

By Email

Our ref: 21-538.02L

Havercroft Construction Limited
Halifax Approach
Elsham Wold Industrial Estate
Brigg
North Lincolnshire
DN20 0SS

11st August 2022

Dear Sirs,

Re: Ground Investigation & Coal Mining Risk Assessment Report – Proposed Commercial Extension, Rear of Unit 3B & 3C, The Peel Centre, Barnsley Retail Park, Off Harborough Hill Road, Barnsley S71 1JE

Following completion of the ground investigation works at the above site, we have pleasure in providing you with our ground investigation report. The following documents are attached with this report;

- Borehole Location Plan
- Borehole Record Sheets
- Laboratory Testing

1.0 Introduction: -

Arc Environmental Limited (ARC) were commissioned by Havercroft Construction Ltd, to undertake ground investigations works for a proposed commercial extension to the rear of Unit 3B & 3C, located at The Peel Centre, Barnsley Retail Park in Barnsley. The ground investigation was required to check ground conditions for a proposed extension. No areas of soft landscaping are proposed with the site area comprising 100% hardcover.

The intrusive investigation works undertaken by Arc Environmental Limited comprised 4 no. windowless sampling boreholes (Labelled WS01 – WS04) and 4 no. rotary boreholes (RBH03, 04, A & B), the positions of which can be seen on the Borehole Location Plan attached. This plan should be used for orientating purposes only, as the positions shown are approximate and the plan is not to a standard scale.

The works undertaken were completed in general accordance with the scope of works provided by Arc Environmental Limited (Email dated 17th June 2021) and subsequent requests from Havercroft.

2.0 Ground Conditions: -

For an accurate description of the ground conditions encountered, reference should be made to the borehole record sheets attached. It should be noted that there is always the possibility of variation in the ground conditions around and between the borehole locations. A summary of the soil profile can be seen in Table 1 on the following page.



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Re: Ground Investigation & Coal Mining Risk Assessment Report – Proposed Commercial Extension, Rear of Unit 3B & 3C, The Peel Centre, Barnsley Retail Park, Off Harborough Hill Road, Barnsley S71 1JE (Cont'd)

2.0 Ground Conditions (Cont'd): -

Table 1

<u>Type of strata</u>	<u>Depths recorded (bgl)</u>	<u>Description</u>
MADE GROUND:	From 0.00m up to c.1.40m to c.3.40m	Initial site surfacing of concrete over dolomitic limestone sub-base, stiff gravelly clay and sandy clayey gravel. The gravel comprised fragments of limestone, sandstone, coal, mudstone and siltstone with cobbles noted.
SOLID GEOLOGY: (Middle Coal Measures)	From c.1.40m and c.3.40m up to c.>30.00m	Interbedded SILTSTONE & MUDSTONE. Evidence of shallow workings i.e. broken ground, was recorded within the rotary boreholes and is discussed further in Section 3.

There was no visual or olfactory evidence or significant or 'gross' contamination (fuel, oils or asbestos) noted on or below the site during the ground investigation works.

3.0 Coal Mining Risk Assessment:-

When considering the geological setting and based on previous investigation works undertaken by others to the immediate north, the site was considered to be at risk from potential shallow mine workings within the Two-foot (aka Royston Half Yard) coal seam and The Adbry (aka Winter coal) coal seam, which are anticipated to be present at shallow depths below the site. Therefore, 4 no. open hole rotary boreholes have been carried out to determine the potential risks posed to this site from this geo-hazard. From the rotary boreholes carried out, evidence of coal and broken ground with complete loss of flush were recorded, ranging between c.0.50m to c.1.70m thick.

It is felt that the coal and broken ground recorded is representative of the Two-foot and The Adbry coal seams. The depths to which evidence of coal and workings (broken ground) were recorded during the investigation works can be seen in Table 2 below, together with the calculated rock cover ratio.

Table 2

<u>Position</u>	<u>Depth to Coal / Workings from EGL (m)</u>	<u>Thickness of Coal / Workings (m)</u>	<u>Intact Rock Cover Ratio</u>
RBH03	13.00 (W) 19.00 (C)	1.00 1.00	10.9:1
RBH04	11.00 (C) 20.50 (C)	1.70 0.70	4.4:1
RBHA	18.00 (C)	0.50	33:1
RBHB	10.50 (W) 21.00 (C)	1.00 0.60	9:1

EGL = Existing ground levels, (C) = Coal, (W) = Workings

When considering the thickness of workings (broken ground) recorded, it appears that some void migration has occurred. The overlying rock cover ratio falls below the conventionally accepted minimum rock cover ratio of 10:1, taken as "safe" conditions (CIRIA Special Publication 32 – Building over abandoned mine workings) in all rotary boreholes. In summary, from these works completed, it can be seen that mitigation measures (i.e. further drilling and / or grouting) will be required, due to the presence of shallow workings and insufficient rock cover being present.

Re: Ground Investigation & Coal Mining Risk Assessment Report – Proposed Commercial Extension, Rear of Unit 3B & 3C, The Peel Centre, Barnsley Retail Park, Off Harborough Hill Road, Barnsley S71 1JE (Cont'd)

4.0 Groundwater: -

A groundwater ingress was recorded within WS04 only at a depth of c.3.00m. The remaining boreholes remained dry during and on completion of the investigation works.

