

MD/D8960/01

8th October 2018**Mr. David Martin**
Beam Consulting.
14 Bond St,
Wakefield
WF1 2QP

Dear Mr. Martin,

PROPOSED STARBUCKS, PEEL CENTRE, BARNSELY
MINEWORKINGS INVESTIGATION

Further to your recent request, a mineworkings investigation has been undertaken for land at the Peel Shopping Centre in Barnsley. It is proposed to build a Starbucks Restaurant at the site. The approximate centre of the site is located at National Grid Reference 435275, 406967 as shown on the appended site location plan.

A previous Geoenvironmental Appraisal was prepared by Dunelm dated 14th September 2018. The Coal Mining Search Report included as part of the Appraisal identified known workings in five seams, the shallowest being the Kents Thick seam at a depth of 66m below ground level. The report also stated the possibility of ancient shallow workings for which no records or plans exist. The published geological mapping indicated the presence of a number of shallower seams above the recorded workings in the Kents Thick: the shallowest being the Winter or Abdy Coal seam. The mining report also indicated that the site was on or adjacent to an area of backfilled open cast mining.

Therefore it was decided to undertake an intrusive investigation to determine if historic coal mining hazards exist beneath the proposed development.

Scope of Mining Investigation

The fieldwork comprised the boring of three rotary open boreholes (R1 to R3) to a depth of 30m to investigate the underlying Carboniferous Strata. Copies of the borehole records are attached to this letter with the locations shown on the attached exploratory hole location plan.

The results of the mining investigation are discussed below.

Results

Intact coal was encountered in all the boreholes as follows:

BH	Depth to head of Rock (m)	Depth to Coal (m)	Thickness of Coal (m)	Remarks
R1	14.80m	Intact coal recorded from 26.20m to 26.90m bgl	0.70m	Full flush returns maintained throughout rock section
R2	14.80m	Intact coal recorded from 26.20m to 26.90m bgl	0.70m	Full flush returns maintained throughout rock section.

BH	Depth to head Rock (m)	Depth to Coal (m)	Thickness of Coal (m)	Remarks
R3	14.80m	Intact coal recorded from 26.20m to 26.90m bgl	0.70m	Full flush returns maintained throughout rock section.

Made ground was encountered in all the boreholes with thicknesses of 14.80m, overlying rock. The made ground comprises the existing car park overlying dolomite gravel horizons and reworked clay onto materials described by the driller as brick, reworked clay and mudstone. Discussions with the driller indicate that these deposits may be opencast backfill.

The implications of the above findings are discussed below.

The boreholes indicate an intact coal seam at 26.20m bgl (some 11.40m below rock head) in all the boreholes.

Information provided by the published mapping suggests the site is underlain by the Winter or Abdy Coal at shallow depth with a seam thickness of upto 1.7m and the Top Beamshaw Coal with a seam thickness of upto 1.82m. In view of the former opencast workings present at the site, it is therefore likely that the Winter Seam (shallowest seam) may have been extracted and the coal seam recorded in the boreholes relates to the Top or Low Beamshaw Coal. Discussions with the Mining Consultant have indicated that the opencast was recorded as 'unlicensed' workings, likely to have taken place between the 1930s and the 1950s. No information is available on the coal seams extracted as part of the workings.

With respect to the seam encountered, the conventional approach to surface stability in undermined areas is to identify a zone of possible subsidence, based on a safe depth below which collapse of workings would not be expected to affect the surface. It should be pointed out that where workable seams underlie a site, some risk of ground subsidence is present.

The definition of a safe depth is based on accumulated experience and case histories which suggest that collapse of workings below this depth do not generally affect the surface.

Experience has shown that the maximum height of collapse that can occur above a seam in Coal Measures strata is 8 to 10 times the seam thickness or extraction height.

With respect to the coal seam encountered in the boreholes, assuming a seam thickness of 0.7m as recorded in the boreholes, the following effective rock covers and seam ratios are calculated:

Position	Effective Rock Cover (m)	Seam Ratio
R1	11.4	16.3:1
R2	11.4	16.3:1
R3	11.4	16.3:1

With respect to the intact seam identified within the boreholes, it is clear that there exists sufficient cover in all the exploratory holes.

