



ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

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Mr Richard Floyd
Cockley Developments Ltd
98 Kirkstall Road
LEEDS
LS3 1YN

BY E-MAIL

Our Ref: CKD/01/EGH

10th August 2016

-- Dear Richard

Intrusive Coal Mining Investigation
Cockley Hill Lane, Kirkheaton, Huddersfield

In accordance with our commission, we are pleased to provide a report on the rotary borehole investigation undertaken at the above site, to determine the risks to ground stability from potential underground coal workings. Details are provided below.

Background

A Stage 1 Desk Study Report had already been undertaken by Sirius Geotechnical and Environmental Ltd (Sirius - ref. C5120). The Sirius Stage 1 Desk Study Report was reviewed by ARP Geotechnical Ltd (ARP), and the findings were used to scope the investigation outlined in more detail below. The Sirius Stage 1 Desk Study Report recommended the drilling of rotary probeholes to confirm the presence/absence of workable coal within influencing distance of the surface, and the need for drilling and grouting. ARP proposed to carry out one day of drilling to provide confidence in the worked/unworked status of the site.

Fieldwork

Thirteen rotary boreholes (RO1 to R10 and R01A, R03A and R05A) were drilled by Ground Support Services Ltd on 2nd August 2016, to depths of between 3m and 18m below existing ground levels. The investigation was designed, organised and supervised by ARP, and boreholes were logged by both the Engineer and the lead driller. As part of the wider intrusive investigation on this site, ARP carried out trial pits and cable percussive boreholes. Additional investigation locations are referred to in this report only where coal was encountered. Borehole and trial pit records and an investigation location plan are attached to this letter (ARP drawing CKD/01/SI03).

Due to the risk of mines/coal gas migration to adjacent dwellings, boreholes were drilled using full water flush techniques.



Ground Conditions

All rotary boreholes proved sandstone bedrock at a depth of between 0.6m and 1.4m, with the exception of borehole R05, which proved coal at a depth of 1.2m to 2m, and then sandstone bedrock below 2m.

In most rotary boreholes, a coal seam (interpreted to be the "Better Bed") was encountered, between 0.2m and 2.2m in thickness, and at a depth of between 1.2m and 7.2m, with the exception of R06 and R04 where it was absent. The location of R06 may have been beyond the line of the conjectured outcrop (orientated approximately north-south), whilst in the location of R04, the borehole is likely to have intercepted a buried soakaway, which would account for the loss of flush at relatively shallow depth (from 1.3m to 3m depth). The depth of this coal generally increased from northwest to southeast (R05, R08, R09). The much reduced thickness of the coal seam towards the west is probably due to it nearing the surface and its outcrop in these areas, with a consequent higher degree of weathering.

A coal seam (probably also the "Better Bed") was encountered in two trial pits (TP9 and TP10) in the north of the site, between 0.2m and 0.3m thickness, and at a depth of between 1.8m and 1.3m, respectively.

Boreholes R01 and R10 were drilled on the eastern part of the site, where ground levels rise up toward Cockley Hill Lane. This area is to the northeast of an area of backfilled opencast workings. The boreholes revealed workings in the Better Bed seam, comprising broken ground (partial voiding with a loss of flush and no returns), at 10.7m (with a thickness of 2.6m) in R01 and at 14.0m (with a thickness of 2.1m) in R10. Underlying the workings, hard strata were proven to 18.0m and 15.0m depth, respectively. There were no returns from the hard strata below the broken ground.

Backfilled former opencast workings were proven in the south of the site by means of two cable percussive boreholes which bottomed the backfill materials at 4.7m (CP1) and 7m (CP2).

The base of the Better Bed seam was proven in R05 to be at 2m, and in R02 to be at 4m, which corresponds in depth to the base of the adjacent opencast workings. In boreholes R02, R04, R05, R08, and R09, intact coal was encountered, with no indication of workings.

No other coal seams were encountered during the rotary borehole investigation.

No evidence of mine entries (shafts or adits) were encountered during the investigation. However, the surface area of investigation locations is very small in proportion to the total site area, and this does not guarantee the absence of mine entries.



Comment & Conclusion

The Rotary Drilling Investigation undertaken under the supervision of ARP Geotechnical Ltd confirmed underground workings the Better Bed seam in the east of the site, to the northeast of recorded opencast coal workings in the same seam (see ARP drawing CKD/01/SI03). It is a generally accepted rule of thumb that, unless there is at least 10 times the seam thickness of rock cover above any workings, they have the potential to adversely affect ground stability on the site. On this basis, it is considered that there is a risk to ground stability for future development, from underground workings.