Although it is not felt to represent an issue, it would be prudent to allow for the introduction of adequate groundwater control techniques, to take care of any surface water ingresses and pockets of trapped surface drainage within the made ground and natural deposits during the construction period, especially during the wetter periods of the year.

5.0 Insitu Testing: -

5.1 Insitu Standard Penetration Tests: -

Standard penetration tests (SPT's) were carried out with the use of a normal split spoon sampler on the made ground and solid deposits encountered in the shallow boreholes. The results are shown as 'N' values on the borehole record sheets, adjacent to the appropriate sample level.

From the results of the testing completed within the made ground materials, N values ranging between 13 and 28 equating to medium dense materials.

From the results of the testing completed within the solid deposits, 75 blows for limited penetration were recorded, equating to very weak and weak deposits in accordance with N_{60} values after Clayton 1995.

Where the full penetration depth, including seating blows (450mm), could not be achieved, the bottom sampling depth is indicated as less than 0.45m from the top (start of test), with the actual depth of penetration and number of blows undertaken also being recorded.

6.0 Laboratory Testing: -

Ground contamination testing was undertaken by Chemtech Environmental of Stanley, Co. Durham (UKAS & MCERTS accredited).

6.1 Determination of pH & SO₄: -

Representative samples of the made ground and natural deposits were tested to determine their acidic (pH) and soluble sulphate (SO₄) levels. The results are shown in Table 3 below and are also contained in the Chemtech Environmental Ltd. Analytical Test Report (Ref. 98458), a copy of which is attached.

Table 3

ACEC = Aggressive Chemical Environment for Concrete site classification

Position	Strata	Depth (m)	pH	SO ₄ (mg/l)	Design SO ₄ Class	ACEC Class
WS01	Made Ground	0.50	8.3	41	DS-1	AC-1
WS01	Natural	3.00	7.7	11	DS-1	AC-1
WS02	Made Ground	1.00	9.5	103	DS-1	AC-1
WS03	Made Ground	0.65	8.6	26	DS-1	AC-1
WS03	Natural	1.90	8.2	23	DS-1	AC-1
WS04	Made Ground	1.00	9.4	<10	DS-1	AC-1
WS04	Natural	2.00	6.3	<10	DS-1	AC-1

Re: Ground Investigation & Coal Mining Risk Assessment Report – Proposed Commercial Extension, Rear of Unit 3B & 3C, The Peel Centre, Barnsley Retail Park, Off Harbrough Hill Road, Barnsley S71 1JE (Cont'd)

6.0 Laboratory Testing (Cont'd): -

6.1 Determination of pH & SO₄ (Cont'd): -

From these results, the samples tested have pH levels between 6.3 and 9.5, and the amount of soluble sulphate present ranges from <10mg/l to 103mg/l. Therefore, in accordance with BRE Special Digest 1: 2005, the site should be given a classification of Class DS-1 / AC-1.

6.2 Screening for Off-Site Disposal: -

To aid in an assessment for off-site disposal classification, representative samples of the made ground were passed onto Chemtech Environmental Ltd of Stanley, Co. Durham, so that soil contamination screening could be carried out. The results of all the testing can be found in the Chemtech Environmental Limited Report (Ref. 98458), a copy of which is attached.

The total analysis carried out is summarised below:

- 4 no. soil samples screened for a generic contamination suite (Arsenic, Cadmium, Chromium III & VI, Copper, Lead, Mercury, Nickel, Selenium, Zinc, pH, Soluble Sulphate, Total Sulphur, free Cyanide, and Total Organic Carbon (TOC)).
- 4 no. soil samples screened for speciated PAH (USEPA 16).
- 4 no. soil samples screened for speciated TPH.
- 4 no. soil samples screened for BTEX.
- 4 no. soil samples screened for asbestos.

Based on the results of the contamination screening, the low levels of heavy metals, PAH's, TPH and absence of asbestos do not indicate a hazardous waste source. Furthermore, the low recorded levels do not represent a risk to Human Health / end users of the site.

If, during future redevelopment works, any excavated materials that are to be discarded and removed from this site as a waste to landfill will need to be classified in accordance with the 'Guidance on the Classification and Assessment of Waste (1st Edition V1.1, May 2018) – Technical Guidance WM3'.

Where possible, removal of materials from site as a 'waste' should be kept to a minimum and ideally excavated materials should all be reused on site. However, if excavated materials have to be discarded to accommodate finished ground levels etc., it should be noted that additional analysis and screening could be required once each specific waste stream has been identified and the volume of material to be disposed of has been calculated, since the amount of screening required, including any pre-disposal WAC screening, will be dependent upon the final volume of material to be disposed of.

When considering the risks to the construction workforce, adequate PPE will be required to provide protection against the levels of contaminants recorded during these investigation works.

Similarly, the results can also be used by the Main Contractor / Project Coordinator, when devising an adequate Site Health & Safety Plan, in accordance with current CDM Regulations.

Re: Ground Investigation & Coal Mining Risk Assessment Report – Proposed Commercial Extension, Rear of Unit 3B & 3C, The Peel Centre, Barnsley Retail Park, Off Harborough Hill Road, Barnsley S71 1JE (Cont'd)

7.0 Foundation Options: -

Evidence of shallow coal workings (i.e. broken ground) have been recorded below the proposed development area.

Therefore, bearing in mind the above and following completion of the necessary consolidation (drilling and grouting) of the shallow workings, it is felt that proposed foundations should be taken down through the full thickness of made ground and be based within the solid deposits where an allowable bearing pressure of 250kN/m² is available. Based on the investigation works to date, this will result in foundation depths of between c.1.40m and c.3.40m below current ground levels across the site.

