



WARREN CRESCENT, HEADINGTON

INTERPRETATIVE REPORT ON GROUND INVESTIGATION

Prepared for R J LEIGHFIELD & SONS LTD

Report Ref: 35378

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WARREN CRESCENT, HEADINGTON



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Prepared for R J LEIGHFIELD & SONS LTD

Report Ref: 35378

PROJECT: Proposed residential development

CONSULTANT:

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JOHN HANSON Director			COLIN THOMAS Consultant		

The report is not to be used for contractual or engineering purposes unless this sheet is signed and the report designated "Final".

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1. INTRODUCTION

A residential development is proposed for a plot of land within Warren Crescent, Headington. Geotechnical Engineering Limited (GEL) was instructed by R J Leighfield & Sons Ltd (the Client) to carry out an investigation to determine the ground conditions.

The scope of works and terms and conditions of appointment were specified by the Client and GEL correspondence reference T30187 dated 12th May 2019.

This report describes the investigation, presents the findings and comments accordingly. The comments given in this report and the opinions expressed assume that ground conditions do not vary beyond the range revealed by this investigation. There may, however, be conditions at or adjacent to the site, which have not been disclosed by the investigation and which, therefore, have not been considered in this report. Accordingly, a careful watch should be maintained during any future groundworks and the recommendations of this report reviewed as necessary.

Many aspects of the proposed development have yet to be determined. The comments given in this report should therefore be considered in the context of a general overview of the site. It is recommended that the report is reviewed when the design is finalised.

The recommendations given in this report should not be used for any other schemes on or adjacent to this site without further reference to GEL.

2. SITE LOCATION AND GEOLOGY

The site is situated between nos. 31 and 33 Warren Crescent, Headington, Oxford, OX3 7NQ and may be located by its National Grid co-ordinates SP 548 060.



The generally level site predominantly comprised a grassed landscaped area with a few trees, typically around 8m tall. The northern third of the site consisted of a concrete and tarmac parking area.

The northern boundary is delimited by fence line associated with nos. 29 to 31 Warren Crescent. The eastern boundary is demarcated by a fence line within a heavily vegetated screen of mature fruit trees, Field Maples and Ash, amongst others. Beyond the fence line the ground slopes away steeply down to Boundary Brook. Warren Crescent forms the western boundary whilst a footpath delimits the southern boundary with the residential block containing nos. 33 to 43 beyond.

British Geological Survey (BGS) England and Wales (Sheet No. 237, 1:50,000, dated 1994) and the BGS online geology (1:50,000) indicate the site is underlain by the Wheatley Limestone and/or the Beckley Sand Member.

An environmental investigation previously undertaken by this Company in 2012 (Ref: 26795) revealed a variable thickness of Made Ground overlying broken limestone of the Wheatley Limestone Formation or sands of the Beckley Sand Member.

3. PROPOSED WORKS

A residential development is proposed. It is understood to comprise ten, semi-detached two storey houses fronting Warren Crescent with rear gardens extending to the existing fence line.

At the time of preparing this report details of the likely foundation loads have not been provided, however based on a two storey structure, it is anticipated that loads are likely to be in the region of 60kN/m.



4. GROUND INVESTIGATION

4.1 Fieldwork

The fieldwork was carried out in general accordance with BS5930:2015 during the period 17th to 21st June 2019 and comprised three boreholes.

The exploratory hole locations were selected and set out by this Company and the Client and are shown on Figure 1. The ground level at each exploratory hole was established extrapolating spot heights from a plan provided by the Client.

The boreholes, referenced BH01 to BH03 (Appendix A), were formed using a track-mounted Geotechnical Pioneer Rig. Initially, an inspection pit was hand excavated at each borehole location to a depth of 1.20m to check for buried services. Disturbed samples were taken and retained in plastic tubs. Heavy duty dynamic sampling techniques were then employed to produce a continuous disturbed sample of 97mm or 112mm nominal diameter reducing to 97mm as the borehole was advanced. The samples were recovered in semi-rigid plastic liner.

On refusal to dynamic sampling the boreholes were continued by rotary core drilling techniques utilising a waterflush. A double-tube swivel core barrel with semi-rigid plastic liner was utilised to recover a continuous sample of 90mm diameter. Where appropriate, dynamic sampling techniques were carried out to recover dropped core or where rotary core drilling was not suitable.

The dynamic samples and rotary core were extracted horizontally from the sampler and core barrel respectively, the semi-rigid liner was cut to length and caps placed at each end to retain moisture content. All samples and core were retained in sequence in labelled, wooden coreboxes.



Standard penetration tests (SPT) were carried out in general accordance with BS EN ISO 22476-3:2005+A1:2011. A split barrel was used and the split barrel samples retained in airtight jars. The SPT N value was taken as the number of blows to penetrate the 300mm test drive following a 150mm seating drive. Where low penetration was recorded the seating drive was terminated at 25 blows and the test drive completed after a further 50 blows. Detailed SPT results, together with the energy ratio (E_r), are presented in Appendix A and summarised as uncorrected N values on the borehole logs.

Boreholes were monitored for groundwater ingress as dynamic sampling proceeded. Water levels were also recorded at the start and finish of each day's work and on completion of the borehole and are presented on the relevant log.

On completion, the boreholes were backfilled with bentonite pellets and arisings and the surface reinstated.

On completion of fieldwork all samples were brought to this Company's laboratory for testing and storage.

4.2 Logging

The logging of soils and rocks was carried out by an Engineering Geologist in general accordance with BS5930:2015. A key to the exploratory hole logs is presented in Appendix A.

Detailed descriptions of the core and samples are given in the borehole logs, Appendix A, along with details of sampling, in situ testing, groundwater ingress and relevant comments on drilling techniques.



4.3 Laboratory Testing

A schedule of laboratory tests was prepared by GEL, the following tests being carried out in accordance with BS1377:1990, unless stated otherwise. The number in brackets refers to the test number given in that standard. The results are presented in Appendix B.

The natural water content was determined on three selected samples in accordance with BS EN ISO 17892-1:2014.

Liquid limit, plastic limit and plasticity index tests [Part 2:4.3, 4.4, 5.3 and 5.4] were carried out on three selected samples. An Atterberg line plot has also been presented.

Particle size distributions were determined in accordance with BS EN ISO 17892-4:2016 for four samples by wet sieving [5.2]. The results are presented as grading curves.

Point load index tests were carried out on two selected lengths of core in accordance with ISRM (2007).

The BRE SD1 (2005) reduced suite; water soluble sulphate, total sulphate and total sulphur, together with pH were determined for two samples and a further two samples tested for water soluble sulphate and pH by Chemtest using in-house methods.



5. GEOTECHNICAL ASSESSMENT

5.1 Ground Conditions

The ground conditions revealed by the investigation generally confirm the strata indicated by the geological records.

Made Ground

All boreholes encountered Made Ground from surface to between 1.10 and 3.70m below ground level (bgl). The previous investigation proved Made Ground to depths between 0.45 and 3.50m. The Made Ground would appear to increase in thickness from the west (Warren Crescent) to the east (fence line and break in slope). The Made Ground typically comprised slightly sandy to sandy clay or clayey sand with a variable gravel and cobble content. The coarser fraction of the material included limestone, brick, coal, concrete, slag, metal, rubber, porcelain, slate and organic material.

Wheatley Limestone Formation

Underlying the Made Ground, boreholes BH01 and BH02 encountered shelly limestone gravel locally tending to limestone to 2.80m and 2.40m bgl respectively. This material is considered to represent the weathered profile of the Wheatley Limestone Formation. The limestone was absent in borehole BH03 inferring the unit is replaced with Made Ground towards the eastern break in slope.

Beckley Sand Member

The Beckley Sand Member was encountered in all boreholes beneath the Wheatley Limestone Formation or Made Ground. The profile typically comprised a sequence of slightly clayey to clayey, slightly silty sand with bands of limestone; the latter often recovered as gravel. Laminae of clay and shell fragments were also observed. Locally the



material appeared poorly cemented. The Beckley Sand Member was proved to the full depth of the boreholes and a maximum depth of 14.65m.

Groundwater

Groundwater was not encountered in the boreholes prior to the introduction of water to aid the drilling process. The water levels recorded may not therefore necessarily reflect standing groundwater level. Similarly, groundwater strikes may have been masked by the addition of water as the borehole was advanced.

Water levels recorded in the monitoring wells from the previous investigation ranged around 5.00m bgl. Attempts were made to access these old wells but the headworks were sealed shut. It should be noted that water levels can vary seasonally and over time.

5.2 Geotechnical Appraisal

Made Ground

Index tests within the Made Ground indicate the material is of low to intermediate plasticity. Based upon the plasticity indices, this material is considered to be of low and medium volume change potential in response to changes in moisture content (NHBC, 2016).

SPT N values of 5 to 10 were obtained for the cohesive Made Ground inferring a soft to firm consistency, after the application of a 5kPa correlation factor (Stroud, 1974).

Wheatley Limestone Formation

Particle size distribution tests carried out on samples of the weathered Wheatley Limestone Formation indicate the material to be clayey, very sandy, fine to coarse gravel.

SPT N values obtained from tests within the weathered Wheatley Limestone Formation indicated the material to be of very dense relative density. Point load tests of the more



competent Limestone yielded I_{s50} values of between 0.10 to 1.43 MPa inferring a very weak to medium strong unconfined compressive strength.

Beckley Sand Member

Particle size distribution tests carried out on samples of the Beckley Sand Member indicate the material to be very clayey, medium sand with a variable gravel content. The gravel content is considered to represent poorly cemented clasts of sand or from a broken limestone band.