Based on the findings of the ground investigation, it is possible to highlight the following potential constraints:

Discussion on Future Redevelopment

The Geoenvironmental Appraisal identified the following:

- The Mining Report noted the site was on or adjacent to an area of former opencast workings.
- A fault is located 4m to the east of the site (inferred) aligned northwest to southeast with a downthrow to the north east. (i.e. the site is mapped on the upthrow side of the fault).
- The previous investigation recorded suspected rock at shallow depth and advised a shallow foundation solution. However possible opencast backfill has been encountered in the rotary open boreholes suggesting the rock encountered in the previous boreholes represents cobbles and boulders. It was not possible to determine if the opencast backfill was present under the entire building footprint.
- The opencast backfill, comprising in the most part brick, reworked clay and mudstone, is not a suitable founding horizon. In view of the findings of this latest phase of investigation, a deep foundation solution comprising piles is advised end-bearing on bedrock at approximately 15m bgl. This may be subject to revision following any further investigation of the site.

In view of the uncertainty over the location of the opencast high wall in relation to the site, further investigation is advised. At this stage we suggest the following scope of further investigation:

- Two cable percussion boreholes at the eastern and western edge of the site to confirm the nature and extent of the suspected opencast backfill. It may be necessary to extend one of the boreholes using rotary open hole techniques if evidence of the high wall is found beneath the building footprint (i.e. rockhead is encountered at shallow depth with the possibility of unworked coal present above the seam encountered in the previous boreholes).