For the construction of ground bearing floor slabs, road pavement and car park areas, where the made ground materials are to be used as an undisturbed subgrade, a design CBR value of 3% can be adopted.

Furthermore, it is recommended that the sub-grade materials are 'proof rolled' to identify any potential 'loose spots' below this development area, and these can be dealt with by excavation, processing and re-compaction or by introducing an increased thickness of compacted sub-base and/or a geogrid reinforcement.

8.0 General Comments: -

For future site works, adequate lateral trench support will be required for excavations, to prevent trench wall collapse or over excavations, as well as to create a safe working environment, and any excavations on this site should remain open for as short a period as possible, since some of these materials may be susceptible to deterioration, if left open to the natural elements for any significant period of time.

With regard to asbestos in soil, where we have sampled and tested for asbestos this is discussed in the report. Whilst we would target any asbestos sampling and testing in accordance with a Conceptual Site Model and site findings, there is always the possibility, along with other contamination, that undiscovered asbestos exists between sample locations and the possibility of unknown asbestos exists on all sites, particularly brownfield sites where previous buildings have been demolished, there were previous features that were infilled (old hollows, pits etc) or where significant quantities of materials such as demolition and brick rubble exist. It is not uncommon for historical asbestos wastes to be deliberately buried on derelict sites, or imported old demolition rubble which could contain asbestos to be imported for use as hardstanding/hardcore. Unless otherwise stated we have not assessed any above or below ground features such as existing buildings, service ducts, basements, culverts, partly demolished or dilapidated structures, spoil heaps, fly tipped materials, security bunds, etc.

It is also recommended for the development of this site, adequate surface drainage should be designed and installed by a competent contractor, to prevent surface water 'ponding' or collection, during and post construction, particularly where the existing surface drainage system is disrupted or damaged.

**Re: Ground Investigation & Coal Mining Risk Assessment Report – Proposed Commercial Extension,
Rear of Unit 3B & 3C, The Peel Centre, Barnsley Retail Park, Off Harborough Hill Road, Barnsley S71
1JE (Cont'd)**

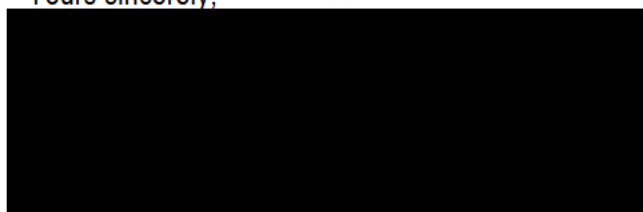
8.0 General Comments (Cont'd): -

In addition, for deeper excavations, drainage, service runs or the like that may pass close to or beneath any existing or proposed new foundations, these should be undertaken with care and completed prior to the preparation of any new foundations, so as not to allow any loose or granular material to move or 'flow', thus causing settlement to occur to any new or adjacent old foundation based at a higher level.

An "observational technique" can be applied to the design and construction of this site, and where ground conditions seem to vary from that indicated from the conceptual ground model derived from works to date, then advice from a suitably qualified Engineer should be sought.

We trust the contents of this report is to your satisfaction and if you require any further information or clarification please do not hesitate to contact us.

Yours sincerely,



Associate Director

Borehole Location Plan



The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.

rev.	date	amendments	drawn	chckd

Client:

HAVERCROFT CONSTRUCTION LIMITED

Project Title:

