Low
	Unlikely	Moderate/Low	Low	Very Low	Very Low

### 7.2.3 Final Conceptual Site Model

The complete linkages and resulting risks have been identified and are presented in the table below:

Potential Source	Potential Pathway	Potential Receptor	Probability	Consequence	Risk	Comments
Soil contaminants (lead in TP12)	Ingestion/ Dermal Contact	Future on-site users (residents)	Low likelihood	Medium	Moderate/Low	Replace made ground/topsoil (0.3m thick) if soft landscaping proposed in vicinity of TP12
	Permeation	Subsurface plastic water pipes	Low likelihood	Medium	Moderate/Low	Consult water company as to whether alternative pipes are required
Ground gases (e.g. methane/carbon dioxide)	Migration along backfill around services, more permeable strata inhalation/ explosion	Future on-site users (residents)	Low likelihood	Severe	Moderate	Provide gas protection to CS2 of CIRIA C665
		Maintenance workers		Severe	Moderate	

This Generic Quantitative Risk Assessment (GQRA) indicates that complete and significant pollutant linkages exist at the site that require further action (e.g. remediation or other risk reduction measures).



## **7.3 Risk Reduction**

### **7.3.1 Human Health**

TP12 at 0.15 m showed elevated lead in the made ground. Therefore the made ground (0.3m thick) should be replaced in vicinity of TP12 if soft landscaping is proposed in this area. Further testing might be required to delineate the area.

### **7.3.2 Water Pipes**

Normal polythene water supply pipes should be suitable for the site, but this should be confirmed with the local water company.

### **7.3.3 Ground Gas**

GSVs for methane and carbon dioxide have been calculated to be 0.26 l/hr and 0.0 l/hr respectively. Therefore the site falls into 'Characteristic Situation' 2 (low hazard) in Table 8.5 of CIRIA 665.

The type of building proposed is commercial and for this Table 8.6 of CIRIA 665 indicates that the following special protection measures are required in the new buildings.

- Reinforced cast insitu floor slab with at least 1200 gauge DPM
- Beam block or precast concrete slab and at least 2000 gauge DPM/reinforced gas membrane
- Underfloor venting
- All joints and penetrations sealed

Underfloor venting is not required in large spaces such as a warehouse but it is required where smaller rooms such as offices are present.

### **7.3.4 Unforeseen Risks During Development**

The site contains made ground/possible made ground in some areas and thus landscape and maintenance workers should wear gloves, boots and overalls and wash their hands before eating, drinking and smoking. Excessive dust generation should be avoided.

Given the existence of made ground on the site it would be prudent to maintain vigilance during site clearance and construction, in case any further areas of suspected contamination are



encountered. If areas are found then a suitably qualified person should undertake appropriate sampling, testing and further risk assessment.

Excavations or below ground voids should be checked for the presence of harmful gases prior to personnel entry.

## **7.4 Off-site Disposal of Surplus Soil**

### **7.4.1 General**

All excavated material and excess spoil must be classified for waste disposal purposes prior to disposal at landfill. Under the Landfill (England and Wales) Regulations 2002 (as amended), prior to disposal all wastes must be classified as:

- ‘inert’, or
- ‘non-hazardous’, or
- ‘hazardous’.

The Environment Agency’s *Hazardous Waste (Technical Guidance WM2)* document outlines the methodology for classifying wastes.

Currently all wastes may require pre-treatment prior to disposal at landfill.

### **7.4.2 Initial Waste Characterisation**

Envirolab have produced an assessment tool, ‘Haswaste’, that characterises contaminated waste soil by following the guidance within WM2. The ‘total solid testing’ results from this investigation have been run through this assessment tool to aid potential future off-site disposal of materials. This assessment produces an ‘initial’ characterisation of the waste which determines if it is hazardous or not (if it is ‘not’ hazardous, then it may be either inert (insoluble and inorganic) or non-hazardous. However, due to complications with the terminology of ‘inert waste’ it is best not to refer to it as such until after Waste Acceptance Criteria testing).

The initial waste characterisation shows that the samples tested are not classed as hazardous, except for TP12 at 0.15m which is classed as hazardous due to its high lead result. The assessment is included in Appendix D.

It is important to note that whilst we believe our in-house assessment tool to be an accurate interpretation of the requirements of WM2, thereby producing initial classifications in



accordance with it, landfill operators often have their own assessment tools and can often come to a different conclusion. As a result, some landfill operators could even refuse to take apparently suitable waste.