SPT N values obtained from tests within the Beckley Sand Member indicated the material to be of medium dense and dense relative density. The limestone bands within the Beckley Sand Member typically returned N values between 56 and to 300 with one test meeting effective refusal.

5.3 Foundation Considerations

Since limited detail is available with respect to the proposed scheme and/or loadings at the time of reporting, the following comments are of a general nature and should be reviewed when appropriate information becomes available.

The Made Ground is not considered suitable as a bearing stratum. Foundations will therefore need to extend to the underlying Wheatley Limestone Formation or the Beckley Sand Member. The Made Ground appears to deepen from the west to the east. To the west, the Made Ground was typically less than 1.5m thick, whereas the rear elevations of the proposed development to the east, may be underlain by Made Ground extending down to 2.0 to around 3.5m bgl.

Traditional strip/trench foundations could be adopted although the practicality of excavating to potentially 3.5m would need to be reviewed. Consideration could be given to



stepping the foundations down from the western elevations where a minimum founding depth of 1m (and in natural material) is recommended. Foundations should be adequately reinforced.

For 0.60m wide strip or trench foundations bearing within the natural material, an allowable bearing pressure of up to 100kPa is estimated to incur settlements in the order of 5 to 15mm.

Alternatively, a piled foundation could be considered. The vibration associated with driven piles may be problematic given the proximity of nearby structures and services. Cased bored piles could be considered suitable. It is recommended that specialist piling contractors should be consulted to advise further on the most suitable pile type, installation method and to provide working loads on their chosen system. The piling contractor should be made aware of the potential for competent limestone at shallow depth (Wheatley Limestone Formation) and limestone banding within the Beckley Sand Member.

Given the variable thickness and content of the Made Ground, it is recommended that a suspended floor slab construction is adopted.

5.4 Excavations

Excavations should be within the scope of conventional backhoe excavators although some difficulty may be experienced if excavations extend into the more competent Wheatley Limestone Formation. Recourse to hydraulic breakers may be required to break out existing obstructions and foundation bases.

Shallow excavations should remain stable in the short term, although minor spalling of the excavation sides may occur, especially in the more granular material. There is an increased



risk of instability for deeper excavations. If groundwater is encountered within the excavations then greater instability should be anticipated.

If potentially unstable excavations or any excavations deeper than 1.00m are to be entered then the sides should be battered back and/or shoring methods and equipment should be utilised in accordance with the relevant Health and Safety Acts.

Prior to development any existing foundation structures and/or obstructions should be broken out and replaced with materials compatible with the surrounding ground.

All excavations should be closely inspected and any loose or soft spots should be removed and replaced with suitably compacted granular material. In order to prevent formation softening and deterioration it is recommended that all foundations be cast as soon as possible after the excavation or a concrete blinding is placed to protect the formation.

5.5 Slope Stability

Slope stability analysis with regard to the slope to the east of the site is outside the remit of this report.

Notwithstanding the above, it is understood that the proposed main structures will be at least 12m from the break in slope. Given the likely foundation depths and the granular nature of the underlying material, any additional loading from the structures should not be detrimental to the slope.

The crest and slope itself are significantly vegetated with mature trees. It is assumed that these trees will remain; their root systems would help provide additional stabilisation to the slope.



5.6 Buried Concrete

In accordance with the BRE Special Digest 1 (2005) the site is not regarded as brownfield and nor containing sulfides within the ground.

The chemical analyses recorded in the investigation fall within the Design Sulfate Class DS-1, based upon the water soluble sulphate and total potential sulphate for the Made Ground. Taking into account potentially mobile groundwater conditions and with pH values of 8.1 to 8.6, an ACEC site classification of AC-1 is proposed.

GEOTECHNICAL ENGINEERING LIMITED



6. REFERENCES

British Standards Institution (2015): Code of practice for ground investigations. BS 5930:2015.

British Standards Institution (2016): Methods of test for soils for civil engineering purposes – Part 1: General requirements and sample preparation. BS1377-1:2016.

British Standards Institution (1990): Methods of tests for soils for civil engineering purposes. BS 1377 Parts 2-9.

British Standards Institution (2014): Geotechnical investigation and testing – Laboratory testing of soil. Part 1: Determination of water content. BS EN ISO 17892-1:2014.

British Standards Institution (2016): Geotechnical investigation and testing – Laboratory testing of soil. Part 4: Determination of particle size distribution. BS EN ISO 17892-4:2016.

British Standards Institution (2012): Geotechnical investigation and testing. Field testing. Standard penetration test. BS EN ISO 22476-3:2005+A1:2011.

Building Research Establishment (2005): Concrete in aggressive ground. BRE Special Digest 1. Third Edition.

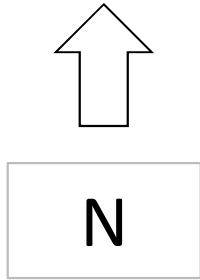
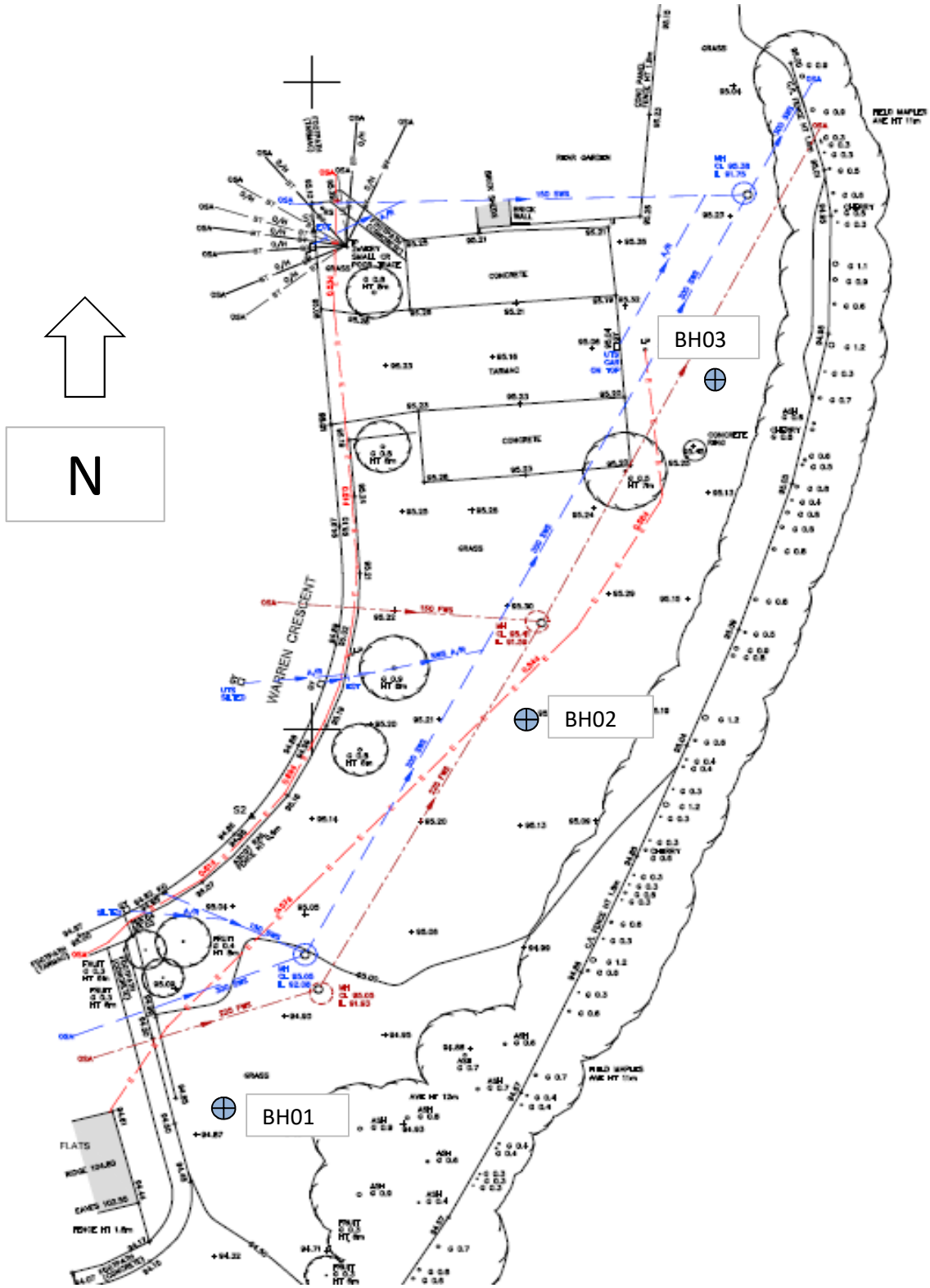
International Society for Rock Mechanics (2007). The complete ISRM suggested methods for rock characterization, testing and monitoring: 1974-2006, edited by R Ulusay & J A Hudson. Ankara, Turkey: Turkish National Group of the International Society for Rock Mechanics.



Stroud M A (1974): The standard penetration test in insensitive clays and soft rocks. Proc. Eurp. Symp. on Penetration Testing, Stockholm.