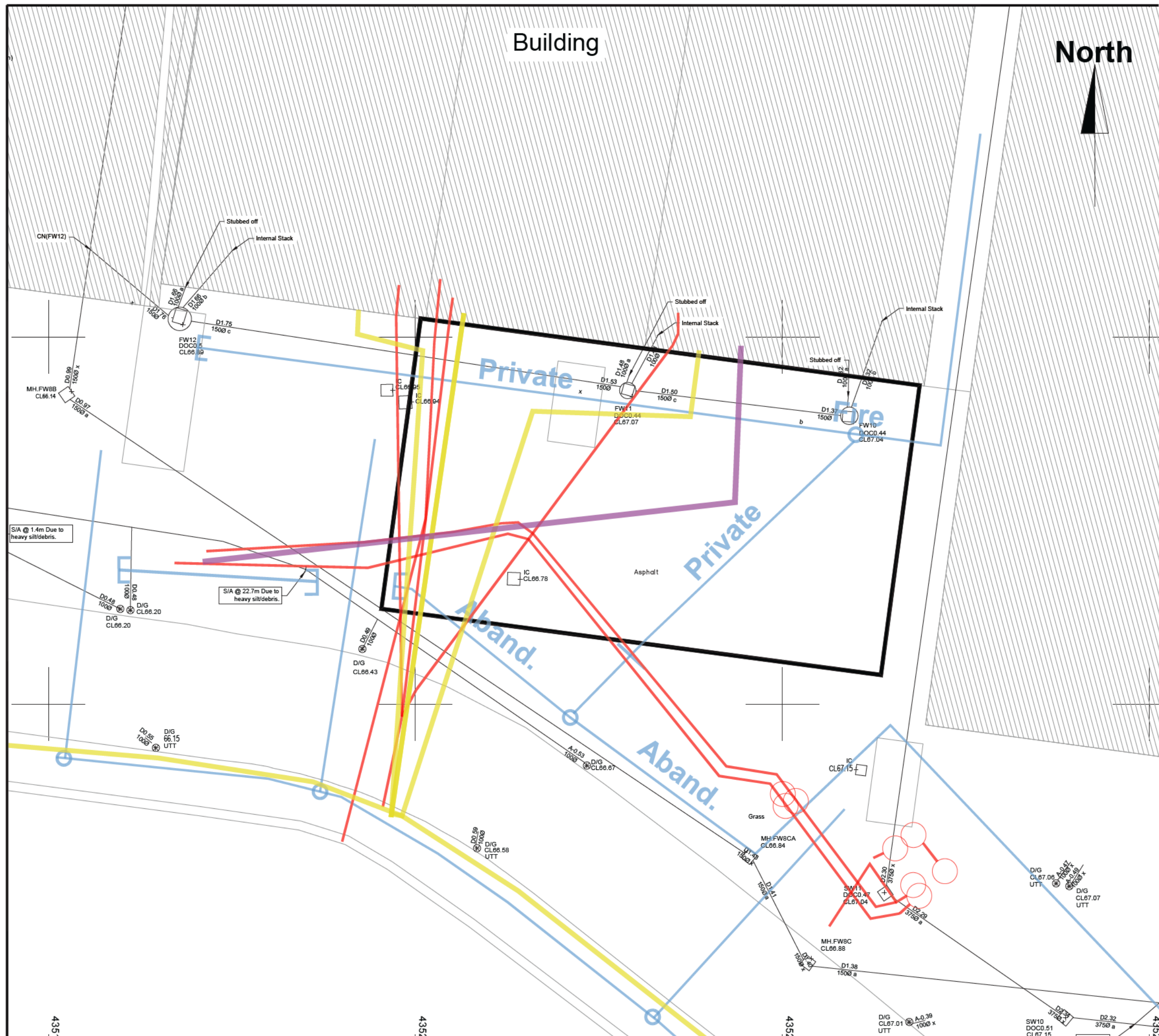
Proposed Extension Unit 3B and 3C
Barnsley Retail Park

Drawing Title:

Proposed Investigation Location Plan

Scale at A3:	Date:	Drawn by:	Approved by:
1:200 @ A3	07.07.21	P.D	M.P.B

Job Ref:	Drg no:	Rev:
21-538	—	—



Borehole Record Sheets



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DRILLHOLE LOG

Project Barnsley Retail Park				DRILLHOLE No RBHA	
Job No 21-837	Date 02-10-21	Ground Level (m)	Co Ordinates ()		
Contractor Arc Environmental Limited				Sheet 1	

RUN DETAILS			STRATA						of 1	
Depth	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick ness)	DESCRIPTION			Geology	Instrument/ Backfill
						Discontinuities	Detail	Main		
					0.30			Concrete (MADE GROUND).		
					1.50			MADE GROUND (Drillers description).		
					2.50			Dark grey SILTSTONE (Drillers description) (MIDDLE COAL MEASURES).		
					(4.50)			Brown and grey SILTSTONE (Drillers description) (MIDDLE COAL MEASURES).		
					7.00			Light grey SILTSTONE (Drillers description) (MIDDLE COAL MEASURES).		
					18.00					
					18.50			Intact COAL (MIDDLE COAL MEASURES).		
					(11.50)			Brown and grey SILTSTONE (Drillers description) (MIDDLE COAL MEASURES).		
					30.00					
								Borehole terminated at 30.00m.		

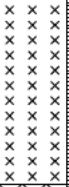
Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
							0	30	Water	100	
All dimensions in metres Scale 1:200			Client			Method/ Plant Used Rotary Openhole			Logged By MW		



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DRILLHOLE LOG

Project Barnsley Retail Park				DRILLHOLE No RBHB	
Job No 21-837	Date 02-10-21	Ground Level (m)	Co Ordinates ()		
Contractor Arc Environmental Limited				Sheet 1	

RUN DETAILS			STRATA						of 1	
Depth	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thickness)	DESCRIPTION			Geology	Instrument/ Backfill
						Discontinuities	Detail	Main		
					0.30			Concrete (MADE GROUND).		
					1.50			MADE GROUND (Drillers description).		
					3.00			Brown and grey SILTSTONE (Drillers description) (MIDDLE COAL MEASURES).		
					4.50			Dark grey SILTSTONE (Drillers description) (MIDDLE COAL MEASURES).		
					(6.00)			Brown and grey SILTSTONE (Drillers description) (MIDDLE COAL MEASURES).		
					10.50					
					11.50			Broken ground. 50% loss of flush (Drillers description).		
					(9.50)			Brown and grey SILTSTONE (Drillers description) (MIDDLE COAL MEASURES).		
					21.00					
					21.60			Intact COAL (MIDDLE COAL MEASURES).		
					(8.40)			Brown and grey SILTSTONE (Drillers description) (MIDDLE COAL MEASURES).		
					30.00					
							Borehole terminated at 30.00m.			