## **8 SUMMARY**

- 8.1** Grovefield Way, Cheltenham is the proposed location for a new car showroom.
- 8.2** A desk study completed prior to the commencement of site works indicated that the site has predominantly been fields since 1884. However there was a cottage present from 1884 until 1887 when it became a farm and later demolished between 1949 and 1972. The A40 trunk road was constructed to the north of the site between 1949 and 1972 and residential and industrial estates were established to the east of the site during this period also. Orchards on the site were felled between 2002 and 2005. The environmental data identified a historic landfill site to the north east of the site of unknown age.
- 8.3** A site investigation was completed between the 31 July 2008 and 6 August 2008. The investigation consisted of 8 no. cable percussion boreholes, 14 no. trial pits, and 7 no. Californian Bearing Ratio tests and 3 no. soakaway tests. The boreholes and trial pits encountered made ground up to 1.4m thick overlying superficial clays, beneath which stiff to hard grey clay and very weak mudstone of the Charmouth Mudstone Formation were encountered.
- 8.4** Tested samples show medium to high volume change potentials with changes in moisture content, according to the criteria of NHBC Standards, Chapter 4.2 (2003) *Building Near Trees*. We recommend that A high volume change potential be assumed for foundation design at this site.
- 8.5** The proposed buildings can be constructed on conventional strip or pad foundations. The foundations should be taken down through the made ground and upper superficial clays to a minimum depth of 1.00m depth. The allowable bearing pressure should be restricted to 140kN/m<sup>2</sup> to keep settlements below the generally accepted value of 25mm.
- 8.6** Lightly loaded ground bearing, floor slabs may be used at this site (designed in accordance with NHBC Standards). For ground bearing slabs the formation must be proof-rolled and any soft spots must be excavated and replaced with suitably compacted granular fill. However where made ground in excess of 600mm deep was encountered, NHBC Standards requires the use of suspended slabs as a precaution against differential settlement.





- 8.7** We recommend using a CBR value of 2.0% for pavement design provided any soft spots are replaced with a suitably compacted granular fill. It should be noted that the CBR tests were carried out on cohesive soils that were dry and stiff when tested, and lower CBR values would be obtained during wetter weather.
- 8.8** Shallow soakaways are not practical at this site.
- 8.9** The Aggressive Chemical Environment for Concrete (ACEC) class is AC-4 where concrete could be contact with groundwater and AC-1 if there is no risk of concrete being in contact with groundwater. The designer should utilise these classifications in order to produce the concrete specification.
- 8.10** No radon protection is necessary for this site as less than 1% of homes are above the action level.
- 8.11** TP12 at 0.15 m showed elevated lead in the made ground. Therefore the made ground (0.3m thick) should be replaced in the vicinity of TP12 if soft landscaping is proposed in this area. Further testing might be required to delineate the area.
- 8.12** Normal polythene water supply pipes should be suitable for the site, but this should be confirmed with the local water company
- 8.13** The gas monitoring results suggest that gas protection to CS2 of C665 should be provided. This requires a gas resistant membrane, sealed around service entries, and a vented underfloor void. Underfloor venting may not be required for large spaces such as warehouse.
- 8.14** All samples, except for TP12 at 0.15m depth, have not been classed as hazardous for disposal. Trial pit TP12 however was classed as hazardous.

#### STRUCTURAL SOILS LIMITED

S Pond BSc CChem MRSC

A Watts BSc (Hons)