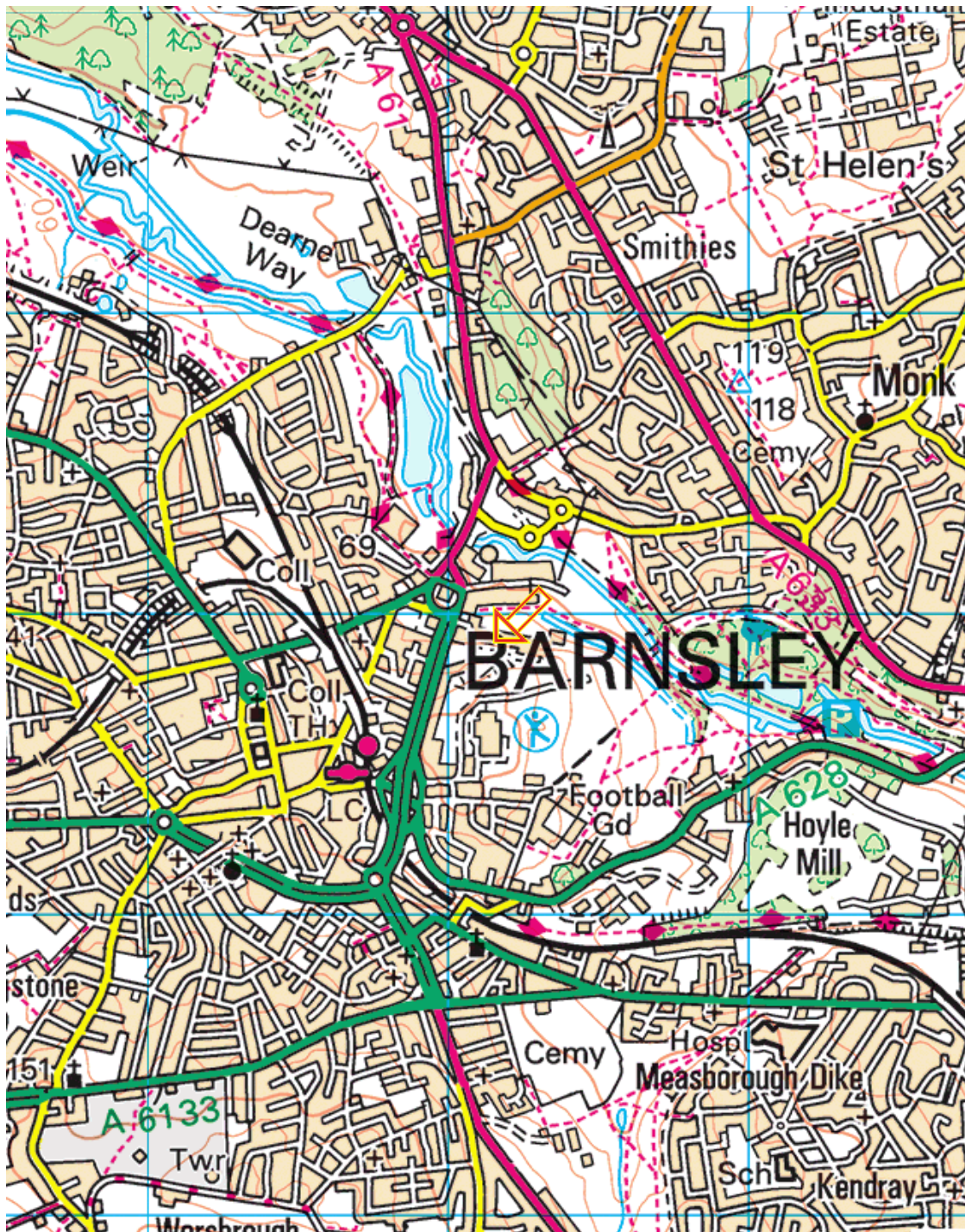
Yours sincerely

DUNELM GEOTECHNICAL AND ENVIRONMENTAL



Martin Davidson

Encl: drawings, exploratory hole logs.



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Contract:
Peel Centre, Barnsley

Contract No:
D8960

Client:
Peel Property (Investments) Ltd.