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
							0 10.5	10.5 30	Water Water	100 50	
All dimensions in metres Scale 1:200			Client			Method/ Plant Used Rotary Openhole			Logged By MW		

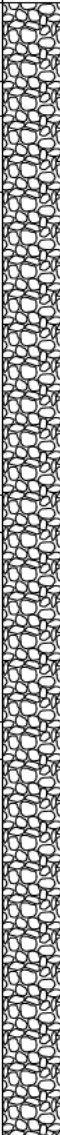
AGS3 UK DH RBH LOGS 21-837 GPJ AGS3 ALL GD 5/10/21



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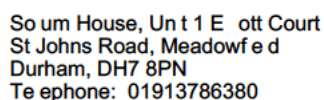
DRILLHOLE LOG

Project Barnsley Retail Park				DRILLHOLE No RBH03	
Job No 21-538	Date 27-07-21	Ground Level (m)	Co Ordinates ()		
Contractor Arc Environmental Limited				Sheet 1	

RUN DETAILS			STRATA						of 1	
Depth	TCR (SCR) RQD	(SPT) Fracture Spacing	Red'cd Level	Legend	Depth (Thick ness)	DESCRIPTION			Geology	Instrument/ Backfill
						Discontinuities	Detail	Main		
					(2.10) 2.10			See WS03 log.		
				× × × ×	3.00			Light grey SILTSTONE (MIDDLE COAL MEASURES).		
				× 						

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
							0 13	13 30	Water Water	100 0	
All dimensions in metres Scale 1:200			Client			Method/ Plant Used	Rotary Openhole			Logged By MW	

AGS3 UK DH 21-538 RBH LOGS GPJ AGS3 ALL GD 2/8/21



DRILLHOLE LOG

Project Barnsley Retail Park				DRILLHOLE No RBH04
Job No 21-538	Date 27-07-21	Ground Level (m)	Co Ordinates ()	
Contractor Arc Environmental Limited				Sheet 1

[illegible]

Drilling Progress and Water Observations							Rotary Flush				GENERAL REMARKS
Date	Time	Depth	Casing	Core Dia mm	Strike	Water Standing	From	To	Type	Returns	
							0	30	Water	100	

All dimensions in metres Scale 1:200	Client	Method/ Plant Used	Rotary Openhole	Logged By MW
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AGS3 UK DH 21-538 RBH LOGS GPJ AGS3 ALL GD 2/8/21



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BOREHOLE LOG

Project Barnsley Retail Park				BOREHOLE No WS01	
Job No 21-538	Date 09-07-21	Ground Level (m)	Co Ordinates ()		
Contractor Arc Environmental Limited				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.50	J/D	N 28				(0.20) 0.20	Concrete. Rebar noted at 0.07m. DPM at base (MADE GROUND).		
						(0.20) 0.40	Dense yellow brown dolomitic limestone sub base (MADE GROUND).		
						(0.20) 0.60	Brown and black sandy gravel. Gravel is fine to coarse comprising fragments of sandstone and occasional coal (MADE GROUND).		
						(0.20) 0.80	Red brown bedding sand. Yellow plastic gas warning tape and pipe noted at 0.65m in side of service pit (MADE GROUND).		
1.00	B					(0.40)	Stiff brown very sandy very gravelly clay. Gravel is fine to coarse comprising fragments of limestone sandstone and occasional coal. Cobbles noted (MADE GROUND).		
1.00 1.45	SPT	N 28				1.20			
2.00	B	N 16				(1.30)	Brown and grey sandy clayey gravel. Gravel is fine to coarse comprising fragments of mudstone siltstone and occasional coal. Reworked natural materials (MADE GROUND).		
						2.50			
3.00	B					(0.85)	Hard interbedded SILTSTONE and MUDSTONE (MIDDLE COAL MEASURES).		
3.00 3.35	SPT	75 Blows				3.35			
							Borehole terminated at 3.35m due to refusal.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Borehole remained dry on completion.
All dimensions in metres Scale 1:25			Client			Method/ Plant Used Windowless Sampling			Logged By MPB		

AGS3 UK BH 21-538 WS LOGS GPJ AGS3 ALL GD 15/7/21



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BOREHOLE LOG

Project Barnsley Retail Park				BOREHOLE No WS02
Job No 21-538	Date 09-07-21	Ground Level (m)	Co Ordinates ()	
Contractor Arc Environmental Limited				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
1.00	J/D					(0.23) 0.23	Concrete. Rebar noted at 0.08m. DPM at base (MADE GROUND).		
						(0.57) 0.80	Dense yellow brown dolomitic limestone sub base (MADE GROUND).		
						(0.20) 1.00	Brown and black sandy gravel. Gravel is fine to coarse comprising fragments of sandstone and occasional coal (MADE GROUND).		
							Borehole terminated at 1.00m owing to presence of water pipe.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Borehole remained dry on completion.

All dimensions in metres Scale 1:25	Client	Method/ Plant Used Windowless Sampling	Logged By MPB
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AGS3 UK BH 21-538 WS LOGS GPJ AGS3 ALL GD 15/7/21



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BOREHOLE LOG

Project Barnsley Retail Park				BOREHOLE No WS03	
Job No 21-538	Date 09-07-21	Ground Level (m)	Co Ordinates ()		
Contractor Arc Environmental Limited				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.65	J/D					(0.25) 0.25	Concrete. Rebar noted at 0.10m. DPM at base (MADE GROUND).		
						(0.35) 0.60	Dense yellow brown dolomitic limestone sub base (MADE GROUND).		
						(0.30) 0.90	Brown and black sandy gravel. Gravel is fine to coarse comprising fragments of sandstone and occasional coal (MADE GROUND).		
1.00 1.00 1.45	B SPT	N 24				(0.50) 1.40	Stiff brown very sandy very gravelly clay. Gravel is fine to coarse comprising fragments of limestone sandstone and occasional coal. Cobbles noted (MADE GROUND).		
1.80 2.10 1.90	SPT B	75 Blows				(0.70) 2.10	Hard interbedded SILTSTONE and MUDSTONE (MIDDLE COAL MEASURES).		
							Borehole terminated at 2.10m due to refusal.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Borehole remained dry on completion.
All dimensions in metres Scale 1:25			Client			Method/ Plant Used Windowless Sampling			Logged By MPB		