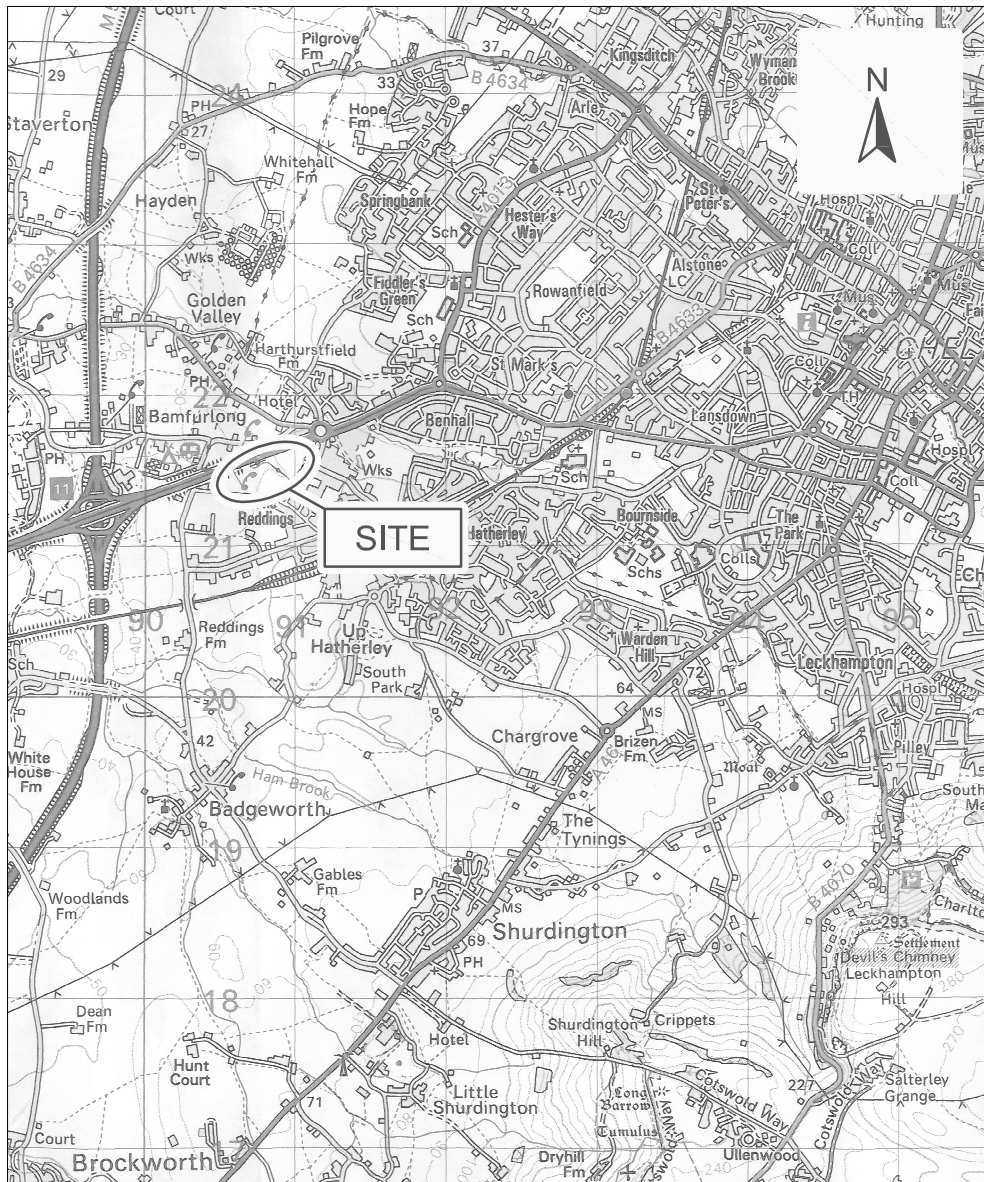


## 9 REFERENCES

- 9.1 BS 5930:1999 Code of Practice for Site Investigations
- 9.2 BS 5930:1999 *Code of Practice for Site Investigations*: including amendment 2 (2010)
- 9.3 BS 10175:2011 *Investigation of potentially contaminated sites: Code of practice*, including amendment A1 (2013)
- 9.4 Geological Survey of Great Britain for *Tewkesbury*, sheet 216, scale 1:50,000
- 9.5 Environment Agency website, [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)
- 9.6 CIRIA Report C552 (2001), *Contaminated Land Risk Management; A Guide to Good Practice*
- 9.7 BRE Report 279 *Sulphate and acid attack on concrete in the ground*: recommended procedures for soil analysis
- 9.8 Health and Safety in Construction, HSG150, HSE, 1996
- 9.9 NHBC Standards, Chapter 4.2, 2007 *Building Near Trees*
- 9.10 BRE Digest 365 (1991) *Soakaway Design*
- 9.11 BRE Special Digest 1 (SD1)(2005) *Concrete in Aggressive Ground Part 1: Assessing the aggressive chemical environment*. Third Edition
- 9.12 Environment Agency Policy. Part IIA – *Detailed Quantitative Assessment of Chronic Risks to Human Health from Contaminated Soils*. Policy Number 199\_04, dated 9 March 2004.
- 9.13 R & D Publication CLR 11 (September 2004). *Model Procedures for the Management of Contaminated Land*. Contaminated Land. Environment Agency.
- 9.14 The Water Supply (Water Quality) Regulations 2000, DoE
- 9.15 CIRIA Report C665 *Assessing risks posed by hazardous ground gases to buildings*, London, 2007
- 9.16 *Hazardous Waste: Interpretation of the Definition and Classification of Hazardous Waste*, Environment Agency, WM2 Version 1.0, June 2003
- 9.17 *Landfill (England & Wales) Regulations 2002*
- 9.18 N. A. Tranter (2001) *Earthworks: A guide* published by Thomas Telford Limited

## **APPENDIX A**

- (i) Site Location Plan
- (ii) Exploratory Hole Location Plan
- (iii) Current Plan of Development Site