BOREHOLE LOCATION PLAN

CLIENT R J LEIGHFIELD & SONS LTD
SITE WARREN CRESCENT, HEADINGTON



Scale unknown

Base plan provided by Client

Approx. borehole location



CONTRACT	FIGURE
35378	1



APPENDIX A

FIELDWORK DATA



Sample type

D Small disturbed	U Undisturbed	L Dynamic	ES Environmental - soil	Cs Core subsample (prepared)
B Bulk disturbed	UT Undisturbed thin wall	C Core	EW Environmental - water	Ls Dynamic subsample (prepared)
LB Large bulk disturbed	P Piston	W Water		

Test type

- S SPT - Split spoon sampler followed by uncorrected SPT 'N' Value
- C SPT - Solid cone followed by uncorrected SPT 'N' Value
(*250 - Where full test drive not completed, linearly extrapolated 'N' value reported, ** - Denotes no effective penetration)
- H Hand vane - direct reading in kPa - not corrected for BS1377 (1990). Re* denotes refusal
- M Mackintosh probe - number of blows to achieve 100mm penetration
- Mx Mexe cone - average reading of equivalent CBR value in %
- PP Pocket penetrometer - direct reading in kg/sq.cm
- Vo Headspace vapour reading, uncorrected peak values in ppm, using a PID (calibrated with Isobutylene, using a 10.6eV bulb)

Sample/core range/l_r

| Dynamic sample

|

█ Undisturbed sample - open drive including thin wall. Symbol length reflects recovery

x x = Total Core Recovery (TCR) as percentage of core run

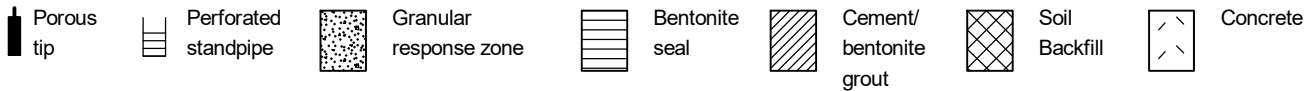
y y = Solid Core Recovery (SCR) as percentage of core run. Assessment of core is based on full diameter.

z z = Rock Quality Designation (RQD). The amount of solid core greater than 100mm expressed as percentage of core run.

Where SPT has been carried out at beginning of core run, disturbed section of core excluded from SCR and RQD assessment.

l_r - fracture spacing - the modal fracture spacing (mm) over the indicated length of core. Where spacing varies significantly, the minimum, mode and maximum values are given. NI = non-intact core NA = not applicable

Instrumentation



Stratum boundaries



Logging

The logging of soils and rocks has been carried out in general accordance with BS 5930:2015.

Chalk is logged in general accordance with Lord et al (2002) CIRIA C574. Where possible, dynamic samples in chalk have been logged in accordance with CIRIA C574; descriptions and gradings (if presented) should be treated with caution given the potential for sample disturbance.

For rocks the term fracture has been used to identify a mechanical break within the core. Where possible incipient and drilling induced fractures have been excluded from the assessment of fracture state. Where doubt exists, a note has been made in the descriptions. All fractures are considered to be continuous unless otherwise reported.

Made Ground is readily identifiable when, within the material make up, man made constituents are evident. Where Made Ground appears to be reworked natural material the differentiation between in situ natural deposits and Made Ground is much more difficult to ascertain. The interpretation of Made Ground within the logs should therefore be treated with caution.

The descriptors "topsoil" and "tarmacadam" are used as generic terms and do not imply conformation to any particular standard or composition.

Rootlets are defined as being less than 2mm in diameter, roots are defined as in excess of 2mm diameter.

General Comments

The process of drilling and sampling will inevitably lead to disturbance, mixing or loss of material in some soil and rocks.

Indicated water levels are those recorded during the process of drilling or excavating exploratory holes and may not represent standing water levels.

All depths are measured along the axis of the borehole and are related to ground level at the point of entry. All inclinations are measured normal to the axis of the core.

Where provided, the stratigraphic names/geological rock units are for guidance only and may not be wholly accurate.

BOREHOLE LOG



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 Start Date 17 June 2019
 End Date 18 June 2019

BH01

Sheet 1 of 4
 Scale 1 : 25
 Ground level 94.85mOD* Depth 14.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
17/06/19 0800hrs							Grass over soft dark brown sandy CLAY. Frequent rootlets. (MADE GROUND)	0.10	94.75	
	1D	0.40 - 0.50					Soft brown slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine to coarse limestone, concrete, brick and coal. Rare rootlets. (MADE GROUND)	0.40	94.45	
	2D	1.00 - 1.10					Brown slightly gravelly clayey fine to coarse SAND with a low subangular brick cobble content. Gravel is angular to subrounded fine to coarse concrete, brick, slag and coal. Rare pockets (up to 20mm) of light brown clay. (MADE GROUND)	0.70 0.80	94.15 94.05	
	3D 4L	1.20 - 1.65 1.20 - 1.70	Nil	S 36			Firm brown slightly sandy gravelly CLAY with a medium subrounded quartzite cobble content. Gravel is angular to subrounded fine to coarse limestone, concrete and rare brick. Frequent fragments (up to 10mm) of black organic material and rare pockets (up to 10mm) of orangish brown silt. (MADE GROUND)	1.10	93.75	
	5D 6C	1.70 - 2.06 1.70 - 2.20	1.70	S*65	20		Brown slightly gravelly clayey fine to coarse SAND. Gravel is angular to subrounded fine to coarse concrete, brick, slag and coal. Rare fragments of porcelain (up to 30mm). (MADE GROUND)			
	7D 8C	2.20 - 2.50 2.20 - 3.20	2.20	S*100	77 12 0		Dense becoming very dense light brown mottled yellowish brown clayey very sandy angular to subrounded fine to coarse limestone GRAVEL with low limestone cobble content tending to weak locally moderately strong yellowish brown and light grey shelly limestone. (WHEATLEY LIMESTONE MEMBER) 1.70 - 2.20m: Limited recovery.			
	9D 10L	3.20 - 3.65 3.20 - 4.20	2.20	S 41			Light brown fine to coarse SAND. (BECKLEY SAND MEMBER) 3.00 - 3.10m: Coarse sand.	2.80	92.05	
							Dense yellowish brown, light brown, brown and off-white slightly silty fine to coarse SAND with rare pockets (up to 40mm) of brown clay. (BECKLEY SAND MEMBER)	3.35	91.50	
							Continued Next Page	{4.00}		

EQUIPMENT: Geotechnical Pioneer rig.
 METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-1.70m, (113mm) 3.20-5.70m, 6.70-8.20m and 9.70-12.70m. Waterflush rotary core drilled (116mm) 1.70-3.20m, 5.70-6.70m and 8.20-9.70m and 12.70-14.20m.
 CASING: 140mm diam to 12.70m.
 BACKFILL: On completion, hole backfilled with bentonite pellets 14.20-1.20m and material arisings 1.20-0.00m.
 REMARKS: Dynamic sampling to retrieve dropped core 2.80-3.20m, recovered 0.40m and 6.10-7.70m, recovered 0.40m.
 * Ground level interpolated from base plan survey provided by Client.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks
 Groundwater not encountered prior to use of water flush.



CONTRACT
35378

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BOREHOLE LOG



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 Start Date 17 June 2019
 End Date 18 June 2019

BH01

Sheet 2 of 4
 Scale 1 : 25
 Ground level 94.85mOD*
 Depth 14.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
17/06/19 1720hrs 4.00m	11D 12L	4.20 - 4.65 4.20 - 5.20	4.20	S 30			4.80 - 5.10m: Rare fragments of white shell (up to 10mm).	5.20	89.65	
	13D 14L	5.20 - 5.63 5.20 - 5.70	5.20	S*54		Very dense light brown slightly clayey fine to coarse SAND. (BECKLEY SAND MEMBER)				
	15C	5.70 - 6.70			52	5.70 - 6.70m: Limited recovery and drilling disturbed. Recovered as yellowish brown and light grey slightly sandy angular and subangular fine to coarse limestone gravel.				
	18/06/19 0845hrs 4.12m	16D 17L	6.70 - 7.15 6.70 - 8.20	6.70	S 20		Medium dense light brown mottled yellowish brown and orangish brown very clayey predominantly medium SAND with frequent pockets (up to 30mm) and thin laminae of greyish brown clay. Rare fragments of white shell (up to 10mm). (BECKLEY SAND MEMBER)	6.75	88.10	
	18D 19C	8.20 - 8.24 8.20 - 9.70	8.20	S**	13 13 13		7.80m: Thin vein of black organic material with thick laminae of grey medium sand. 8.20 - 9.70m: Limited recovery. Recovered 0.2m of very weak light grey limestone.			
Continued Next Page								{9.00}		

Geotechnical Engineering Ltd, Tel. 01452 527743 35378.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 04/07/2019 12:32:22 LH JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT 35378	CHECKED CT
				Groundwater not encountered prior to use of water flush.			

BOREHOLE LOG



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 Start Date 17 June 2019
 End Date 18 June 2019

BH01

Sheet 3 of 4
 Scale 1 : 25
 Ground level 94.85mOD*
 Depth 14.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	20D 21L	9.70 - 10.15 9.70 - 11.20	9.70	S 36			9.70m: Dense	10.20	84.65	
							Light brown mottled yellowish brown rarely mottled orangish brown slightly clayey medium and coarse SAND with frequent pockets (up to 30mm) and thin laminae of greyish brown clay. (BECKLEY SAND MEMBER)	10.70	84.15	
	22D 23L	11.20 - 11.65 11.20 - 12.70	11.20	S 41			Dense light brown, orangish brown, yellowish brown and brown slightly clayey medium and coarse SAND with frequent thin and thick laminae of greyish brown clay. (BECKLEY SAND MEMBER)	11.70	83.15	
							Greyish brown mottled dark grey and orangish brown slightly clayey slightly gravelly fine to coarse SAND with frequent pockets (up to 20mm) and thin laminae of dark grey clay. Gravel is angular and subangular fine and medium limestone. (BECKLEY SAND MEMBER)	12.00	82.85	
							Dark grey slightly clayey slightly gravelly medium SAND with frequent pockets (up to 20mm) of dark grey clay. Gravel is poorly cemented subangular fine and medium gravel size clasts. (BECKLEY SAND MEMBER)			
	24D 25C	12.70 - 13.00 12.70 - 14.20	12.70	S*100	31 13 13		12.70 - 14.20m: Limited recovery. 12.70 - 12.85m: Abundant fragments of cream shell (up to 5mm) and frequent pockets (up to 15mm) of light brown medium sand. 12.90 - 13.15m: Bed of very weak light grey limestone.			
Continued Next Page								{14.00}		

Geotechnical Engineering Ltd, Tel. 01452 527743 35378.GPJ TRIAL\JH.GPJ GEOTECH2.GLB 04/07/2019 12:32:23 LH JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT 35378	CHECKED CT
				Groundwater not encountered prior to use of water flush.			