AGS3 UK BH 21-538 WS LOGS GPJ AGS3 ALL GD 15/7/21



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BOREHOLE LOG

Project Barnsley Retail Park				BOREHOLE No WS04	
Job No 21-538	Date 09-07-21	Ground Level (m)	Co Ordinates ()		
Contractor Arc Environmental Limited				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
1.00 1.00 1.45	J/D SPT	N 15				(0.22) 0.22	Concrete. Rebar noted at 0.11m and 0.15m. DPM at base (MADE GROUND).		
						(0.68)	Dense yellow brown dolomitic limestone sub base (MADE GROUND).		
						0.90			
						(0.60)	Stiff brown very sandy very gravelly clay. Gravel is fine to coarse comprising fragments of limestone sandstone and occasional coal. Cobbles noted (MADE GROUND).		
2.00 2.00 2.45	B SPT	N 13				(1.90)	Brown and grey sandy clayey gravel. Gravel is fine to coarse comprising fragments of mudstone siltstone and occasional coal. Reworked natural materials (MADE GROUND).		
3.00 3.00 3.45	B SPT	N 24				3.40	Becoming wet.		
						3.55	Hard interbedded SILTSTONE and MUDSTONE (MIDDLE COAL MEASURES).		
3.50 3.55	SPT	75 Blows					Borehole terminated at 3.55m due to refusal.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Borehole becoming wet from 3.00m.

All dimensions in metres Scale 1:25	Client	Method/ Plant Used	Windowless Sampling	Logged By MPB
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AGS3 UK BH 21-538 WS LOGS GPJ AGS3 ALL GD 15/7/21

Laboratory Testing



ANALYTICAL TEST REPORT

Contract no: 98458
Contract name: Barnsley Retail Park
Client reference: 21-538
Clients name: ARC Environmental
Clients address: Solum House, Unit 1 Elliott Court
St Johns Road
Meadowfield
DH7 8PN

Samples received: 16 July 2021

Analysis started: 16 July 2021

Analysis completed: 23 July 2021

Report issued: 23 July 2021

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.
BTEX compounds are identified by retention time only and may include interference from co-eluting compounds.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by:


Rachael Burton
Customer Support Squad Leader

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
98458-1	WS01	0.50	Clayey Sand with Gravel	-	-	17.3
98458-2	WS01	3.00	Sandy Clay	-	-	5.4
98458-3	WS02	1.00	Sandy Clay with Gravel	-	-	12.2
98458-4	WS03	0.65	Sand with Gravel	-	-	12.2
98458-5	WS03	1.90	Sandy Clay with Gravel	-	-	6.6
98458-6	WS04	1.00	Sandy Clay with Gravel	-	-	10.7
98458-7	WS04	2.00	Sandy Clay with Gravel	-	-	16.3