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CLIENT

HA Bailey, JA Bailey & CH Harvey

PROJECT

Grovefield Way, Cheltenham

TITLE

SITE LOCATION MAP

REV.	DATE	DESCRIPTION	BY	CHD.	APR.
-	11.09.2008	-	SM	MB	-
DIMENSION		SCALE	ORIGIN SIZE		
m		1:50 000	A4		

GRID REFERENCE	JOB NO.	DRAWING STATUS	FIGURE
E 390641, N 221457	722048	-	-



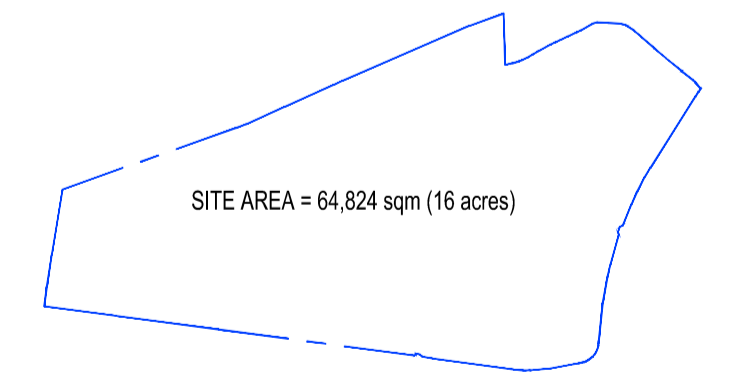
**LEGEND**

- BH Borehole
- TP Trial Pit
- CBR CBR Test
- SA Soakaway

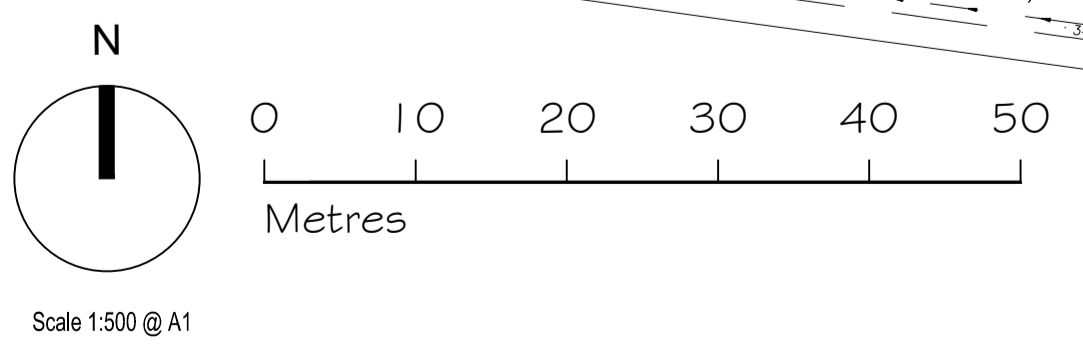
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-	11.09.2008	-	SM	MB	-
DIMENSION		SCALE	ORIGIN SIZE		
m		1:1500	A3		
<b>STRUCTURAL SOILS LIMITED</b>					
The Old School Still House Lane Bedminster Bristol BS3 4EB Tel: 0117 947 1000 Fax: 0117 947 1004 admin@soils.co.uk www.soils.co.uk					
CLIENT					
HA Bailey, JA Bailey & CH Harvey					
PROJECT					
Grovefield Way, Cheltenham					
TITLE					
EXPLORATORY HOLE LOCATION PLAN					
JOB NO.		FIGURE			
722048		-			
DRAWING STATUS					REV.
-					-



DEMOLITION



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EXISTING SITE PLAN 1:500



NEW BMW MINI DEALERSHIP GROVEFIELD WAY, CHELTENHAM.

FEB 2013 M999.01J

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## **APPENDIX B**

- (i) Borehole Logs
- (ii) SPT Table of Results
- (iii) Trial Pit Logs
- (iv) Californian Bearing Ratio Logs
- (v) Soakaway Logs



# STRUCTURAL SOILS

## KEY TO EXPLORATORY HOLE LOGS

### SAMPLING

B	Bulk disturbed sample.
BLK	Block sample.
C	Core sample.
CBR	CBR mould sample.
CS	Core sample taken from rotary core for laboratory testing.
D	Small disturbed sample.
J	Glass jar sample.
LB	Large bulk disturbed sample (for earthworks testing).
P	Undisturbed pushed piston sample - 102 mm diameter, 1000 mm long.
TW	Thin walled push in sample.
U	Undisturbed driven tube sample - 102 mm diameter, 450 mm long. Number of blows indicated.
VL	Vial sample.
W	Water sample.
U+, P+	No recovery in undisturbed sample.

### IN-SITU TESTING

SPT	Standard Penetration Test using split spoon sampler. (SPT <sub>(NR)</sub> indicates 'No Sample Recovery').
SPT <sub>(c)</sub>	Standard Penetration Test using a solid 60 degree cone. The N Value is the number of blows required to complete a test drive of 300 mm after a seating drive of 150 mm or 25 blows. Where the full test drive is not completed, a linearly extrapolated N value is given and suffixed by a '*' character. 'NP' denotes No Penetration in the Test Drive.
HP	Hand Penetrometer Test. Value given as shear strength cu, in kPa.
V <sub>(cu)</sub>	Field Vane Test. Peak value given as shear strength cu, in kPa.
V <sub>(cr)</sub>	Field Vane Test. Residual value given as shear strength cr, in kPa.
G	Gas Test
PID	Photo Ionisation Detector Results, in ppm.

### DRILLING RECORDS

W	Water flush returns.	Core	Hole progressed by rotary coring techniques.
TCR	Total Core Recovery, %.	O/H	Hole progressed by rotary percussive drilling techniques.
SCR	Solid Core Recovery, %.	W/S	Hole progressed by dynamic drilling techniques.
RQD	Rock Quality Designation, %.		
If	Fracture spacing, mm. Where variable, the minimum, average and maximum spacing may be quoted. 'NI' denotes non intact core. 'NA' denotes not applicable.		