It is anticipated that, in the area of R01 and R10 in the east of the site, workings below future building footprints, roads and drives will require treatment on a 3m by 3m grid, using drill and grout techniques. Further west, there was no indication of the seam having been worked, but this should be confirmed by drilling initially on a wider spaced grid (say 9m by 9m) as part of the drilling and grouting works. If any workings are identified on other areas, these should also be drilled and grouted on a 3m grid. The approximate areas requiring a 3m grid and a 9m grid are shown on the attached investigation location plan (CKD/01/SI.03). This proposed scope of work will be subject to the agreement of the regulatory authorities.

There is a slight possibility of localised opencast coal excavations, bell pits, and mine entries. It would be prudent for an Engineer to inspect the ground surface following the topsoil strip, to check for any signs of such features. Foundation excavations should also be inspected by an Engineer.

Where grout treatment has been carried out, (in areas where strip/trench fill foundations are acceptable) it is necessary to provide a 300mm thick footing reinforced with two layers of B503 mesh.

A Geo-environmental Report is in preparation for the site, and will be issued in the near future.






We trust the above information is sufficient for your purposes, but if you have any queries, please do not hesitate to contact us, at your convenience.

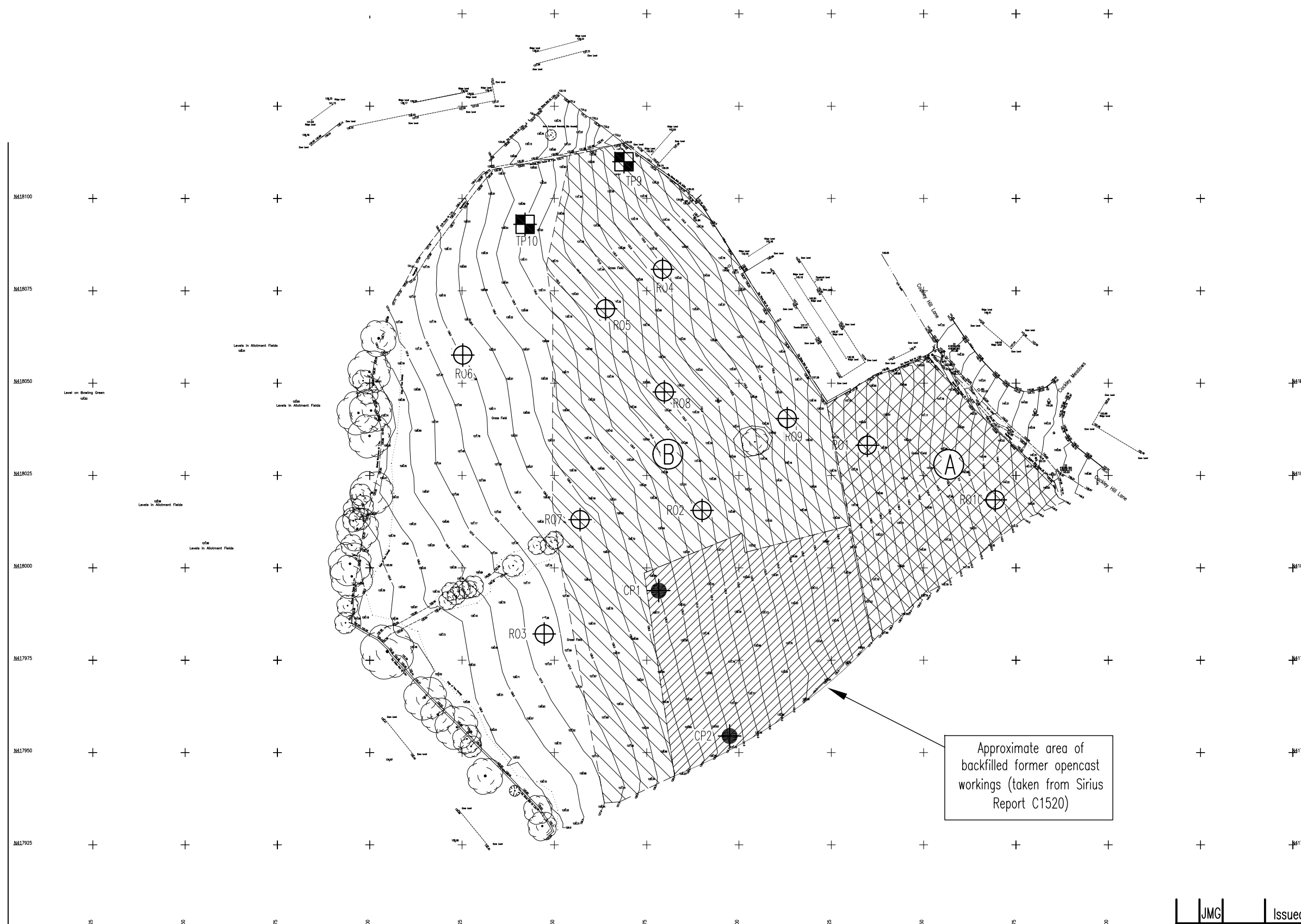
Yours sincerely
for ARP GEOTECHNICAL LTD