Chemtech Environmental Limited

SOILS

Lab number Sample id Depth (m) Date sampled			98458-1 WS01 0.50 09/07/2021	98458-2 WS01 3.00 09/07/2021	98458-3 WS02 1.00 09/07/2021	98458-4 WS03 0.65 09/07/2021	98458-5 WS03 1.90 09/07/2021	98458-6 WS04 1.00 09/07/2021
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	6.8	-	4.5	5.9	-	6.9
Cadmium (total)	CE127 ^M	mg/kg Cd	<0.2	-	0.5	<0.2	-	0.2
Chromium (total)	CE127 ^M	mg/kg Cr	38	-	46	104	-	34
Chromium (III)	CE208	mg/kg CrIII	38	-	46	104	-	34
Chromium (VI)	CE146	mg/kg CrVI	<1	-	<1	<1	-	<1
Copper (total)	CE127 ^M	mg/kg Cu	40	-	17	20	-	18
Lead (total)	CE127 ^M	mg/kg Pb	30	-	26	40	-	18
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	-	<0.5	<0.5	-	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	36	-	11	17	-	20
Selenium (total)	CE127 ^M	mg/kg Se	1.7	-	0.7	0.9	-	1.0
Zinc (total)	CE127 ^M	mg/kg Zn	78	-	49	43	-	69
pH	CE004 ^M	un ts	8.3	7.7	9.5	8.6	8.2	9.4
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	41	11	103	26	23	<10
Cyanide (free)	CE077	mg/kg CN	<1	-	<1	<1	-	<1
Total Organic Carbon (TOC)	CE197	% w/w C	6.0	-	1.5	1.8	-	1.4
PAH								
Acenaphthene	CE087 ^M	mg/kg	<0.02	-	<0.02	<0.02	-	<0.02
Acenaphthylene	CE087 ^M	mg/kg	<0.02	-	<0.02	<0.02	-	<0.02
Anthracene	CE087 ^U	mg/kg	<0.02	-	<0.02	<0.02	-	<0.02
Benzo(a)anthracene	CE087 ^U	mg/kg	<0.02	-	<0.02	0.06	-	<0.02
Benzo(a)pyrene	CE087 ^U	mg/kg	<0.02	-	<0.02	0.07	-	<0.02
Benzo(b)fluoranthene	CE087 ^M	mg/kg	<0.02	-	<0.02	0.08	-	<0.02
Benzo(ghi)perylene	CE087 ^M	mg/kg	<0.02	-	<0.02	0.04	-	<0.02
Benzo(k)fluoranthene	CE087 ^M	mg/kg	<0.03	-	<0.03	<0.03	-	<0.03
Chrysene	CE087 ^M	mg/kg	<0.03	-	<0.03	0.07	-	<0.03
Dibenz(ah)anthracene	CE087 ^M	mg/kg	<0.02	-	<0.02	<0.02	-	<0.02
Fluoranthene	CE087 ^M	mg/kg	<0.02	-	<0.02	0.10	-	<0.02
Fluorene	CE087 ^U	mg/kg	<0.02	-	<0.02	<0.02	-	<0.02
Indeno(123cd)pyrene	CE087 ^M	mg/kg	<0.02	-	<0.02	0.05	-	<0.02
Naphthalene	CE087 ^M	mg/kg	<0.02	-	<0.02	<0.02	-	<0.02
Phenanthrene	CE087 ^M	mg/kg	<0.02	-	<0.02	0.03	-	<0.02
Pyrene	CE087 ^M	mg/kg	<0.02	-	<0.02	0.09	-	<0.02
PAH (total of USEPA 16)	CE087	mg/kg	<0.34	-	<0.34	0.59	-	<0.34
Benzo(j)fluoranthene	CE087	mg/kg	<0.02	-	<0.02	<0.02	-	<0.02
PAH (total of OIL 8)	CE087	mg/kg	<0.18	-	<0.18	0.33	-	<0.18
BTEX & TPH								
Benzene	CE192 ^U	mg/kg	<0.01	-	<0.01	<0.01	-	<0.01
Toluene	CE192 ^U	mg/kg	<0.01	-	<0.01	<0.01	-	<0.01
Ethylbenzene	CE192 ^U	mg/kg	<0.01	-	<0.01	<0.01	-	<0.01
m & p-Xylene	CE192 ^U	mg/kg	<0.02	-	<0.02	<0.02	-	<0.02
o-Xylene	CE192 ^U	mg/kg	<0.01	-	<0.01	<0.01	-	<0.01

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SOILS

Lab number			98458-1	98458-2	98458-3	98458-4	98458-5	98458-6
Sample id			WS01	WS01	WS02	WS03	WS03	WS04
Depth (m)			0.50	3.00	1.00	0.65	1.90	1.00
Date sampled			09/07/2021	09/07/2021	09/07/2021	09/07/2021	09/07/2021	09/07/2021
Test	Method	Units						
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	-	<0.1	<0.1	-	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	-	<0.1	<0.1	-	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	-	<0.1	<0.1	-	<0.1
EPH Aliphatic (>C10-C12)	CE068	mg/kg	<4	-	<4	<4	-	<4
EPH Aliphatic (>C12-C16)	CE068	mg/kg	<4	-	10	8	-	<4
EPH Aliphatic (>C16-C35)	CE068	mg/kg	27	-	39	86	-	76
EPH Aliphatic (>C35-C44)	CE068	mg/kg	14	-	<10	27	-	36
VPH Aromat c (>EC5-EC7)	CE067	mg/kg	<0.01	-	<0.01	<0.01	-	<0.01
VPH Aromat c (>EC7-EC8)	CE067	mg/kg	<0.01	-	<0.01	<0.01	-	<0.01
VPH Aromat c (>EC8-EC10)	CE067	mg/kg	<0.01	-	0.02	<0.01	-	<0.01
EPH Aromatic (>EC10-EC12)	CE068	mg/kg	<1	-	<1	<1	-	<1
EPH Aromatic (>EC12-EC16)	CE068	mg/kg	<1	-	<1	<1	-	<1
EPH Aromatic (>EC16-EC21)	CE068	mg/kg	<1	-	<1	<1	-	<1
EPH Aromatic (>EC21-EC35)	CE068	mg/kg	<1	-	<1	<1	-	<1
EPH Aromatic (>EC35-EC44)	CE068	mg/kg	<1	-	<1	<1	-	<1
Subcontracted analysis								
Asbestos (qualitative)	\$	-	NAD	-	NAD	NAD	-	NAD