### WATER COLUMN SYMBOLS

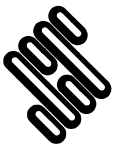
	First water strike, second water strike etc.
	Standing water level following first strike, standing water level following second strike etc.
	Seepage.
	Standing water level recorded at documented date.

### INSTRUMENTATION SYMBOLS

	Arisings		Gravel filter		Sand filter		Bentonite seal
	Bentonite cement grout		Concrete		Solid pipe		Slotted pipe
	Stopcock cover		Upstand cover				

- NOTES:**
- All soil and rock descriptions and legends in general accordance with BS5930:1999.
  - All lengths used to determine rock core mechanical properties taken along the centre line of the core. Obvious induced fractures have been ignored.
  - The assessment of solid core is based on lengths that show a full diameter and not necessarily a full circumference.
  - Material types divided by a broken line (- - -) indicates an unclear boundary.





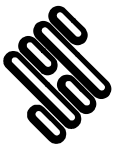
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Contract Ref: <b>722048</b>		Start: <b>05.08.08</b> End: <b>06.08.08</b>	Ground Level (m): <b>37.21</b>	National Grid Co-ordinate: <b>E:390777.8 N:221502.3</b>	
Sheet: <b>1 of 1</b>					

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.00-0.50	1	B				Grass over MADE GROUND: Dark brown slightly sandy slightly gravelly friable CLAY. Gravel is fine subangular to subrounded brick and charcoal, also frequent rootlets.	(0.50)	
0.70	2	D				Firm brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to medium subrounded mudstone. (Superficial Deposits)	(0.70)	
1.20-1.65	1	SPT	N=7			Firm grey mottled brown slightly sandy CLAY with occasional decomposing rootlets. (Charmouth Mudstone Formation)	1.20	
1.20	4	B					(0.80)	
1.90	5	D	28 blows			Very stiff dark grey slightly sandy thinly laminated CLAY with occasional gypsum crystals (1mm to 5mm) and shell fragments. (Charmouth Mudstone Formation)	2.00	
2.00	6	U						
2.60	7	D				... no gypsum crystals below 4.00m depth.	(5.00)	
3.00-3.45	2	SPT	N=29					
3.70	9	D						
4.00-4.45	3	SPT	N=38					
4.70	11	D				Weak dark grey MUDSTONE with occasional shell fragments, (Charmouth Mudstone Formation)	7.00	
5.00-5.45	4	SPT	N=50				(0.70)	
5.70	13	D				Weak dark grey MUDSTONE with occasional shell fragments, (Charmouth Mudstone Formation)	7.70	
6.00-6.38	5	SPT	N=67*				(0.70)	
7.00	15	D						
7.50-7.70	6	SPT	N=120*					

STRUCTURAL\_SOILS\_GINT\_LIBRARY\_GLIBCABLE\_PERCUSSION\_LOG\_722048\_GROVEFIELD\_WAY\_CHELTEHAM.GPJ - v8\_02 | 14/07/14 - 12:17: Structural Soils Ltd, Head Office - Bristol: The Old School, Stillhouse Lane, Bedminster, Bristol, BS3 4EB. Tel: 0117-947-1000, Fax: 0117-947-1004, Web: www.soils.co.uk, Email: admin@soils.co.uk.

Boring Progress and Water Observations						Chiselling			General Remarks	
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)		
05/08/08	17:00	7.70	1.60	150	Dry	7.20	7.50	01:00	1. No groundwater encountered. 2. Single standpipe installed on completion.	
All dimensions in metres								Scale:	<b>1:50</b>	
Method Used: <b>Cable percussion</b>		Plant Used: <b>Dando 3000</b>		Drilled By: <b>RS</b>		Logged By: <b>MBaker</b>		Checked By: <b>SP</b>		





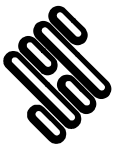
Contract: <b>Grovefield Way, Cheltenham</b>		Client: <b>H N Bailey, J A Bailey and C H Harvey</b>		Borehole: <b>BH2</b>	
Contract Ref: <b>722048</b>		Start: <b>31.07.08</b> End: <b>01.08.08</b>	Ground Level (m): <b>38.61</b>	National Grid Co-ordinate: <b>E:390755.3 N:221397.0</b>	Sheet: <b>1 of 2</b>