TEL: 0191 378 3151
FAX: 0191 378 3157

Drawing Title:
Site Location Plan

Drawing No:
D8960/01

Date:
August 2018

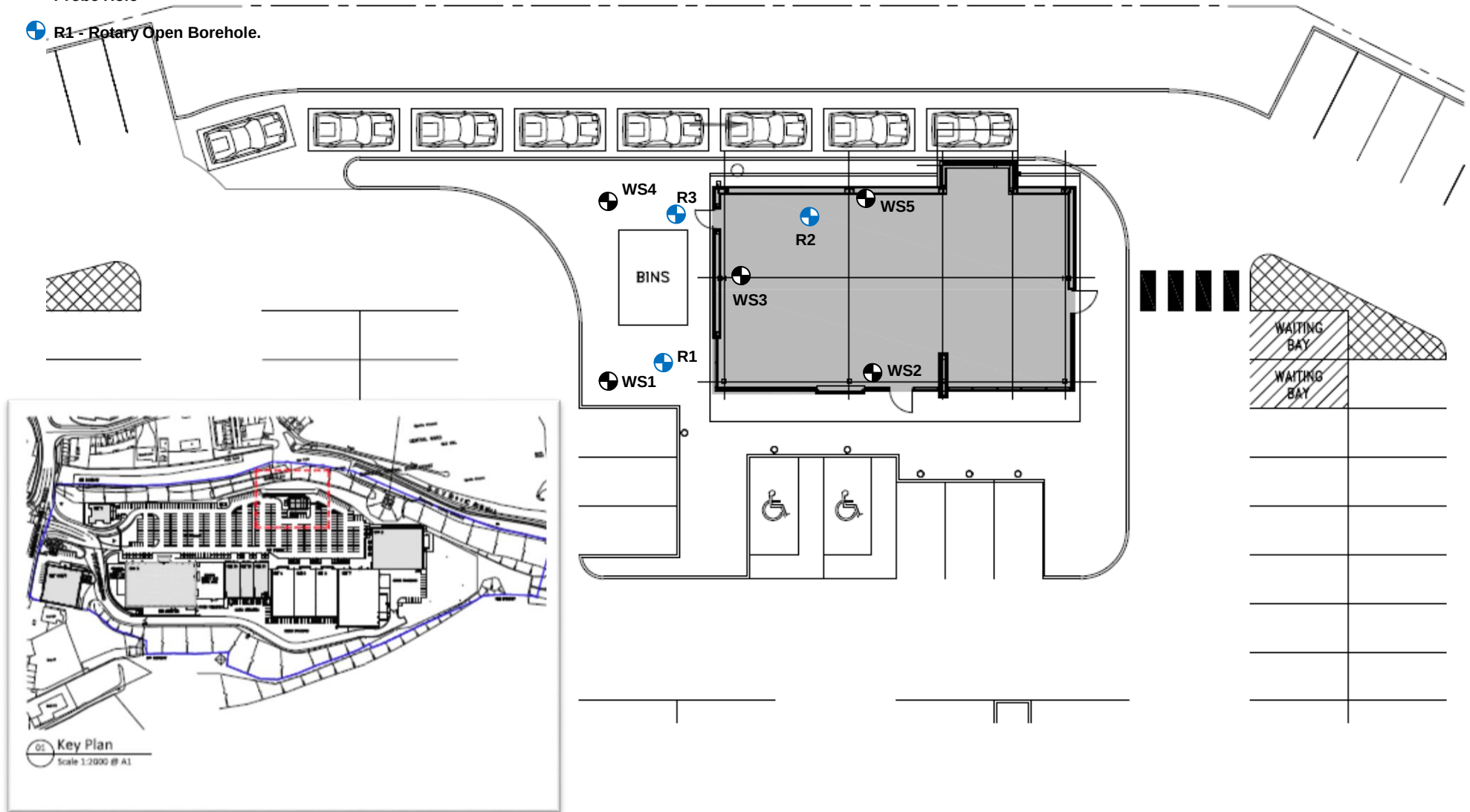
Scale:
NTS

Status:
Final

Drawn by:
KD

Legend

- WS1 – Window Sample
Probe Hole
- R1 – Rotary Open Borehole.



Contract:
Peel Centre, Barnsley

Drawing Title:
Revised Exploratory Hole Location Plan

Drawing No:
D8960/02

Date:
October 2018

Scale:
NTS

Drawn by:
MD



Borehole
R1

Scale 1:50

Sheet 1 of 3

Dates:	02/10/2018
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Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
								87	12.00			1. Inspection pit from ground level to 1.20m.
Log last updated 04/10/2018												

				BOREHOLE RECORD										Borehole R1				
Contract No: D8960					Site: Peel Centre, Barnsley										Scale 1:50			
Client: Peel Property (Investments) Ltd.										Driller: RC		Logged By: Driller		Sheet 2 of 3				
Method: Rotary Open Hole Drilling										Checked By: MD		Dates: 02/10/2018						
SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill						
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI												
								MADE GROUND: Brick, reworked clay, mudstone. (Driller's description).										
							11											
							12											
							13											
							14											
							14.80 - 30.00 100 % Air Mist	MUDSTONE with bands of sandstone and traces of coal. (Driller's description).	14.80									
							15											
							16											
							17											
							18											
							19											
							20											
Continued on next sheet																		
Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks 1. Inspection pit from ground level to 1.20m.						
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)							
								87	12.00									
Log last updated 04/10/2018																		

 		BOREHOLE RECORD				Borehole R1							
Contract No: D8960		Site: Peel Centre, Barnsley				Scale 1:50							
Client: Peel Property (Investments) Ltd.				Driller: RC		Logged By: Driller		Sheet 3 of 3					
Method: Rotary Open Hole Drilling				Checked By: MD		Dates: 02/10/2018							
SAMPLE DETAILS						(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill		
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %							FI	
							MUDSTONE with bands of sandstone and traces of coal. (Driller's description).	(11.40)					
						21							
						22							
						23							
						24							
						25							
						26							
						26.20	COAL. (Driller's description).	26.20					
						(0.70)							
						26.90	MUDSTONE with grey sandstone bands. (Driller's description).	26.90					
						27							
						28							
						(3.10)							
						29							
						30							
							End of Borehole at 30.00 m	30.00					
Ground Water (m)						Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks 1. Inspection pit from ground level to 1.20m.
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)		
								87	12.00				
Log last updated 04/10/2018													