E G Heatherington

Enc

Key

- TP1  Trial Pit (18th July 2016)
- CP1  Cable Percussive Borehole (18th July 2016)
- R01  Rotary Borehole (2nd August 2016)
- (A)  Approximate area requiring drill & grout on a 3m grid
- (B)  Approximate area requiring drill & grout on a 9m grid (to be changed to 3m if workings are found)



JMG		Issued for approval		Chk
Rev	By	Date	Amendment	
Date	AUG 16		Scale	NTS @ A3
Drawn	JMG		No	CKD/01/SI.03
Chk.	EGH		Rev	/

Project	COCKLEY HILL LANE, KIRKHEATON
Client	COCKLEY DEVELOPMENTS LTD

Title	COAL MINING INVESTIGATION LOCATION PLAN 18th JULY & 2nd AUGUST 2016
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ARP ASSOCIATES
 CHARTERED CONSULTING ENGINEERS
 Northwest House • 5/6 Northwest Business Park • Servia Hill • Leeds LS6 2QH
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**Trial Pit
Number
TP09**

Dimensions

Client	Cockley Developments Ltd
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**Job
Number**
CKD/01

Dates 18/07/2016

Engineer
ARP

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	D1				(0.30)	MADE GROUND: Dark greyish brown slightly clayey slightly gravelly sandy TOPSOIL. Gravel is subangular, of sandstone.		
				132.70	0.30	MADE GROUND: Medium strength (firm) orangish brown and grey CLAY.		
0.69	HSV 71.67kPa		70,70,75/Av. 71.67		(1.10)			
				131.60	1.40	MADE GROUND: Yellowish brown (up to 100mm bedded) angular tabular COBBLES of sandstone.		
				131.20	1.80	From 1.6m: Buried ceramic land drain, orientated NE-SW, steeply inclined to the S, possibly leading to a soakaway.		
				131.00	(0.20)	Dark greyish black, lustrous, COAL. Recovered as angular gravel (Better Bed).		
					2.00	Terminated due to drain intersecting pit.		
						Complete at 2.00m		

Plan

Remarks

Groundwater not encountered.
Pit sides generally remained stable for the short period of exposure.
Backfilled with arisings on completion.

Scale (approx)

1:25

Logged By

EGH

Figure No.

CKD/01.TP09



**Trial Pit
Number
TP10**

Dimensions



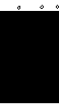
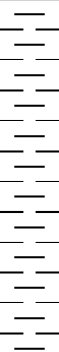


Client	Cockley Developments Ltd
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Job Number
CKD/01

Dates 18/07/2016

Engineer
ARP

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20	D1					MADE GROUND: Dark greyish brown slightly clayey slightly sandy TOPSOIL.		
				131.20	(0.20) 0.20	High strength (stiff) orangish brown and grey slightly gravelly CLAY. Gravel is angular and subangular, of sandstone.		
0.70	HSV 80kPa		70,70,100/Av. 80.00		(1.10)			
				130.10	1.30 (0.30)	Dark greyish black, lustrous COAL. Recovered as angular gravel (slightly weathered in pockets) (Better Bed).		
1.60 1.60-1.80	HSV 76.67kPa D2		80,80,70/Av. 76.67	129.80	1.60	High strength (stiff) dark grey CLAY.		
					(1.20)			
				128.60	2.80 (0.20)	Extremely weak, thickly laminated, pale grey and buff grey MUDSTONE. Recovered as angular tabular gravel (LCM).		
				128.40	3.00	Terminated in hard strata.		
						Complete at 3.00m		

Plan

Remarks

Slight groundwater seepage from 1.3m.
Pit sides generally remained stable for the short period of exposure.
Backfilled with arisings on completion.