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.00-0.40	1	B				Grass over MADE GROUND: Dark brown black slightly sandy friable CLAY with frequent roots.	0.40	
0.40-0.80	2	B				MADE GROUND: Firm brown slightly sandy slightly gravelly CLAY. Gravel is fine subangular to subrounded brick.	0.80	
0.80-1.20	3	B				Firm grey mottled brown slightly sandy CLAY. (Superficial Deposits)	(1.00)	
1.20	4	U	33 blows				1.80	
1.80	5	D				Stiff grey brown mottled orange sandy CLAY. Sand is fine to coarse in pockets of orange with abundant decomposing rootlets. (Superficial Deposits)	2.00	
2.00-2.45	1	SPT	N=20			Firm to stiff thinly laminated brown mottled grey slightly sandy CLAY with pockets of fine sandy orange clay. (Superficial Deposits)	(0.70)	
2.70	7	D				Stiff dark grey very thinly laminated slightly sandy CLAY and occasional orange pockets. (Charmouth Mudstone Formation)	2.70	
3.00-3.45	2	SPT	N=27			Stiff dark grey thinly laminated slightly sandy CLAY with frequent gypsum crystals (2mm in length) and rare shell fragments. (Charmouth Mudstone Formation)	3.00	
3.70	9	D					(1.60)	
4.00	10	U	44 blows				4.60	
4.60	11	D				Very stiff dark grey thinly laminated slightly sandy CLAY with rare shell fragments. (Charmouth Mudstone Formation)	5.00	
5.00-5.45	3	SPT	N=44			Very stiff dark grey thinly laminated CLAY with rare shell fragments. (Charmouth Mudstone Formation)		
5.60	13	D						
6.00	14	U	28 blows					
6.60	15	D						
7.50-7.88	4	SPT	N=67*				(6.10)	
8.50	17	D						

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Boring Progress and Water Observations						Chiselling			General Remarks	
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)		
31/07/08	17:00	6.00	1.60	150	Dry	11.70	11.85	01:00	1. No groundwater encountered. 2. Single standpipe installed on completion.	
01/08/08	17:00	11.80	1.60	150	Dry					
All dimensions in metres								Scale:	<b>1:50</b>	
Method Used: <b>Cable percussion</b>		Plant Used: <b>Dando 3000</b>		Drilled By: <b>DS</b>		Logged By: <b>MBaker</b>		Checked By: <b>SP</b>		



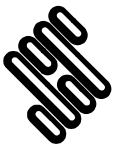


Contract: <b>Grovefield Way, Cheltenham</b>		Client: <b>H N Bailey, J A Bailey and C H Harvey</b>		Borehole: <b>BH2</b>	
Contract Ref: <b>722048</b>		Start: <b>31.07.08</b> End: <b>01.08.08</b>	Ground Level (m): <b>38.61</b>	National Grid Co-ordinate: <b>E:390755.3 N:221397.0</b>	
				Sheet: <b>2 of 2</b>	

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
9.00-9.31	5	SPT	N=94*		Backfill & Instrumentation	Very stiff dark grey thinly laminated CLAY with rare shell fragments. (Charmouth Mudstone Formation) <i>(stratum text copied from layer at 5.00m depth from previous sheet)</i>		Material Graphic Legend
10.00	19	D						
10.50	20	U	35 blows					
11.10	21	D				Very weak dark grey MUDSTONE. (Charmouth Mudstone Formation)	11.10 (0.70)	Material Graphic Legend
11.70-11.80	6	SPT	N=333*				11.80	Material Graphic Legend

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Boring Progress and Water Observations						Chiselling			General Remarks	
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)		
								All dimensions in metres		Scale: <b>1:50</b>
Method Used: <b>Cable percussion</b>		Plant Used: <b>Dando 3000</b>		Drilled By: <b>DS</b>		Logged By: <b>MBaker</b>		Checked By: <b>SP</b>		



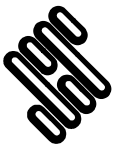
Contract: <b>Grovefield Way, Cheltenham</b>		Client: <b>H N Bailey, J A Bailey and C H Harvey</b>		Borehole: <b>BH3</b>	
Contract Ref: <b>722048</b>		Start: <b>31.07.08</b> End: <b>01.08.08</b>	Ground Level (m): <b>36.78</b>	National Grid Co-ordinate: <b>E:390724.1 N:221434.6</b>	
				Sheet: <b>1 of 2</b>	

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.00-0.50	1	B				Grass over MADE GROUND: Brown slightly sandy slightly gravelly friable CLAY with frequent rootlets. Gravel is fine to medium subrounded charcoal, brick and limestone.	(0.50)	
0.50-1.00	2	B				MADE GROUND: Firm brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium subrounded charcoal and brick.	(0.50)	
1.10-1.65	3	D	N=8			Firm brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine subrounded limestone. (Superficial Deposits)	(1.50)	
1.80	5	D						
2.00	6	U	36 blows					
2.50	7	D						
3.00-3.45	2	SPT	N=29			Very stiff dark grey thinly laminated slightly sandy CLAY with pockets of orange sandy silt and rare to occasional shell fragments and fine (1mm) gypsum crystals. (Charmouth Mudstone Formation) ... at 3.00m depth gypsum crystals occasional to frequent (1mm to 4mm) and no orange pockets.	(5.00)	
3.70	9	D				... shell fragments frequent from 4.50m depth and no gypsum crystals.		
4.00	10	U	52 blows					
4.50	11	D						
5.00-5.45	3	SPT	N=47					
5.70	13	D				Very weak grey MUDSTONE and rare very fine (1mm) shell fragments. (Charmouth Mudstone Formation)	(7.50)	
6.00-6.45	4	SPT	N=48					
7.00	15	D						
7.50-7.82	5	SPT	N=79*					
8.40	17	D					(2.65)	