BOREHOLE LOG



BH01

CLIENT R J LEIGHFIELD & SONS LTD

SITE WARREN CRESCENT, HEADINGTON

Sheet 4 of 4

Start Date 17 June 2019

Scale 1 : 25

End Date 18 June 2019

Ground level 94.85mOD*

Depth 14.65 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
18/06/19 1540hrs 4.00m	26D	14.20 - 14.65	12.70	S 30			Borehole completed at 14.65m.	14.65	80.20	
								{19.00}		

Geotechnical Engineering Ltd, Tel. 01452 527743 35378.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 04/07/2019 12:32:23 LH JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT 35378	CHECKED CT
				Groundwater not encountered prior to use of water flush.			

BOREHOLE LOG



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 Start Date 19 June 2019
 End Date 19 June 2019

BH02

Sheet 1 of 3
 Scale 1 : 25
 Ground level 95.25mOD* Depth 11.43 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
19/06/19 0815hrs							Grass over soft dark brown sandy CLAY. Frequent rootlets. (MADE GROUND)	0.20	95.05	
	1D	0.50 - 0.60					Soft brown slightly sandy gravelly CLAY with a low subangular quartzite and concrete cobble content. Gravel is angular to subrounded fine to coarse quartzite, brick, concrete and slag. Rare fragments of metal (up to 60mm). Frequent rootlets. (MADE GROUND)	0.50	94.75	
	2D	1.00 - 1.10					Soft light brown slightly gravelly sandy CLAY. Gravel is angular to subrounded fine to coarse limestone, concrete, slag and rare brick. Rare fragments of black organic material (up to 15mm). (MADE GROUND)	0.80	94.45	
	3D 4L	1.20 - 1.65 1.20 - 2.20	Nil	S 5			Soft light brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse limestone, quartz, concrete, slag and rare brick. Rare fragments of rubber (up to 20mm). (MADE GROUND)			
	5D 6L	2.20 - 2.65 2.20 - 3.20	Nil	S 12			1.80 - 2.00m: Firm dark brown slightly sandy slightly gravelly clay. Gravel is angular to subrounded fine and medium limestone, brick and coal. Light brown mottled off-white slightly clayey sandy angular and subangular fine to coarse shelly limestone GRAVEL. (WHEATLEY LIMESTONE MEMBER)	2.00	93.25	
							Medium dense light brown, orangish brown, brown and off-white slightly silty fine and medium SAND. (BECKLEY SAND MEMBER) 2.50 - 2.60m: Drilling disturbed. Recovered as yellowish brown and light grey slightly sandy angular and subangular fine to coarse limestone gravel.	2.40	92.85	
	7D 8L	3.20 - 3.65 3.20 - 4.20	Nil 3.20	S 16			Medium dense light brown rarely mottled orangish brown slightly clayey medium and coarse SAND with frequent pockets (up to 20mm) of off-white slightly sandy clay. (BECKLEY SAND MEMBER) 3.20 - 3.50m: Light brown fine and medium sand with frequent fragments of shell (up to 30mm).	3.20	92.05	
							Continued Next Page	{4.00}		

EQUIPMENT: Geotechnical Pioneer rig.
 METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-5.90m and 9.70-11.20m. Waterflush rotary core drilled (116mm) 5.90-9.70m.
 CASING: 140mm diam to 11.20m.
 BACKFILL: On 20/6/19, hole backfilled with bentonite pellets 11.20-1.20m and material arisings 1.20-0.00m.
 REMARKS: Dynamic sampling to retrieve dropped core 7.30-8.20m, recovered 0.65m.
 * Ground level interpolated from base plan survey provided by Client.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks		CONTRACT 35378	CHECKED CT
				Groundwater not encountered prior to use of water flush.			

Geotechnical Engineering Ltd, Tel. 01452 527743 35378.GPJ TRIAL\JH.GPJ GEOTECH2.GLB 04/07/2019 12:32:24 LH JH

BOREHOLE LOG



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 Start Date 19 June 2019
 End Date 19 June 2019

BH02

Sheet 2 of 3
 Scale 1 : 25
 Ground level 95.25mOD*
 Depth 11.43 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	9D 10L	4.20 - 4.65 4.20 - 5.20	4.20	S 16			4.20 - 4.40m: Light brown slightly clayey fine and medium sand. 4.50 - 5.00m: Locally poorly cemented to subangular fine to coarse gravel size clasts.			
	11D 12L	5.20 - 5.65 5.20 - 5.90	5.20	S 19				5.50	89.75	
	13C	5.90 - 6.70			6 6 0		Medium dense yellowish brown slightly clayey fine and medium SAND with frequent pockets (up to 10mm) and thin laminae of light grey clay. (BECKLEY SAND MEMBER)	5.90	89.35	
	14D 15C	6.70 - 6.90 6.70 - 8.20	6.70	S*300	51 10 7		6.70m: Probable limestone band.			
	17D 18C	8.20 - 8.50 8.20 - 9.70	8.20	S*100	15 15 15		8.40 - 8.60m: Bed of weak light grey limestone - approx depth.			
Continued Next Page								{9.00}		

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water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT 35378	CHECKED CT
				Groundwater not encountered prior to use of water flush.			

BOREHOLE LOG



BH02

CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 Start Date 19 June 2019
 End Date 19 June 2019

Sheet 3 of 3
 Scale 1 : 25
 Depth 11.43 m

Ground level 95.25mOD*

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	19D 20L	9.70 - 10.15 9.70 - 11.20	9.70	S 34				9.70	85.55	
19/06/19 1630hrs 3.92m	21D	11.20 - 11.43	11.20	S*200			Dense light brown mottled yellowish brown and orangish brown slightly clayey fine and medium SAND with frequent pockets (up to 20mm) and thin laminae of light brownish grey clay. Rare pockets (up to 5mm) of black organic material. (BECKLEY SAND MEMBER)			
20/06/19 0800hrs 3.69m							11.40m: Possible limestone band. Borehole completed at 11.43m.	11.43	83.82	
								{14.00}		

Geotechnical Engineering Ltd, Tel. 01452 527743 35378.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 04/07/2019 12:32:25 LH JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT 35378	CHECKED CT
				Groundwater not encountered prior to use of water flush.			

BOREHOLE LOG



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 Start Date 20 June 2019
 End Date 21 June 2019

BH03

Sheet 1 of 4
 Scale 1 : 25
 Ground level 95.20mOD*
 Depth 15.58 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
20/06/19 1030hrs							Grass over soft dark brown sandy CLAY. Frequent roots (up to 10mm diam). (MADE GROUND)	0.15	95.05	
	1D	0.50 - 0.60					Soft light brown mottled brown slightly sandy slightly gravelly CLAY. Gravel is angular to subrounded fine to coarse quartzite, brick, concrete, slag and coal. (MADE GROUND)	0.50	94.70	
	2D	1.00 - 1.10					Light brown slightly clayey gravelly fine to coarse SAND with a medium angular brick cobble content. Gravel is angular to subrounded fine and medium slate, concrete, brick, slag and rare limestone. Rare fragments of metal (up to 400mm. Rare rootlets. (MADE GROUND)	0.80	94.40	
	3D 4L	1.20 - 1.65 1.20 - 2.20	Nil	S 5			Soft light brown sandy gravelly CLAY with rare pockets (up to 20mm) of yellowish brown slightly sandy clay. Gravel is angular to subrounded fine and medium slate, quartz, concrete, brick, slag and limestone. Rare fragments of metal (up to 40mm). (MADE GROUND)	1.65	93.55	
	5D 6L	2.20 - 2.65 2.20 - 3.20	Nil	S 9			Brown mottled light brown gravelly very clayey SAND with frequent pockets (up to 10mm) of black organic material. Gravel is angular and subangular fine to coarse quartzite, concrete, brick, slag and rare clinker. Frequent roots (up to 3mm) and rootlets. (MADE GROUND)	2.30	92.90	
							Firm greyish brown rarely mottled orangish brown slightly sandy slightly gravelly CLAY. Gravel is subangular and subrounded fine and medium limestone and concrete. Rare roots (up to 3mm diam). (MADE GROUND)	2.90	92.30	
	7D 8L	3.20 - 3.65 3.20 - 4.20	Nil	S 10			Firm dark brown mottled orangish brown slightly gravelly silty CLAY with frequent fragments of black organic material (up to 20mm). Gravel is subangular fine and medium limestone and rare quartzite and brick. Rare rootlets. (MADE GROUND)	3.20	92.00	
							Firm brown slightly gravelly CLAY with rare pockets (up to 5mm) of black organic material. Gravel is angular fine to coarse limestone and rare brick. (MADE GROUND)	3.70	91.50	
							Locally thinly laminated yellowish brown mottled brown slightly clayey fine and medium SAND. (BECKLEY SAND MEMBER)	{4.00}		

EQUIPMENT: Geotechnical Pioneer rig.
 METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (113mm) 1.20-5.20m and 6.70-14.20m. Waterflush rotary core drilled (116mm) 5.20-6.70m and 14.20-15.20m.
 CASING: 140mm diam to 14.20m.
 BACKFILL: On completion, hole backfilled with bentonite pellets 15.20-1.20m and material arisings 1.20-0.00m.
 REMARKS: * Ground level interpolated from base plan survey provided by Client.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks		CONTRACT 35378	CHECKED CT
				Groundwater not encountered prior to use of water flush.			