				BOREHOLE RECORD										Borehole R2				
Contract No: D8960					Site: Peel Centre, Barnsley										Scale 1:50			
Client: Peel Property (Investments) Ltd.										Driller: RC		Logged By: Driller		Sheet 1 of 3				
Method: Rotary Open Hole Drilling										Checked By: MD		Dates: 02/10/2018						
SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill						
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI												
								TARMAC. (Driller's description). MADE GROUND: Dolomite. (Driller's description).	(0.10) 0.10									
									(0.60)									
							1	MADE GROUND: Reworked clay. (Driller's description).	0.70 (0.50)									
								MADE GROUND: Brick, re worked clay, mudstone. (Driller's description).	1.20									
							2											
							3											
							4											
							5											
							6											
							7											
							8		(13.60)									
							9											
							10											
Continued on next sheet																		
Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks						
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	1. Inspection pit from ground level to 1.20m.						
								87	12.00									
Log last updated 04/10/2018																		

				BOREHOLE RECORD										Borehole R2				
Contract No: D8960					Site: Peel Centre, Barnsley										Scale 1:50			
Client: Peel Property (Investments) Ltd.										Driller: RC		Logged By: Driller		Sheet 2 of 3				
Method: Rotary Open Hole Drilling										Checked By: MD		Dates: 02/10/2018						
SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill						
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI												
								MADE GROUND: Brick, re worked clay, mudstone. (Driller's description).										
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							16											
							17											
							18											
							19											
							20											
Continued on next sheet																		
Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks						
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)							
								87	12.00									
Log last updated 04/10/2018																		

				BOREHOLE RECORD										Borehole R2				
Contract No: D8960					Site: Peel Centre, Barnsley										Scale 1:50			
Client: Peel Property (Investments) Ltd.										Driller: RC		Logged By: Driller		Sheet 3 of 3				
Method: Rotary Open Hole Drilling										Checked By: MD		Dates: 02/10/2018						
SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill						
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI												
								MUDSTONE with bands of sandstone and traces of coal. (Driller's description).	(11.40)									
							21											
							22											
							23											
							24											
							25											
							26											
							26.20	COAL. (Driller's description).	26.20									
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							26.90	MUDSTONE with grey sandstone bands. (Driller's description).	26.90									
							27											
							28											
							29											
							30											
								End of Borehole at 30.00 m	30.00									
Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks						
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)							
								87	12.00									
Log last updated 04/10/2018																		

				BOREHOLE RECORD										Borehole R3				
Contract No: D8960					Site: Peel Centre, Barnsley										Scale 1:50			
Client: Peel Property (Investments) Ltd.										Driller: RC		Logged By: Driller		Sheet 1 of 3				
Method: Rotary Open Hole Drilling										Checked By: MD		Dates: 02/10/2018						
SAMPLE DETAILS							(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill						
Type	Depth From-To (m)	N (cu)	TCR %	SCR %	RQD %	FI												
								TARMAC. (Driller's description). MADE GROUND: Dolomite. (Driller's description).	(0.10) 0.10									
									(0.70)									
							1	MADE GROUND: Re worked clay. (Driller's description).	0.80 (0.40)									
								MADE GROUND: Brick, reworked clay, mudstone. (Driller's description).	1.20									
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							3											
							4											
							5											
							6											
							7											
							8		(13.60)									
							9											
							10											
Continued on next sheet																		
Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks 1. Inspection pit from ground level to 1.20m.						
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)							
								87	12.00									
Log last updated 04/10/2018																		



**Borehole
R3**

Scale 1:50

Sheet 2 of 3

Dates:	02/10/2018
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Continued on next sheetLog last updated 04/10/2018



**Borehole
R3**

Scale 1:50

Sheet 3 of 3

Dates:	02/10/2018
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Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
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Log last updated 04/10/2018												