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Boring Progress and Water Observations						Chiselling			General Remarks	
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)		
31/07/08	17:00	5.00	1.60	150	Dry	9.00	10.00	01:00	1. No groundwater encountered. 2. Backfilled on completion.	
01/08/08	17:00	10.15	1.60	150	Dry					
All dimensions in metres								Scale:	<b>1:50</b>	
Method Used: <b>Cable percussion</b>		Plant Used: <b>Dando 2000</b>		Drilled By: <b>RS</b>		Logged By: <b>MBaker</b>		Checked By: <b>SP</b>		





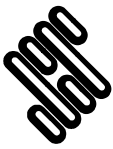
Contract: <b>Grovefield Way, Cheltenham</b>		Client: <b>H N Bailey, J A Bailey and C H Harvey</b>		Borehole: <b>BH3</b>	
Contract Ref: <b>722048</b>		Start: <b>31.07.08</b> End: <b>01.08.08</b>	Ground Level (m): <b>36.78</b>	National Grid Co-ordinate: <b>E:390724.1 N:221434.6</b>	
Sheet: <b>2</b> of <b>2</b>					

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
9.00-9.21	6	SPT	N=158*			Very weak grey MUDSTONE and rare very fine (1mm) shell fragments. (Charmouth Mudstone Formation) <i>(stratum text copied from layer at 7.50m depth from previous sheet)</i>		
9.70	19	D						
10.00-10.15	7	SPT	N=200*				10.15	

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Boring Progress and Water Observations						Chiselling			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	
All dimensions in metres								Scale: <b>1:50</b>	
Method Used: <b>Cable percussion</b>		Plant Used: <b>Dando 2000</b>		Drilled By: <b>RS</b>		Logged By: <b>MBaker</b>		Checked By: <b>SP</b>	





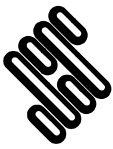
Contract: <b>Grovefield Way, Cheltenham</b>		Client: <b>H N Bailey, J A Bailey and C H Harvey</b>		Borehole: <b>BH4</b>	
Contract Ref: <b>722048</b>		Start: <b>01.08.08</b> End: <b>01.08.08</b>	Ground Level (m): <b>34.36</b>	National Grid Co-ordinate: <b>E:390669.9 N:221492.6</b>	
Sheet: <b>1 of 1</b>					

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.00-0.30	1	B				Grass over MADE GROUND: Brown slightly sandy slightly gravelly friable CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded brick, limestone and charcoal.	0.30	
0.30-1.20	2	B				Firm light brown mottled grey slightly sandy CLAY with occasional rootlets. (Superficial Deposits)	(1.70)	
1.20	3	U	16 blows					
1.80	4	D				... thinly laminated at 1.80m depth.	2.00	
2.00-2.45	1	SPT	N=15					
2.00-2.50	6	B				Stiff dark grey slightly sandy CLAY with occasional fine (1mm to 2mm) gypsum crystals. (Charmouth Mudstone Formation)	(2.00)	
3.00	7	U	22 blows					
3.60	8	D				... rare gypsum crystals (2mm to 4mm) at 3.60m depth.	4.00	
4.00-4.45	2	SPT	N=33					
4.00-4.50	10	B				Stiff dark grey slightly sandy thinly laminated CLAY. No gypsum crystals and rare shell fragments. (Charmouth Mudstone Formation)	(1.60)	
5.00	11	U	35 blows					
5.60	12	D				Hard dark grey very thinly laminated CLAY with rare shell fragments. (Charmouth Mudstone Formation)	5.60	
6.00-6.32	3	SPT	N=91*					
6.00-6.50	14	B					(2.10)	
7.50	15	U					7.70	
8.20	17	D				Very weak dark grey thinly laminated MUDSTONE. (Charmouth Mudstone Formation)	(0.71)	
8.30-8.41	4	SPT	N=300*				8.41	

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Boring Progress and Water Observations						Chiselling			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	
01/08/08	17:00	8.41	1.60	150	Dry	8.00	8.30	01:00	1. No groundwater encountered. 2. Single standpipe installed on completion.
All dimensions in metres								Scale:	<b>1:50</b>
Method Used: <b>Cable percussion</b>		Plant Used: <b>Dando 2000</b>		Drilled By: <b>DS</b>		Logged By: <b>MBaker</b>		Checked By: <b>SP</b>	