BOREHOLE LOG



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 Start Date 20 June 2019
 End Date 21 June 2019

BH03

Sheet 2 of 4
 Scale 1 : 25
 Ground level 95.20mOD*
 Depth 15.58 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	9D 10L	4.20 - 4.65 4.20 - 5.20	Nil	S 14			4.20m: Medium dense.	4.70	90.50	
	12D 13C	5.20 - 5.62 5.20 - 6.70	Nil 5.20	S*56	60		Brown, light brown, yellowish brown and off-white slightly clayey fine and medium SAND with rare thin laminae of grey clay. (BECKLEY SAND MEMBER) 5.20 - 5.40m: Drilling disturbed. Recovered as yellowish brown and light grey slightly sandy subangular to rounded fine to coarse limestone gravel. 5.20 - 6.70m: Limited recovery.	6.00	89.20	
	14L	6.00 - 6.70					Light brown clayey fine and medium SAND. (BECKLEY SAND MEMBER)	7.20	88.00	
	15D 16L	6.70 - 7.08 6.70 - 8.20	6.70	S 26			6.70m: Medium dense. Yellowish brown fine and medium SAND with frequent thin laminae of dark grey clay. (BECKLEY SAND MEMBER)	8.60	86.60	
20/06/19 1640hrs 2.35m	17D 18L	8.20 - 8.50 8.20 - 9.70	8.20	S*100			8.40 - 8.60m: Bed of extremely weak light grey limestone. Medium dense to dense yellowish brown clayey fine and medium SAND with frequent thin laminae of dark grey clay. (BECKLEY SAND MEMBER)	{9.00}		
							Continued Next Page			

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water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT 35378	CHECKED CT
				Groundwater not encountered prior to use of water flush.			

BOREHOLE LOG



BH03

CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 Start Date 20 June 2019
 End Date 21 June 2019

Sheet 3 of 4
 Scale 1 : 25
 Depth 15.58 m

Ground level 95.20mOD*

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	19D 20L	9.70 - 10.15 9.70 - 11.20	9.70	S 29						
	21D 22L	11.20 - 11.65 11.20 - 12.70	11.20	S 32			11.30 - 11.45m: Subangular to rounded fine sandstone gravel. Frequent fragments of shell (up to 1mm) 11.80m: Pocket of light grey silt.			
	23D 24L	12.70 - 13.14 12.70 - 14.20	12.70	S*52			Very dense dark grey fine and medium SAND. (BECKLEY SAND MEMBER) 12.40 - 12.65m: Dark brown fine and medium sand with frequent thin laminae of dark grey clay.	12.40	82.80	
Continued Next Page								{14.00}		

Geotechnical Engineering Ltd, Tel. 01452 527743 35378.GPJ TRIAL\JH.GPJ GEOTECH2.GLB 04/07/2019 12:32:26 LH/DC JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT 35378	CHECKED CT
				Groundwater not encountered prior to use of water flush.			

BOREHOLE LOG



BH03

CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 Start Date 20 June 2019
 End Date 21 June 2019

Sheet 4 of 4
 Scale 1 : 25
 Depth 15.58 m

Ground level 95.20mOD*

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
21/06/19 1400hrs 3.96m	25D 26C	14.20 - 14.59 14.20 - 15.20	14.20	S*52	60		Very dense dark grey slightly clayey fine and medium SAND. (BECKLEY SAND MEMBER) 14.65 - 14.75m: Drilling disturbed. Recovered as subangular and subrounded medium and coarse limestone gravel. 14.75 - 14.85m: Dark grey sandy clay.	14.65	80.55	
	27D	15.20 - 15.58	14.20	S*67				15.58	79.62	
							Borehole completed at 15.58m.			

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water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT	CHECKED
				Groundwater not encountered prior to use of water flush.		35378	CT

STANDARD PENETRATION TEST



CLIENT R J LEIGHFIELD & SONS LTD

SITE WARREN CRESCENT, HEADINGTON

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows		pen (mm)				
BH01	1.20		1.65	Nil	Dry	2 5	75 75	6 6 9 15	75 75 75 75	S	36	73		
BH01	1.70		2.06	1.70	0.24	16 9	75 10	15 14 21 10	75 75 75 50	S	65	73		
BH01	2.20		2.50	2.20	0.19	2 3	75 75	4 46	75 75	S	100	73		
BH01	3.20		3.65	2.20	2.23	3 5	75 75	8 8 10 15	75 75 75 75	S	41	73		
BH01	4.20		4.65	4.20	0.27	2 4	75 75	5 8 9 8	75 75 75 75	S	30	73		
BH01	5.20		5.63	5.20	0.29	4 5	75 75	5 5 7 33	75 75 75 55	S	54	73		
BH01	6.70		7.15	6.70	4.20	1 3	75 75	4 4 5 7	75 75 75 75	S	20	73		
BH01	8.20		8.24	8.20	4.20	25	35	50	5	S	**	73		
BH01	9.70		10.15	9.70	4.00	4 6	75 75	6 8 11 11	75 75 75 75	S	36	73		
BH01	11.20		11.65	11.20	4.20	5 6	75 75	6 7 10 18	75 75 75 75	S	41	73		
BH01	12.70		13.00	12.70	4.20	4 9	75 75	16 34	75 75	S	100	73		
BH01	14.20		14.65	12.70	4.00	4 5	75 75	6 8 7 9	75 75 75 75	S	30	73		
BH02	1.20		1.65	Nil	Dry	1 1	75 75	2 2 1 0	75 75 75 75	S	5	73		
BH02	2.20		2.65	Nil	Dry	19 6	75 75	4 2 3 3	75 75 75 75	S	12	73		
BH02	3.20		3.65	Nil	Dry	2 4	75 75	4 4 4 4	75 75 75 75	S	16	73		
BH02	4.20		4.65	4.20	2.30	1 2	75 75	3 3 5 5	75 75 75 75	S	16	73		
BH02	5.20		5.65	5.20	2.60	2 4	75 75	4 5 5 5	75 75 75 75	S	19	73		
BH02	6.70		6.90	6.70	2.60	4 3	75 75	50	50	S	300	73		
BH02	8.20		8.50	8.20	2.60	3 6	75 75	9 41	75 75	S	100	73		
BH02	9.70		10.15	9.70	2.60	2 7	75 75	7 9 8 10	75 75 75 75	S	34	73		
BH02	11.20		11.43	11.20	2.60	5 9	75 75	12 38	75 0	S	200	73		
BH03	1.20		1.65	Nil	Dry	1 1	75 75	1 1 2 1	75 75 75 75	S	5	73		
BH03	2.20		2.65	Nil	Dry	1 2	75 75	2 3 3 1	75 75 75 75	S	9	73		
BH03	3.20		3.65	Nil	Dry	5 5	75 75	4 2 2 2	75 75 75 75	S	10	73		

notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. ** Denotes no effective penetration.

CONTRACT

35378

CHECKED

CT

STANDARD PENETRATION TEST



CLIENT R J LEIGHFIELD & SONS LTD

SITE WARREN CRESCENT, HEADINGTON

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows		pen (mm)				
BH03	4.20		4.65	Nil	Dry	2 3	75 75	3 3 4 4	75 75 75 75	S	14	73		
BH03	5.20		5.62	Nil	Dry	3 3	75 75	3 5 31 11	75 75 75 45	S	56	73		
BH03	6.70		7.08	6.70	2.30	25	75	9 8 5 4	75 75 75 75	S	26	73		
BH03	8.20		8.50	8.20	2.50	3 3	75 75	6 44	75 75	S	100	73		
BH03	9.70		10.15	9.70	2.60	4 5	75 75	6 7 8 8	75 75 75 75	S	29	73		
BH03	11.20		11.65	11.20	2.40	5 8	75 75	7 8 9 8	75 75 75 75	S	32	73		
BH03	12.70		13.14	12.70	2.60	6 6	75 75	11 15 15 9	75 75 75 65	S	52	73		
BH03	14.20		14.59	14.20	2.30	15 10	75 25	16 10 14 10	75 75 75 65	S	52	73		
BH03	15.20		15.58	14.20	2.40	8 10	75 75	15 20 15	75 75 75	S	67	73		

notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. ** Denotes no effective penetration.