Scale (approx)


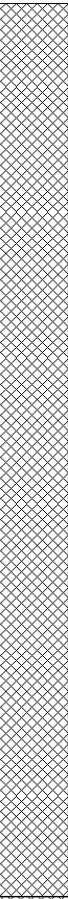

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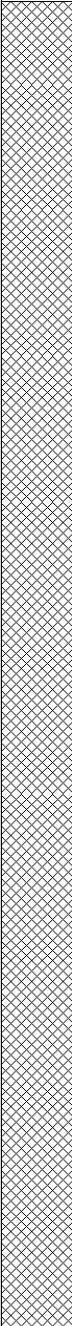

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



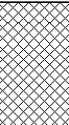
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Figure No.






CKD/01.TP10



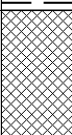
 ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS							Site Cockley Hill Lane, Kirkheaton		Borehole Number CP1
Boring Method Trailer mounted cable percussive borehole drilling rig.		Casing Diameter		Ground Level (mOD) 130.00		Client Cockley Developments Ltd		Job Number CKD/01	
		Location 418276 E 417994 N		Dates 02/08/2016		Engineer ARP		Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							MADE GROUND: Grass on to dark grey mudstone (Driller's Description) (Backfilled Opencast Workings).		
					125.30	4.70	Light grey SILTSTONE (Weathered) (LCM).		
					124.50	5.50	Terminated on hard strata. Complete at 5.50m		
Remarks Groundwater not encountered. Casing used from ground level to 5.5m. Gas monitoring well installed to 5m depth. With lower 4m comprising slotted pipe with gravel surround, and upper 1m comprising plain pipe with bentonite seal. Bung and tap provided, with lockable flush cover.								Scale (approx) 1:40	Logged By EGH
								Figure No. CKD/01.CP1	

 ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS							Site Cockley Hill Lane, Kirkheaton		Borehole Number CP2
Boring Method Trailer mounted cable percussive borehole drilling rig.		Casing Diameter		Ground Level (mOD) 131.10		Client Cockley Developments Ltd		Job Number CKD/01	
		Location 418296 E 417953 N		Dates 02/08/2016		Engineer ARP		Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00-1.45	SPT N=7			1,2/2,2,1,2			MADE GROUND: Grass on to colliery waste (Driller's Description) (Backfilled Opencast Workings).		
2.00-2.45	SPT N=10			1,3/3,3,3,1					
3.00-3.45	SPT N=6			1,1/2,1,2,1					
4.00-4.45	SPT N=8			2,2/1,2,2,3		(7.00)			
5.00-5.45	SPT N=11			2,3/3,2,3,3					
6.00-6.45	SPT N=10			2,2/2,2,3,3					
7.50-7.80	SPT 50/150			25/50	124.10	7.00	Light grey SILTSTONE (LCM).		
						(0.80)	From 7.5m: Extremely weak rock.		
					123.30	7.80	Terminated in hard strata.		
Remarks Groundwater not encountered. Casing used from ground level to 5.5m. Gas monitoring well installed to 7.5m depth. With lower 4.5m comprising slotted pipe with gravel surround, and upper 3m comprising plain pipe with bentonite seal. Bung and tap provided, with lockable flush cover.								Scale (approx) 1:40	Logged By EGH
								Figure No. CKD/01.CP2	

<div></div> <div>ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS</div>						Site Cockley Hill Lane, Kirkheaton			Borehole Number R01		
Machine : Flush : Core Dia: mm Method : Rotary Cored			Casing Diameter			Ground Level (mOD) 138.80		Client Cockley Developments Ltd		Job Number CKD/01	
			Location 418333 E 418034 N			Dates 02/08/2016		Engineer ARP		Sheet 1/1	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
						138.20	(0.60) 0.60	Clay (Driller's Description). SANDSTONE.			
							(3.70)				
							134.50	4.30	Grey MUDSTONE.		
							(6.40)				
							128.10	10.70	BROKEN GROUND (no returns).		
							(2.60)				
							125.50	13.30	Hard Strata (no returns).		
							(1.70)				
							123.80	15.00	Complete at 15.00m		
							<div>Remarks Groundwater not encountered. Casing not used. Borehole backfilled with arisings on completion.</div>				
									Figure No. CKD/01.R01		

 ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS							Site Cockley Hill Lane, Kirkheaton		Borehole Number R02	
Machine : Flush : Core Dia: mm Method : Rotary Cored			Casing Diameter		Ground Level (mOD) 131.70		Client Cockley Developments Ltd		Job Number CKD/01	
			Location 418288 E 418016 N		Dates 02/08/2016		Engineer ARP		Sheet 1/1	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
								Clay (Driller's Description).		
							(1.40)			
						130.30	1.40	SANDSTONE.		
						129.90	(0.40)			
							1.80	COAL (Better Bed).		
							(2.20)			
						127.70	4.00	Grey MUDSTONE.		
							(2.00)			
						125.70	6.00	Complete at 6.00m		
Remarks Groundwater not encountered. Casing not used. Borehole backfilled with arisings on completion.								Scale (approx) 1:100		Logged By JS and EGH
								Figure No. CKD/01.R02		

 ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS							Site Cockley Hill Lane, Kirkheaton		Borehole Number R03	
Machine : Flush : Core Dia: mm Method : Rotary Cored			Casing Diameter		Ground Level (mOD) 127.30		Client Cockley Developments Ltd		Job Number CKD/01	
			Location 418245 E 417982 N		Dates 02/08/2016		Engineer ARP		Sheet 1/1	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						126.50	(0.80) 0.80	Clay.		
								SANDSTONE.		
							(3.30)			
						123.20	4.10	COAL (Better Bed).		
						123.00	4.30	SANDSTONE.		
							(1.70)			
						121.30	6.00	Complete at 6.00m		
Remarks Groundwater not encountered. Casing not used. Borehole backfilled with arisings on completion.								Scale (approx) 1:100		Logged By JS and EGH
								Figure No. CKD/01.R03		

 ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS							Site Cockley Hill Lane, Kirkheaton		Borehole Number R04	
Machine : Flush : Core Dia: mm Method : Rotary Cored			Casing Diameter		Ground Level (mOD) 133.20		Client Cockley Developments Ltd		Job Number CKD/01	
			Location 418277 E 418083 N		Dates 02/08/2016		Engineer ARP		Sheet 1/1	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
								Clay.		
						131.90	(1.30) 1.30	Hard strata (no returns). From 1.3m to 3m: Loss of flush (no returns). Possibly due to a buried soakaway adjacent to the borehole.		
						130.20	(1.70) 3.00	Complete at 3.00m		
Remarks Groundwater not encountered. Casing not used. Borehole backfilled with arisings on completion.								Scale (approx) 1:100		
								Logged By JS and EGH		
								Figure No. CKD/01.R04		



**Borehole
Number**
R05

Machine :
Flush :
Core Dia: mm
Method : Rotary Cored

Casing Diameter
Location 418270 E 418076 N

Ground Level (mOD)	133.10
Dates	02/08/2016

Client Cockley Developments Ltd
Engineer ARP

**Job
Number**
CKD/01



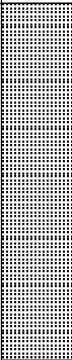
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Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
								Clay.		
						131.90	1.20 (0.80)	COAL (Better Bed).		
						131.10	2.00	SANDSTONE.		
							(4.00)			
						127.10	6.00	Complete at 6.00m		

Remarks
Groundwater not encountered.
Casing not used.
Borehole backfilled with arisings on completion.

Scale (approx)	Logged By
1:100	JS and EGH

Figure No.
CKD/01.R05

 ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS							Site Cockley Hill Lane, Kirkheaton		Borehole Number R06	
Machine : Flush : Core Dia: mm Method : Rotary Cored			Casing Diameter		Ground Level (mOD) 128.00		Client Cockley Developments Ltd		Job Number CKD/01	
			Location 418223 E 418059 N		Dates 02/08/2016		Engineer ARP		Sheet 1/1	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						126.70	(1.30) 1.30	Clay.		
								SANDSTONE.		
						122.00	(4.70) 6.00	Complete at 6.00m		
Remarks Groundwater not encountered. Casing not used. Borehole backfilled with arisings on completion.								Scale (approx) 1:100		Logged By JS and EGH
								Figure No. CKD/01.R06		