Chemtech Environmental Limited

SOILS

Lab number Sample id Depth (m) Date sampled			98458-7 WS04 2.00 09/07/2021
Test	Method	Units	
Arsenic (total)	CE127 ^M	mg/kg As	-
Cadmium (total)	CE127 ^M	mg/kg Cd	-
Chromium (total)	CE127 ^M	mg/kg Cr	-
Chromium (III)	CE208	mg/kg CrIII	-
Chromium (VI)	CE146	mg/kg CrVI	-
Copper (total)	CE127 ^M	mg/kg Cu	-
Lead (total)	CE127 ^M	mg/kg Pb	-
Mercury (total)	CE127 ^M	mg/kg Hg	-
Nickel (total)	CE127 ^M	mg/kg Ni	-
Selenium (total)	CE127 ^M	mg/kg Se	-
Zinc (total)	CE127 ^M	mg/kg Zn	-
pH	CE004 ^M	un ts	6.3
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	<10
Cyanide (free)	CE077	mg/kg CN	-
Total Organic Carbon (TOC)	CE197	% w/w C	-
PAH			
Acenaphthene	CE087 ^M	mg/kg	-
Acenaphthylene	CE087 ^M	mg/kg	-
Anthracene	CE087 ^U	mg/kg	-
Benzo(a)anthracene	CE087 ^U	mg/kg	-
Benzo(a)pyrene	CE087 ^U	mg/kg	-
Benzo(b)fluoranthene	CE087 ^M	mg/kg	-
Benzo(ghi)perylene	CE087 ^M	mg/kg	-
Benzo(k)fluoranthene	CE087 ^M	mg/kg	-
Chrysene	CE087 ^M	mg/kg	-
Dibenz(ah)anthracene	CE087 ^M	mg/kg	-
Fluoranthene	CE087 ^M	mg/kg	-
Fluorene	CE087 ^U	mg/kg	-
Indeno(123cd)pyrene	CE087 ^M	mg/kg	-
Naphthalene	CE087 ^M	mg/kg	-
Phenanthrene	CE087 ^M	mg/kg	-
Pyrene	CE087 ^M	mg/kg	-
PAH (total of USEPA 16)	CE087	mg/kg	-
Benzo(j)fluoranthene	CE087	mg/kg	-
PAH (total of OIL 8)	CE087	mg/kg	-
BTEX & TPH			
Benzene	CE192 ^U	mg/kg	-
Toluene	CE192 ^U	mg/kg	-
Ethylbenzene	CE192 ^U	mg/kg	-
m & p-Xylene	CE192 ^U	mg/kg	-
o-Xylene	CE192 ^U	mg/kg	-

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SOILS

Lab number			98458-7
Sample id			WS04
Depth (m)			2.00
Date sampled			09/07/2021
Test	Method	Units	
VPH Aliphatic (>C5-C6)	CE067	mg/kg	-
VPH Aliphatic (>C6-C8)	CE067	mg/kg	-
VPH Aliphatic (>C8-C10)	CE067	mg/kg	-
EPH Aliphatic (>C10-C12)	CE068	mg/kg	-
EPH Aliphatic (>C12-C16)	CE068	mg/kg	-
EPH Aliphatic (>C16-C35)	CE068	mg/kg	-
EPH Aliphatic (>C35-C44)	CE068	mg/kg	-
VPH Aromat c (>EC5-EC7)	CE067	mg/kg	-
VPH Aromat c (>EC7-EC8)	CE067	mg/kg	-
VPH Aromat c (>EC8-EC10)	CE067	mg/kg	-
EPH Aromatic (>EC10-EC12)	CE068	mg/kg	-
EPH Aromatic (>EC12-EC16)	CE068	mg/kg	-
EPH Aromatic (>EC16-EC21)	CE068	mg/kg	-
EPH Aromatic (>EC21-EC35)	CE068	mg/kg	-
EPH Aromatic (>EC35-EC44)	CE068	mg/kg	-
Subcontracted analysis			
Asbestos (qualitative)	\$	-	-

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE208	Chromium (III)	Calculation: Cr (total) - Cr (VI)	Dry		1	mg/kg CrIII
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO ₄
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
CE087	Benzo(j)fluoranthene	Solvent extraction, GC-MS	As received		0.02	mg/kg
CE087	PAH (total of OIL 8)	Solvent extraction, GC-MS	As received		0.18	mg/kg
CE192	Benzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Toluene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Ethylbenzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	m & p-Xylene	Headspace GC-FID	As received	U	0.02	mg/kg
CE192	o-Xylene	Headspace GC-FID	As received	U	0.01	mg/kg
CE067	VPH Aliphatic c (>C5-C6)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic c (>C6-C8)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic c (>C8-C10)	Headspace GC-FID	As received		0.1	mg/kg
CE068	EPH Aliphatic (>C10-C12)	Solvent extraction, GC-FID	As received		4	mg/kg
CE068	EPH Aliphatic (>C12-C16)	Solvent extraction, GC-FID	As received		4	mg/kg

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE068	EPH Aliphatic (>C16-C35)	Solvent extraction, GC-FID	As received		4	mg/kg
CE068	EPH Aliphatic (>C35-C44)	Solvent extraction, GC-FID	As received		10	mg/kg
CE067	VPH Aromatic (>EC5-EC7)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC7-EC8)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC8-EC10)	Headspace GC-FID	As received		0.01	mg/kg
CE068	EPH Aromat c (>EC10-EC12)	Solvent extraction, GC-FID	As received		1	mg/kg
CE068	EPH Aromat c (>EC12-EC16)	Solvent extraction, GC-FID	As received		1	mg/kg
CE068	EPH Aromat c (>EC16-EC21)	Solvent extraction, GC-FID	As received		1	mg/kg
CE068	EPH Aromat c (>EC21-EC35)	Solvent extraction, GC-FID	As received		1	mg/kg
CE068	EPH Aromat c (>EC35-EC44)	Solvent extraction, GC-FID	As received		1	mg/kg
\$	Asbestos (qualitative)	HSG 248, M croscopy	Dry	U	-	-

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
98458-1	WS01	0.50	N	
98458-2	WS01	3.00	N	
98458-3	WS02	1.00	N	
98458-4	WS03	0.65	N	
98458-5	WS03	1.90	N	
98458-6	WS04	1.00	N	
98458-7	WS04	2.00	N	