CONTRACT 35378	CHECKED CT
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APPENDIX B

LABORATORY TESTING



2718



GEOTECHNICAL ENGINEERING LIMITED

For the attention of John Hanson

Version No. 1

Page No. 1 of 12

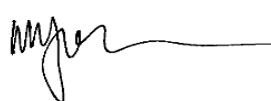
Date of Issue 02/07/2019

TEST REPORT

PROJECT/SITE	WARREN CRESCENT, HEADINGTON	Samples received	26/06/2019
GEL REPORT NUMBER	35378	Schedule received	26/06/2019
Your ref/PO:		Testing commenced	27/06/2019
Test report refers to	Schedule 1	Status	Final

SUMMARY OF RESULTS ATTACHED

TEST METHOD & DESCRIPTION	QUANTITY	ACCREDITED TEST
BS EN ISO 17892-1: 2014:5. Water Content	3	YES
BS1377: Part 2: 1990:4.2-4.4&5.2-5.4, Liquid & Plastic Limits	3	YES
BS EN ISO 17892-4: 2016: 5.2, Particle Size Distribution - Wet Sieve	4	YES
ISRM: 2007: Point Load Strength Test	2	YES
BRE SD1 Reduced Suite: pH, Sulphate - water and acid soluble, sulphur (Subcontracted)	2	YES
pH (Subcontracted)	2	YES
Sulphate Content - 2:1 Water Soluble (Subcontracted)	2	YES

Remarks This report may not be partially reproduced without written permission from this laboratory.	Approved Signatories: W Jones (Laboratory Manager) E Crimp (Senior Engineer) J Hanson (Director) N Parry (Director) 
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Doc TR01 Rev No. 20 Revision date 09/10/17 DC:JH

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Sort code: 16-22-11 Bank account: 11125135

LIQUID AND PLASTIC LIMITS

BS.1377 : PART 2 : 1990 : 4 and 5



CLIENT R J LEIGHFIELD & SONS LTD

SITE WARREN CRESCENT, HEADINGTON

borehole /trial pit no.	sample		specimen depth (m)	natural water content (%)	specimen preparation and test method	fraction >0.425 mm (%)	liquid limit (%)	plastic limit (%)	plasticity index (%)	description and remarks
	no./type	depth (m)								
BH02	3D	1.20	1.20	17.1	BXE	50	48	22	26	Brown slightly sandy gravelly CLAY
BH03	2D	1.00	1.00	14.6	BXE	29	29	20	9	Brown slightly gravelly sandy CLAY
BH03	4L	1.20	1.75	13.7	BYE	19	33	NP		Brown gravelly clayey SAND

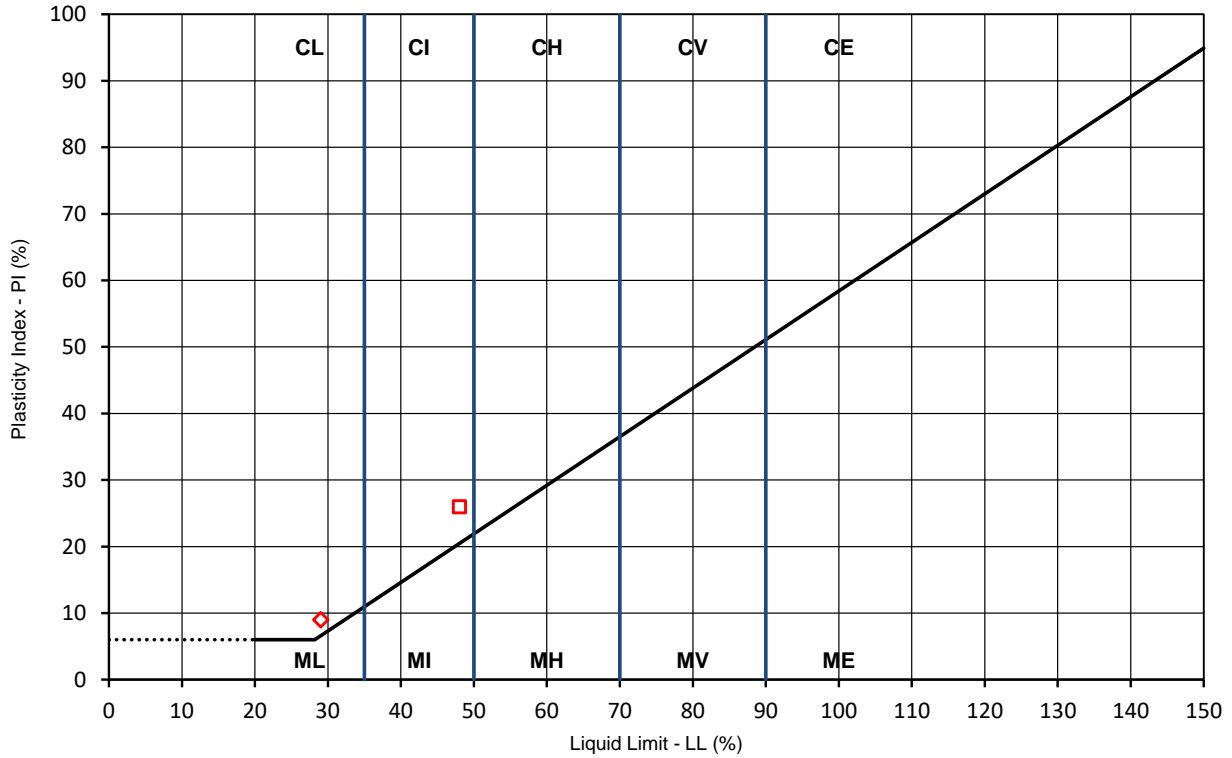
<p>general remarks</p> <p>natural water content determined in accordance with BS EN ISO 17892 - 1 : 2014 (unless specified)</p> <p>NP denotes non plastic</p> <p># denotes sample tested is smaller than that which is recommended in accordance with BS1377 or BS EN ISO 17892</p>											
specimen preparation					test method					CONTRACT	CHECKED
A - as received			D - oven dried (60oC)		X - cone penetrometer (test 4.3)			35378	WJ		
B - washed on 0.425mm sieve			E - oven dried (105oC)		Y - cone penetrometer (test 4.4)						
C - air dried			F - not known		Z - casagrande apparatus (test 4.5)						

Geotechnical Engineering Limited
ATTERBERG LINE PLOT



CLIENT R J LEIGHFIELD & SONS LTD

SITE WARREN CRESCENT, HEADINGTON



	BH/TP No.	depth (m)	LL	PL	PI	remarks
□	BH02	1.20	48	22	26	
◇	BH03	1.00	29	20	9	
	BH03	1.75	33	NP		

CONTRACT	CHECKED
35378	WJ

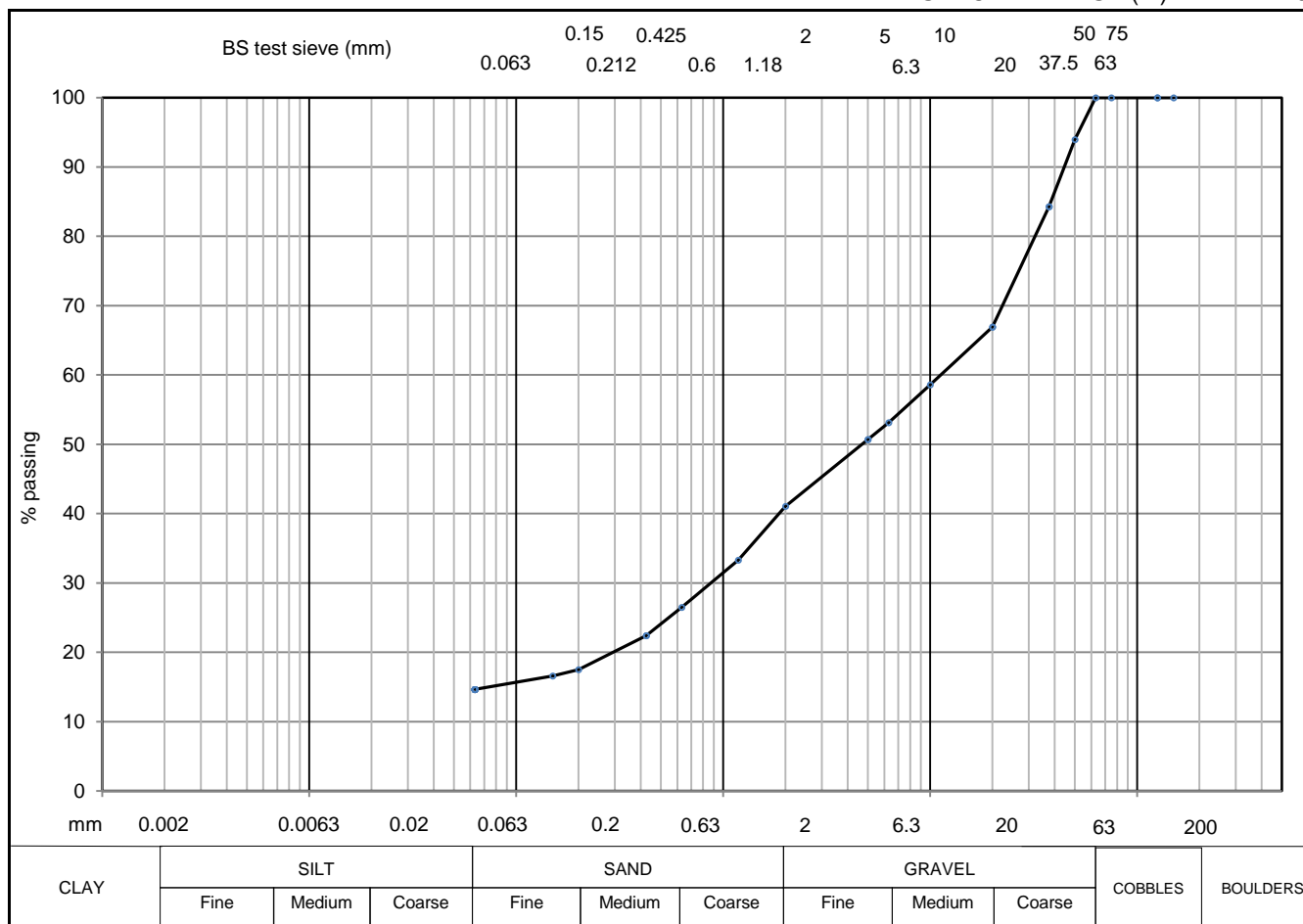
Geotechnical Engineering Limited
PARTICLE SIZE DISTRIBUTION
 BS EN ISO 17892 - 4 : 2016 : 5