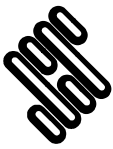
Contract: <b>Grovefield Way, Cheltenham</b>		Client: <b>H N Bailey, J A Bailey and C H Harvey</b>		Borehole: <b>BH5</b>	
Contract Ref: <b>722048</b>		Start: <b>01.08.08</b> End: <b>01.08.08</b>	Ground Level (m): <b>34.33</b>	National Grid Co-ordinate: <b>E:390626.0 N:221408.5</b>	Sheet: <b>1 of 1</b>

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.00-0.40	1	B				Grass over MADE GROUND: Dark brown slightly sandy friable CLAY with frequent rootlets.	(0.60)	
0.40-1.00	2	B				MADE GROUND: Firm light brown slightly sandy slightly gravelly CLAY. Gravel is fine subangular brick, charcoal, ceramic and limestone.	0.60	
1.20-1.65	1	SPT	N=6			Firm brown mottled grey slightly sandy CLAY. (Superficial Deposits)	(1.00)	
1.80	4	D				Stiff to very stiff dark grey thinly laminated CLAY with fine occasional gypsum crystals (2mm) and decomposing rootlets on laminated surfaces. (Charmouth Mudstone Formation)	2.00	
2.00	5	U	23 blows					
3.00-3.45	2	SPT	N=32			... occasional shell fragments at 3.70m depth.	(3.00)	
3.70	7	D						
4.00	8	U	40 blows					
4.60	9	D						
5.00-5.36	3	SPT	N=71*			Very weak dark grey thinly laminated MUDSTONE with occasional fine shell fragments. (Charmouth Mudstone Formation)	5.00	
5.70	11	D						
6.00-6.38	4	SPT	N=67*			... becoming weak below 8.10m depth.	(3.25)	
7.00	13	D						
7.50-7.86	5	SPT	N=71*					
7.50	15	D						
8.00	16	D					8.25	
8.10-8.25	6	SPT	N=200*					
8.10	18	D						

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Boring Progress and Water Observations						Chiselling			General Remarks
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)	
01/08/08	17:00	8.25	1.60	150	Dry	5.20 7.90	6.00 8.10	01:00 00:30	
1. No groundwater encountered. 2. Single standpipe installed on completion.									
All dimensions in metres								Scale: <b>1:50</b>	
Method Used: <b>Cable percussion</b>			Plant Used: <b>Dando 2000</b>			Drilled By: <b>RS</b>		Logged By: <b>MBaker</b>	Checked By: <b>SP</b>





Contract: <b>Grovefield Way, Cheltenham</b>		Client: <b>H N Bailey, J A Bailey and C H Harvey</b>		Borehole: <b>BH6</b>	
Contract Ref: <b>722048</b>		Start: <b>04.08.08</b> End: <b>04.08.08</b>	Ground Level (m): <b>32.79</b>	National Grid Co-ordinate: <b>E:390566.0 N:221478.8</b>	Sheet: <b>1 of 1</b>

Samples and In-situ Tests				Water	Backfill	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.20	1	D			[Cross-hatched pattern]	Grass over MADE GROUND: Dark brown slightly sandy slightly gravelly friable CLAY. Gravel is fine subangular to subrounded brick and charcoal.	(1.20)	[Cross-hatched pattern]
0.50	2	D						
0.50	3	D						
1.20	3a	U	16 blows		[Horizontal line pattern]	Stiff brown mottled grey slightly sandy CLAY. (Superficial Deposits)	(0.80)	[Horizontal line pattern]
1.80	4	D						
2.00-2.45	1	SPT	N=18		[Cross-hatched pattern]	Stiff dark grey CLAY. (Charmouth Mudstone Formation)	2.00	[Horizontal line pattern]
2.00-2.50	6	B						
3.00	7	U	29 blows					
3.60	8	D						
4.00-4.41	2	SPT	N=59*					
4.00-4.45	10	B			[Cross-hatched pattern]	... very stiff and thinly laminated from 4.00m depth.	(5.80)	[Horizontal line pattern]
5.00	11	U	29 blows					
5.60	12	D						
6.00-6.32	3	SPT	N=88*					
6.00-6.65	14	B			[Cross-hatched pattern]	... occasional fine shell fragments and small gastropod shells (5mm diameter) at 5.60m depth. ... hard clay from 6.00m depth.	7.80	[Horizontal line pattern]
7.50-7.88	4	SPT	N=67*					
8.10-8.15	5	SPT	N=600*					

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Boring Progress and Water Observations						Chiselling			General Remarks	
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)		
04/08/08	17:00	8.15	1.60	150	Dry	7.80	8.10	01:00	1. No groundwater encountered. 2. Backfilled on completion.	
All dimensions in metres								Scale: <b>1:50</b>		
Method Used: <b>Cable percussion</b>		Plant Used: <b>Dando 2000</b>		Drilled By: <b>DS</b>		Logged By: <b>MBaker</b>		Checked By: <b>SP</b>		