ARP GEOTECHNICAL LIMITED
CHARTERED CONSULTING ENGINEERS

Machine :
Flush :
Core Dia: mm
Method : Rotary Cored

Casing Diameter

Location
 418255 E 418013 N

Ground Level (mOD)
 128.70

Dates
 02/08/2016

Site
 Cockley Hill Lane, Kirkheaton


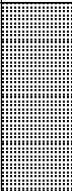


Client
 Cockley Developments Ltd

Engineer
 ARP

Borehole Number
R07

Job Number
 CKD/01

Sheet
 1/1







Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
								Clay.		
						127.50	(1.20) 1.20	SANDSTONE.		
						124.90	(2.60)			
						124.50	3.80 (0.40) 4.20	COAL (Better Bed).		
								Grey MUDSTONE.		
						122.70	(1.80) 6.00	Complete at 6.00m		

Remarks
 Groundwater not encountered.
 Casing not used.
 Borehole backfilled with arisings on completion.

Scale (approx)
 1:100

Figure No.
 CKD/01.R07

Logged By
 JS and EGH

<div></div> <div>ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS</div>						Site Cockley Hill Lane, Kirkheaton			Borehole Number R08		
Machine : Flush : Core Dia: mm Method : Rotary Cored			Casing Diameter			Ground Level (mOD) 132.00		Client Cockley Developments Ltd		Job Number CKD/01	
			Location 418278 E 418049 N			Dates 02/08/2016		Engineer ARP		Sheet 1/1	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
						130.90	(1.10)	Clay.			
							1.10	SANDSTONE.			
							(1.70)				
							129.20	2.80 (0.50)	COAL (Better Bed).		
							128.70	3.30 (0.90)	Grey MUDSTONE.		
							127.80	4.20	SANDSTONE.		
							(1.80)				
							126.00	6.00	Complete at 6.00m		
<div>Remarks</div> <div>Groundwater not encountered. Casing not used. Borehole backfilled with arisings on completion.</div>									<div>Scale (approx)</div> <div>1:100</div>		<div>Logged By</div> <div>JS and EGH</div>
									<div>Figure No.</div> <div>CKD/01.R08</div>		



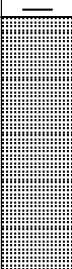
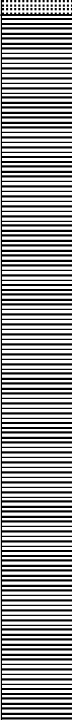