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON

BH/TP No. BH01
 SAMPLE No./TYPE 4L
 SAMPLE DEPTH (m) 1.20
 SPECIMEN TOP (m) 1.20
 SPECIMEN BASE (m) 1.70

DESCRIPTION Yellowish brown clayey very sandy GRAVEL



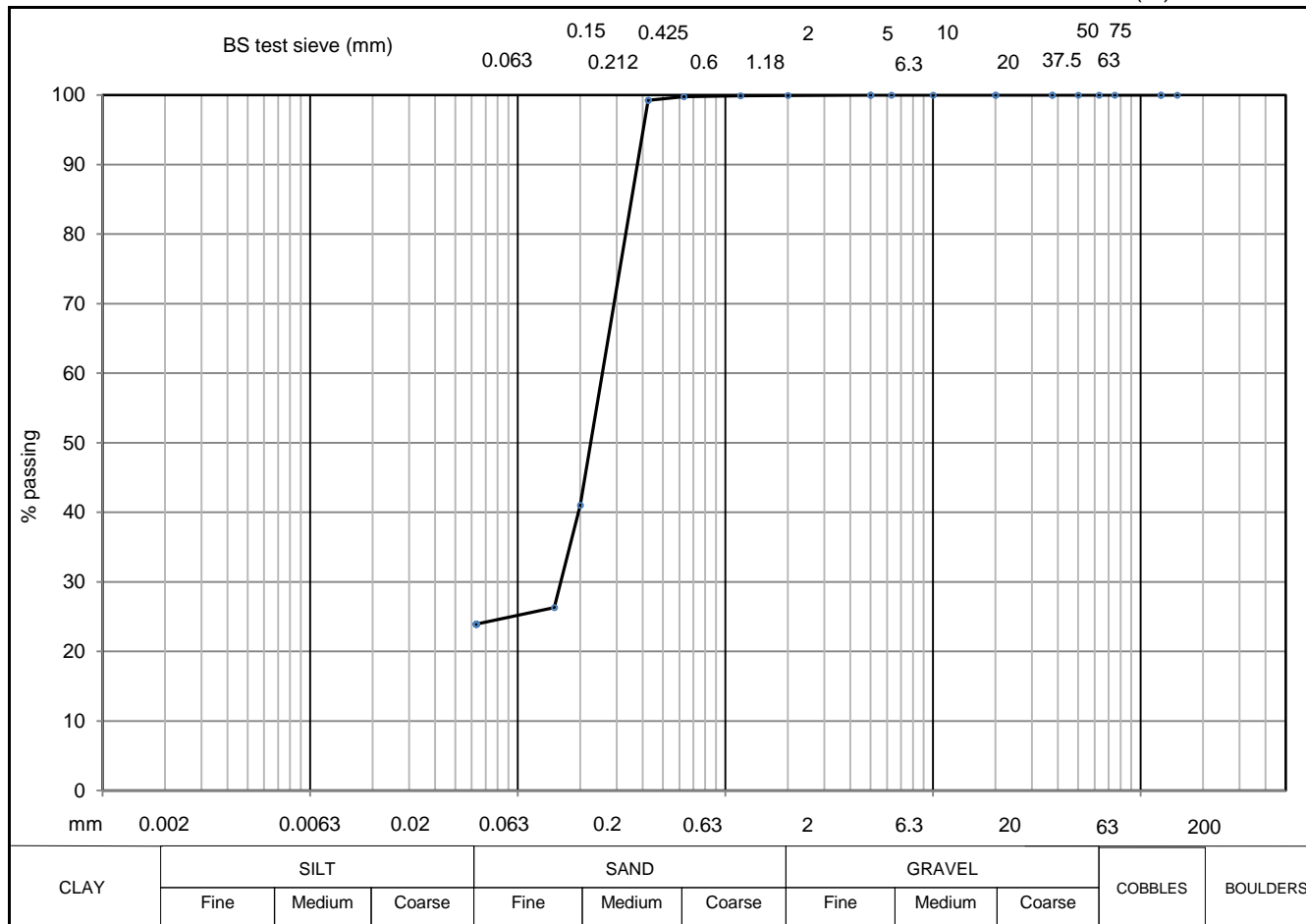
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
SILT		150		5	51	20	
SILT & CLAY	15						
SAND	26	75		2	41	6	
GRAVEL	59						
COBBLE & BOULDER	0	63	100	1.18	33	2	
test method(s)	5.2	50	94	0.63	26		
test method		37.5	84	0.425	22		
5.2 - sieving		20	67	0.2	17		
5.3 - sedimentation by hydrometer		10	59	0.15	17		
5.4 - sedimentation by pipette		6.3	53	0.063	15		
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m ³					CONTRACT	CHECKED
						35378	WJ

Geotechnical Engineering Limited
PARTICLE SIZE DISTRIBUTION
 BS EN ISO 17892 - 4 : 2016 : 5



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 DESCRIPTION Yellowish brown very clayey SAND

BH/TP No. BH01
 SAMPLE No./TYPE 17L
 SAMPLE DEPTH (m) 6.70
 SPECIMEN TOP (m) 7.00
 SPECIMEN BASE (m) 7.40



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY		150		5	100	20	
SILT		75		2	100	6	
SILT & CLAY	24	63		1.18	100	2	
SAND	76						
GRAVEL	0						
COBBLE & BOULDER	0						
test method(s)	5.2	50		0.63	100		
test method		37.5		0.425	99		
5.2 - sieving		20		0.2	41		
5.3 - sedimentation by hydrometer		10		0.15	26		
5.4 - sedimentation by pipette		6.3		0.063	24		
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m ³					CONTRACT	CHECKED
						35378	WJ

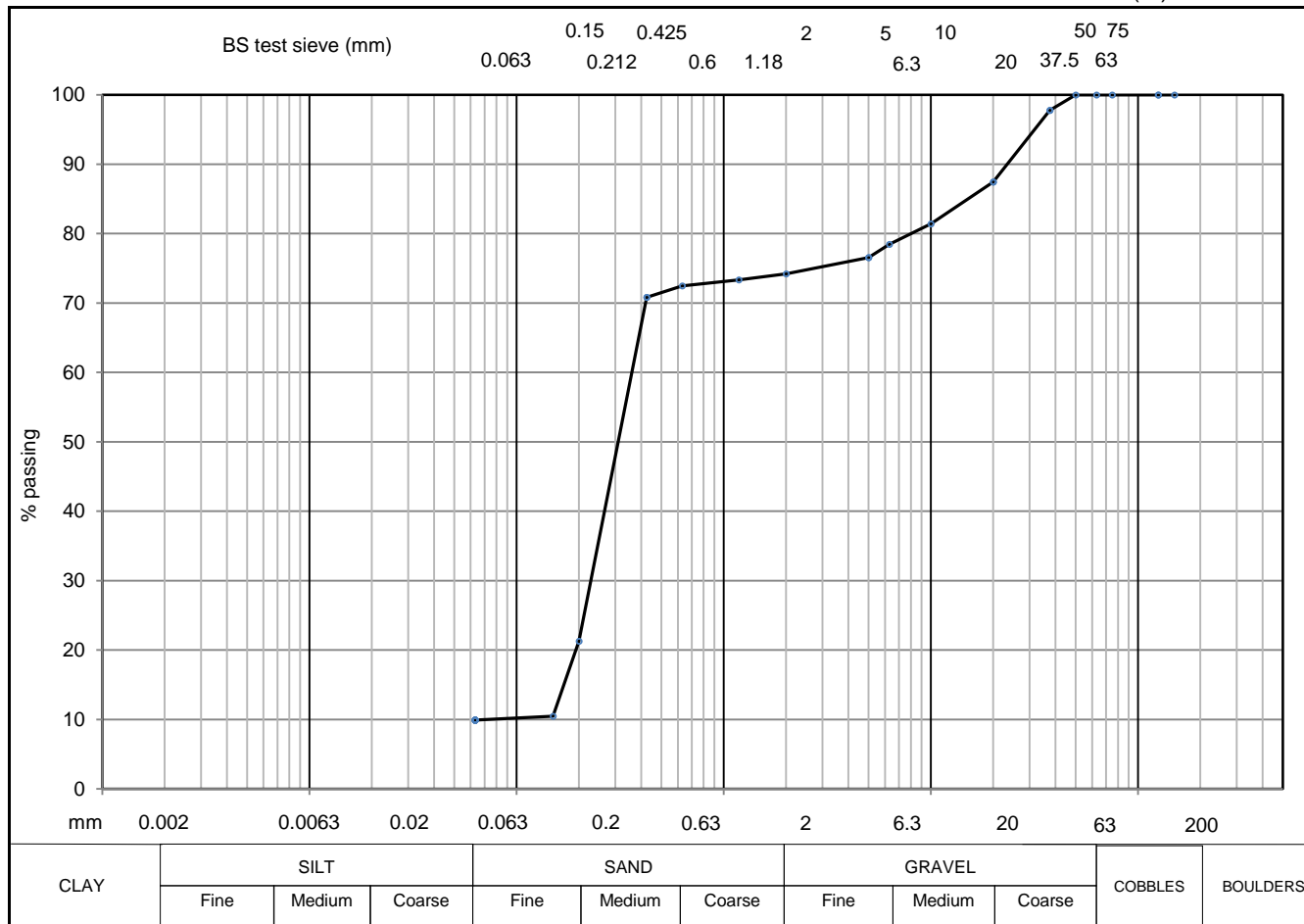
Geotechnical Engineering Limited
PARTICLE SIZE DISTRIBUTION
 BS EN ISO 17892 - 4 : 2016 : 5



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON

BH/TP No. BH02
 SAMPLE No./TYPE 6L
 SAMPLE DEPTH (m) 2.20
 SPECIMEN TOP (m) 2.50
 SPECIMEN BASE (m) 3.00

DESCRIPTION Yellowish brown and grey clayey very gravelly SAND



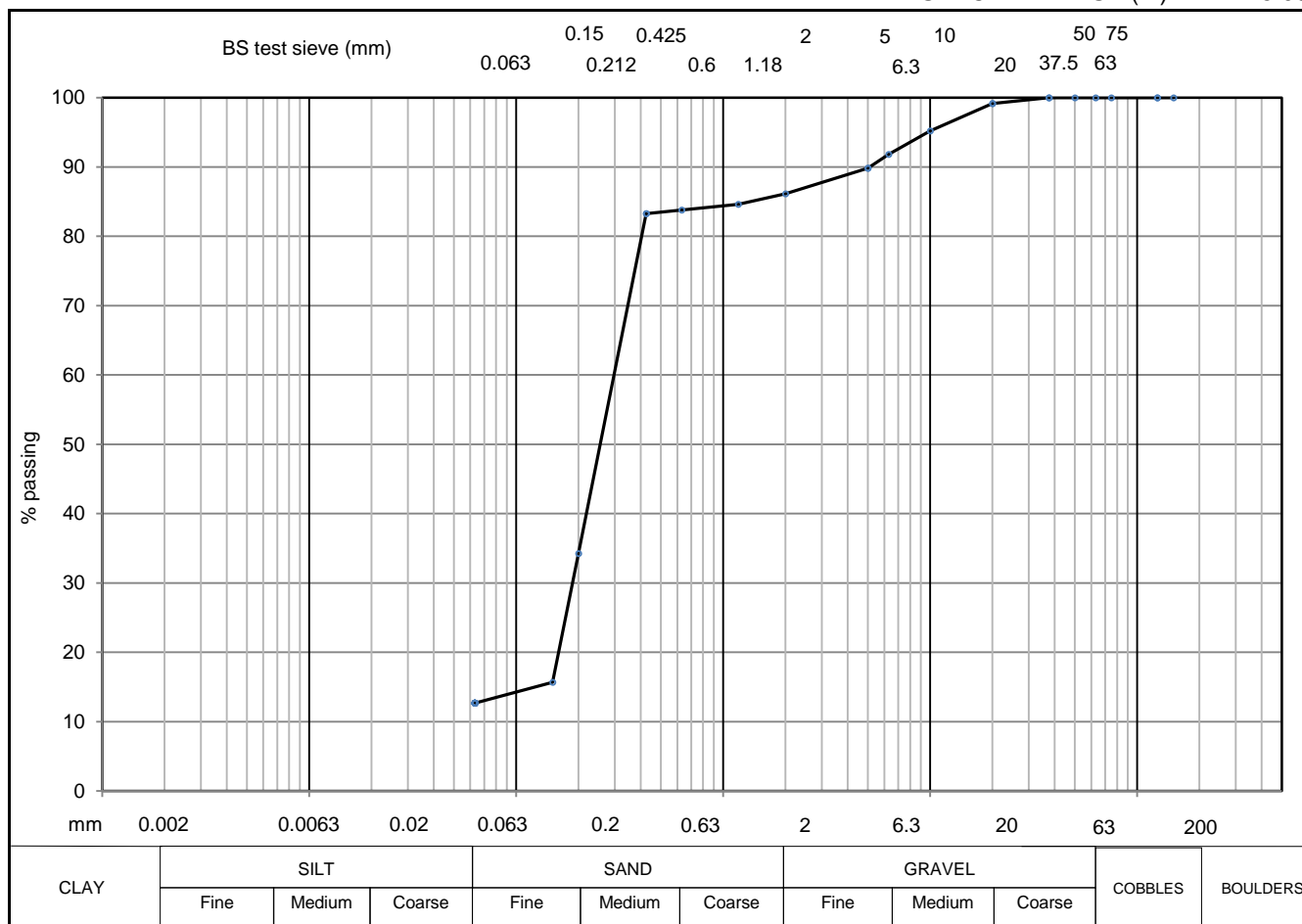
soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY							
SILT		150		5	77	20	
SILT & CLAY	10			2	74	6	
SAND	64	75		1.18	73	2	
GRAVEL	26						
COBBLE & BOULDER	0	63					
test method(s)	5.2	50	100	0.63	72		
test method		37.5	98	0.425	71		
5.2 - sieving		20	87	0.2	21		
5.3 - sedimentation by hydrometer		10	81	0.15	10		
5.4 - sedimentation by pipette		6.3	78	0.063	10		
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m3					CONTRACT	CHECKED
						35378	WJ

Geotechnical Engineering Limited
PARTICLE SIZE DISTRIBUTION
 BS EN ISO 17892 - 4 : 2016 : 5



CLIENT R J LEIGHFIELD & SONS LTD
 SITE WARREN CRESCENT, HEADINGTON
 DESCRIPTION Yellowish brown clayey gravelly SAND

BH/TP No. BH02
 SAMPLE No./TYPE 10L
 SAMPLE DEPTH (m) 4.20
 SPECIMEN TOP (m) 4.50
 SPECIMEN BASE (m) 5.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
SILT		150		5	90	20	
SILT & CLAY	13						
SAND	73	75		2	86	6	
GRAVEL	14						
COBBLE & BOULDER	0	63		1.18	85	2	
test method(s)	5.2	50		0.63	84		
test method		37.5	100	0.425	83		
5.2 - sieving		20	99	0.2	34		
5.3 - sedimentation by hydrometer		10	95	0.15	16		
5.4 - sedimentation by pipette		6.3	92	0.063	13		
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m ³					CONTRACT	CHECKED
						35378	WJ

POINT LOAD STRENGTH TEST

I.S.R.M. Suggested Methods : 2007 Edition



CLIENT R J LEIGHFIELD & SONS LTD

SITE WARREN CRESCENT, HEADINGTON

borehole /trial pit no.	sample depth (m)	test type	test orientation	moisture condition	width		length	platen sep.	failure load	equiv. diam.	Is	size factor	Is(50)	description and remarks
					W (mm)	L (mm)	D (mm)	P (kN)	De (mm)	(MPa)	(MPa)			
BH01	2.65	D	Y	P		30	90	3.04	90.00	0.38	1.30	0.49	Yellowish brown LIMESTONE	
BH01	2.65	A	X	P	90		45	6.26	71.81	1.21	1.18	1.43	Yellowish brown LIMESTONE	
BH01	2.75	D	Y	P		30	90	0.60	90.00	0.07	1.30	0.10	Yellowish brown LIMESTONE	
BH01	2.75	A	X	P	90		40	3.22	67.70	0.70	1.15	0.81	Yellowish brown LIMESTONE	

general remarks

tests carried out in accordance with I.S.R.M.(2007): Suggested Methods for Determining Point Load Strength
test machine PLM02

test type	test orientation relative to discontinuities	moisture condition	CONTRACT	CHECKED
A - axial	X - perpendicular U - unknown	N - natural moisture content	35378	WJ
D - diametral	Y - parallel	P - partially air dried		
I - irregular lump	Z - oblique	S - soaked		



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Analytical Report Number : 19-47470

Project / Site name:	Warren Crescent, Headington	Samples received on:	27/06/2019
Your job number:	35378	Samples instructed on:	27/06/2019
Your order number:	35378-WJ	Analysis completed by:	02/07/2019
Report Issue Number:	1	Report issued on:	02/07/2019
Samples Analysed:	4 soil samples		

Signed: *K. Lewicka*

Katarzyna Lewicka
Head of Reporting Section
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.



Analytical Report Number: 19-47470

Project / Site name: Warren Crescent, Headington

Your Order No: 35378-WJ

Lab Sample Number	1254984			1254985		1254986		1254987	
Sample Reference	BH01			BH02		BH02		BH03	
Sample Number	3			2		5		9	
Depth (m)	1.20-1.65			1.00-1.10		2.20-2.65		4.20-4.65	
Date Sampled	27/06/2019			27/06/2019		27/06/2019		27/06/2019	
Time Taken	0645			0645		0645		0645	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status						
Stone Content	%	0.1	NONE	5.7	< 0.1	< 0.1	< 0.1		
Moisture Content	%	N/A	NONE	5.8	15	5.6	6.2		
Total mass of sample received	kg	0.001	NONE	0.28	0.23	0.31	0.26		

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.3	8.1	8.6	8.2		
Total Sulphate as SO ₄	mg/kg	50	MCERTS	1400	900	-	-		
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.023	0.022	0.017	0.029		
Total Sulphur	mg/kg	50	MCERTS	580	420	-	-		



Analytical Report Number : 19-47470

Project / Site name: Warren Crescent, Headington

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1254984	BH01	3	1.20-1.65	Grey gravelly clay with stones.
1254985	BH02	2	1.00-1.10	Grey clay with gravel.
1254986	BH02	5	2.20-2.65	Light brown sandy clay with gravel.
1254987	BH03	9	4.20-4.65	Light brown sandy clay with gravel.



Analytical Report Number : 19-47470

Project / Site name: Warren Crescent, Headington

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.