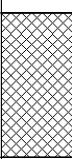


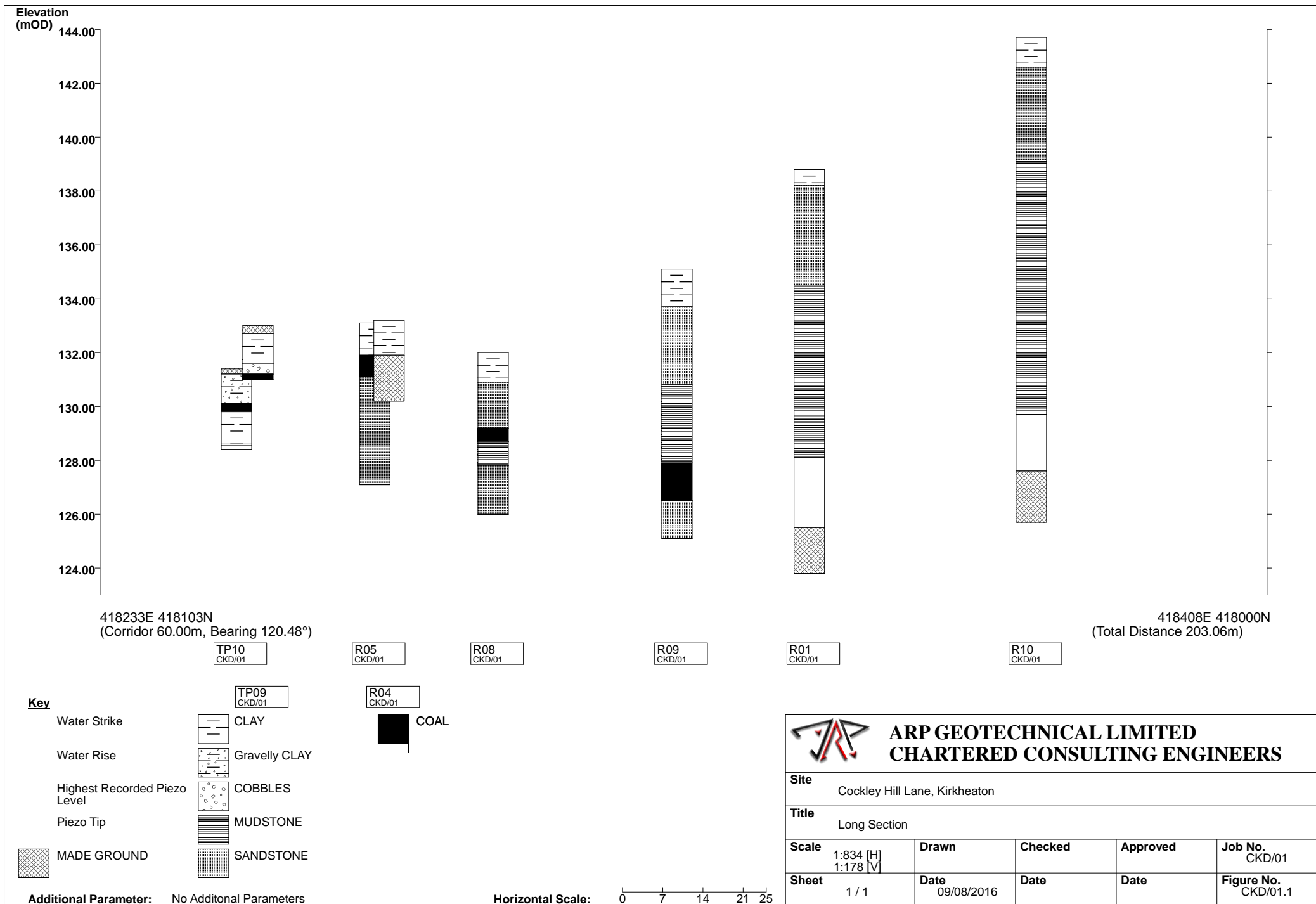
ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS

Site Cockley Hill Lane, Kirkheaton		Borehole Number R09
Machine : Flush : Core Dia: mm Method : Rotary Cored	Casing Diameter	Ground Level (mOD) 135.10
	Location 418311 E 418042 N	Dates 02/08/2016
		Client Cockley Developments Ltd
		Engineer ARP
		Job Number CKD/01
		Sheet 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
								Clay.		
						133.70	(1.40) 1.40	SANDSTONE.		
							(2.90)			
						130.80	4.30	Grey MUDSTONE.		
							(2.90)			
						127.90	7.20	COAL.		
							(1.40)			
						126.50	8.60	SANDSTONE.		
							(1.40)			
						125.10	10.00	Complete at 10.00m		

Remarks Groundwater not encountered. Casing not used. Borehole backfilled with arisings on completion.									Scale (approx)	Logged By
									1:100	JS and EGH
									Figure No. CKD/01.R09	

 ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS							Site Cockley Hill Lane, Kirkheaton		Borehole Number R10	
Machine : Flush : Core Dia: mm Method : Rotary Cored			Casing Diameter		Ground Level (mOD) 143.70		Client Cockley Developments Ltd		Job Number CKD/01	
			Location 418369 E 418019 N		Dates 02/08/2016		Engineer ARP		Sheet 1/1	
Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
								Clay.		
						142.60	1.10	SANDSTONE.		
							(3.50)			
						139.10	4.60	Grey MUDSTONE.		
							(9.40)			
						129.70	14.00	BROKEN GROUND (no returns).		
							(2.10)			
						127.60	16.10	Hard strata (no returns).		
							(1.90)			
						125.70	18.00	Complete at 18.00m		
Remarks Groundwater not encountered. Casing not used. Borehole backfilled with arisings on completion.									Scale (approx) 1:100	Logged By JS and EGH
									Figure No. CKD/01.R10	



ARP GEOTECHNICAL LIMITED CHARTERED CONSULTING ENGINEERS				
Site Cockley Hill Lane, Kirkheaton				
Title Long Section				
Scale 1:834 [H] 1:178 [V]	Drawn	Checked	Approved	Job No. CKD/01
Sheet 1 / 1	Date 09/08/2016	Date	Date	Figure No. CKD/01.1